Installation and user's guide
H-2000-5347-01-C

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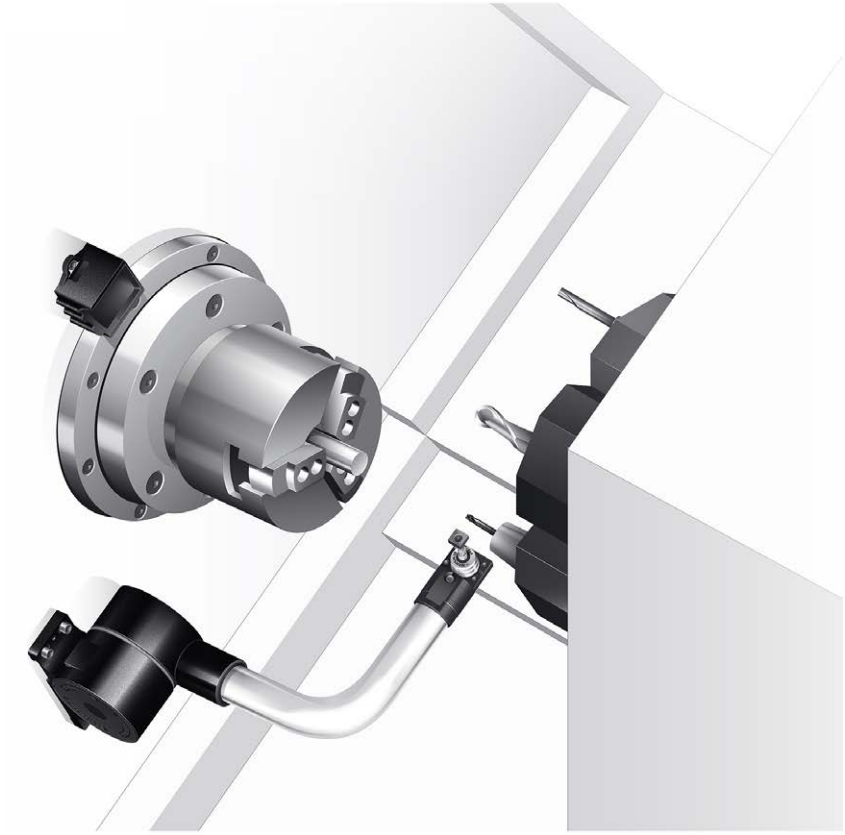
HPMA high-precision motorised arm



English

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EN	Publications for this product are available by visiting **www.renishaw.com/hpma**.
DE	Weitere Informationen zu diesem Produkt sind unter folgendem Link **www.renishaw.de/hpma** abrufbar.
ES	Las publicaciones para este producto están disponibles a través de **www.renishaw.es/hpma**.
FR	Les documentations pour ce produit sont disponibles en visitant le site **www.renishaw.fr/hpma**.
IT	La documentazione per questo prodotto è disponibile visitando il sito **www.renishaw.it/hpma.**
日本語	本製品に関する資料は、**www.renishaw.jp/hpma** からダウンロードいただけます。
PL	Publikacje dotyczące tego produktu są dostępne w witrynie **www.renishaw.pl/hpma**.
CS	Dokumentaci k produktu najdete na **www.renishaw.cz/hpma**.
RU	Документация по данному изделию доступна на сайте **www.renishaw.ru/hpma**.
中文（繁體）	請訪問雷尼紹網站以獲得此產品的的相關文件檔案: **www.renishaw.com.tw/hpma**。
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한국어	이 제품의 관련 자료는 **www.renishaw.co.kr/hpma** 에서 확인 가능 합니다.

GB – Safety

Remove power before performing any maintenance operations.
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 halt the movement of the machine.
Pinch hazards exist between moving parts and between moving and static parts.

BG – Раздел по безопасност

Преди извършване на всякакви операции по поддръжката да се изключва захранването
Отговорност на доставчика на машината е да гарантира, че на потребителя са обяснени всякакви рискове по време на работа, включително онези, упоменати в документацията на продуктите Renishaw и да гарантира осигуряване на съответни предпазители и обезопасителни блокировки.
При определени обстоятелства сигналът от пробника може да посочва фалшиво състояние на опрян пробник. Да не се разчита на сигналите от пробника за спиране движението на машината.
Съществуват рискове от притискане между движещи се части и между движещи се и неподвижни части.

CS – Upozornění

Před započetím jakékoliv údržby zařízení odpojte napájení.
Povinností dodavatele stroje je informovat uživatele o nebezpečích spojených s provozem i o nebezpečích zmiňovaných v dokumentaci k produktům společnosti Renishaw a zajistit dostatečné ochranné a bezpečnostní systémy.
Za určitých okolností může signál sondy nesprávně označovat klidový stav sondy. Nevyužívejte signály sondy jako hlavní impuls pro zastavování stroje.
Mezi pohyblivými součástmi a mezi pohyblivými a statickými součástmi hrozí nebezpečí přiskřípnutí.

DA – Sikkerhed

Afbryd strømforsyningen, før der foretages vedligeholdelse.
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 af sikkerhedsblokeringer.
Under visse omstændigheder kan sondesignalet ved en fejl angive, at sonden står stille. Stol ikke på, at probesignaler vil stoppe maskinens bevægelse.
Der er risiko for at blive klemt mellem bevægelige dele og mellem bevægelige og statiske dele.
Hold ikke sondehovedet under bevægelse eller ved manuelle sondeskift.

EL – Ασφάλεια

Αποσυνδέστε το μηχάνημα από το ηλεκτρικό ρεύμα πριν επιχειρήσετε οποιεσδήποτε εργασίες συντήρησης.

Αποτελεί ευθύνη του προμηθευτή του μηχανήματος να εξασφαλίσει ότι ο χρήστης είναι ενήμερος για τυχόν κινδύνους που συνεπάγεται η λειτουργία, συμπεριλαμβανομένων όσων αναφέρονται στα εγχειρίδια του προϊόντος της Renishaw. Είναι επίσης ευθύνη του να εξασφαλίσει ότι υπάρχουν τα απαιτούμενα προστατευτικά καλύμματα και οι συνδέσεις ασφαλείας.

Υπό ορισμένες συνθήκες το σήμα του ανιχνευτή μπορεί να υποδεικνύει λανθασμένη ένδειξη τοποθέτησης του ανιχνευτή. Μη βασίζεστε στα σήματα ανιχνευτή για τη διακοπή της κίνησης του μηχανήματος.

Υπάρχει κίνδυνος πιασίματος μεταξύ των κινούμενων μερών όπως και μεταξύ των κινούμενων και στατικών μερών.

ET – Ohutusosa

Enne hooldustoimingute teostamist ühendage seade alati vooluvõrgust lahti.

Masina tarnija vastutuseks on tagada, et kasutajat teavitatakse masina tööga kaasnevatest ohtudest, kaasa arvatud need ohud, mida on mainitud Renishaw toote dokumentides, ning samuti tagada, et masinaga oleks kaasas korrektsed kaitsepiirded ja turvalukud.

Teatud tingimustel võib sondi signaal ekslikult näidata, nagu oleks sond paigale asetunud. Ärge lähtuge masina liikumise peatamisel sondi signaalidest.

Masina liikuvad osad võivad põhjustada muljumisohtu.

FI – Turvallisuus

Katkaise virta ennen huoltotoimenpiteiden suorittamista.

Koneen toimittajan vastuulla on, että käyttäjä on saanut tiedon mahdollisista käyttöön liittyvistä vaaroista mukaan lukien Renishaw'n tuoteselosteessa mainitut vaarat. Konetoimittajan tulee myös varmistaa, että suojukset ja turvalukitukset ovat riittävät.

Tietyissä olosuhteissa anturilta tuleva signaali saattaa virheellisesti osoittaa, että mitta-anturi on lepotilassa (=ei-kosketuksessa). Älä pysäytä koneen liikettä mittapään signaalien perusteella.

Liikkuvien osien sekä liikkuvien ja staattisten osien välillä on olemassa puristusvaara. Älä pidä kiinni anturin päästä sen liikkuessa tai vaihtaessasi anturia käsin.

GA – Rannóg sábháilteachta

Bain an chumhacht de sula ndéantar aon oibríochtaí cothabhála.

Is í freagracht sholáthraí an mheaisín í a chinntiú go gcuirtear an t-úsáideoir ar an eolas i leith aon ghuaiseacha a bhaineann leis an oibriúchán, lena n-áirítear iad siúd a luaitear i gcáipéisíocht táirge Renishaw, agus a chinntiú go soláthraítear sciatha cosanta agus idirghlais sábháilteachta leordhóthanacha.

Féadtar toisc bhréagach tóireadóra-shuite a léiriú i roinnt cúinsí le comhartha an tóireadóra féin. Ná bí ag brath ar chomharthaí tóireadóra le gluaiseacht an mheaisín a stopadh.

Tá guaiseacha liomóige ann idir codanna gluaisteacha agus idir codanna gluaisteacha agus statacha.

HU – Figyelem
Mielőtt bármilyen karbantartási művelet végezne, kapcsolja ki a berendezést.
A gép szállítója felelős azért, hogy felhívja a felhasználó figyelmét az üzemeltetéssel kapcsolatos veszélyforrásokra, ideértve az illető Renishaw termék dokumentációjában ismertetetteket is, és hogy gondoskodjon a megfelelő védőburkolatok és biztonsági reteszelések meglétéről.
Bizonyos körülmények között a mérőtapintó azt jelezheti, hogy a mérőtapintó felfeküdt a mérendő objektumon, noha ez nincs így. Ezért a gép mozgásának leállításakor nem szabad a mérőtapintó jeleire hagyatkozni.
Fennáll a veszélye, hogy a keze beszorulhat mozgó alkatrészek valamint mozgó és álló alkatrészek közé.

HR – Sigurnosnim
Isključite napajanje prije provođenja bilo kakvih radova održavanja.
Dobavljač stroja dužan je osigurati da korisnik bude upozoren na sve opasnosti tijekom rada, uključujući one navedene u dokumentaciji proizvoda Renishaw, te mora osigurati odgovarajuće zaštite i sigurnosne blokade.
Pod određenim okolnostima signal sonde može lažno pokazivati stanje položaja sonde. Nemojte se pouzdati da će signali sonde zaustaviti kretanje stroja.
Između dijelova u pokretu i između pokretnih i statičkih dijelova postoji opasnost od uklještenja.

LV – Drošības sadaļa
Atvienojiet no strāvas pirms jebkuru apkalpošanas darbu veikšanas.
Lekārtas piegādātājs atbild par to, lai lietotājs būtu iepazīstināts ar jebkuriem draudiem, kas saistīti ar tās darbību (ieskaitot tos, kas minēti Renishaw izstrādājuma dokumentācijā), un lai būtu nodrošinātas atbilstošas aizsargierīces un aizsargbloķētāji.
Noteiktos apstākļos tausta signāls var nepareizi norādīt tausta stāvokli.Nepaļaujieties uz tausta signālu, lai apturētu iekārtas kustību.
Starp kustīgajām daļām, kā arī kustīgajām un nekustīgajām daļām iespējams saspiešanas risks.

LT – Saugos skyrius
Prieš atlikdami techninę priežiūrą, išjunkite elektros srovės tiekimą.
Įrenginio tiekėjas atsako už tai, kad naudotojas būtų įspėtas apie pavojus, susijusius su įrenginio naudojimu, taip pat pavojus, minimus Renishaw prietaiso techninėje dokumentacijoje, ir kad būtų sumontuoti atitinkami apsauginiai įrenginiai bei blokatoriai.
Susiklosčius tam tikroms aplinkybėms, zondo signalas gali neteisingai informuoti, kad jo reikšmės nustatytos į pradinę būseną. Nepasikliaukite zondo signalais ir iš karto nestabdykite įrenginio.
Tarp judančių detalių bei tarp judančių ir statiškų detalių pakliuvę daiktai gali būti suspausti.

MT – Taqsima tas-sigurtà
Itfi d-dawl qabel tibda tagħmel xi xogħol ta' manutenzjoni.
Hija r-responsabbiltà tal-fornitur tal-makna li jiżgura li l-utent ikun magħmul konxju ta' kwalunkwe perikli involuti fit-tħaddim, inklużi dawk imsemmija fid-dokumentazzjoni tal-prodott ta' Renishaw, u li jiżgura li hemm provdut l-ilqugħ u l-interlocks ta' sigurtà adegwati.
Taħt ċerti ċirkostanzi s-sinjal tas-sonda jista' b'mod falz jindika kundizzjoni ta' sonda mhux attiva. Tiddependix fuq sinjali tas-sonda sabiex twaqqaf il-moviment tal-makna.
Hemm il-periklu li wieħed jinqaras bejn biċċiet li jiċċaqilqu u bejn biċċiet li jiċċaqilqu u biċċiet statiċi.

RO – Secțiune de protecția muncii
Înainte de orice intervenție pentru întreținere, opriți alimentarea cu energie electrică.
Este sarcina furnizorului maşinii să se asigure că utilizatorul cunoaşte toate riscurile ce pot apărea pe durata utilizării echipamentului respectiv, inclusiv riscurile menționate în documentația produsului Renishaw, şi să se asigure că au fost prevăzute şi furnizate toate apărătorile şi sistemele de protecție necesare.
În anumite condiții, pot apărea semnale false de la palpator indicând un contact. Nu vă bazați pe semnalul transmis de palpator pentru oprirea maşinii.
Există pericolul prinderii pielii între elemente aflate în mişcare sau între elemente fixe şi cele mobile.

SK – Bezpečnostná časť
Pred každým vykonávaním údržby odpojte napájanie.
Zodpovednosťou dodávateľa stroja je zaručiť oboznámenie používateľa so všetkými rizikami súvisiacimi s prevádzkou, vrátane tých, ktoré sú uvedené v dokumentácii k produktu spoločnosti Renishaw, a zaručiť poskytnutie adekvátnych zábran a bezpečnostných blokovaní.
Signál sondy môže za určitých okolností nesprávne indikovať parkovaciu polohu sondy. Pri zastavovaní pohybov stroja sa nespoliehajte na signály sondy.
Medzi pohyblivými časťami a medzi pohyblivými a statickými časťami vzniká riziko pomliaždenia.

SL – Varnostni napotki
Pred kakrsnimkoli vzdrzevanjem odklopite napajanje.
Odgovornost dobavitelja stroja je, da uporabnika opozori na vse nevarnosti, ki nastopajo med delovanjem, vkljucno s tistimi, ki so omenjene v Renishaw-ovi produktni dokumentaciji, in da zagotovi, da so dobavljene vse potrebne zascite in varnostne zapore.
Pod dolocenimi pogoji lahko signal sonde napacno nakazuje, da je sonda v lezecem polozaju. Ne zanasajte se na signale sonde za ustavitev premikanja stroja.
Pazite, da se ne uscipnete med gibajocimi deli ter med gibajocimi in staticnimi deli.

SV – Säkerhet
Koppla bort strömmen innan underhåll utförs.
Maskinleverantören ansvarar för att användaren informeras om de risker som drift innebär, inklusive de som nämns i Renishaws produktdokumentation, samt att tillräckliga skydd och säkerhetsförreglingar tillhandahålls.
Under vissa omständigheter kan probsignalen felaktigt ange att en prob är monterad. Lita inte på probsignaler för att stoppa maskinens rörelse.
Det finns risk för klämning mellan rörliga delar och mellan rörliga och stillastående delar.

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Disclaimer

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Trade marks

RENISHAW and the probe symbol used in the RENISHAW logo are registered trade marks of Renishaw plc in the United Kingdom and other countries. **apply innovation** and names and designations of other Renishaw products and technologies are trade marks of Renishaw plc or its subsidiaries.

All other brand names and product names used in this document are trade names, trade marks, or registered trade marks of their respective owners.

Warranty

Equipment requiring attention under warranty must be returned to your equipment supplier.

Unless otherwise specifically agreed in writing between you and Renishaw, if you purchased the equipment from a Renishaw company, the warranty provisions contained in Renishaw's CONDITIONS OF SALE apply. You should consult these conditions in order to find out the details of your warranty but, in summary, the main exclusions from the warranty are if the equipment has been:

- neglected, mishandled or inappropriately used; or
- modified or altered in any way except with the prior written agreement of Renishaw.

If you purchased the equipment from any other supplier, you should contact them to find out what repairs are covered by their warranty.

Changes to equipment

Renishaw reserves the right to change equipment specifications without notice.

CNC machines

CNC machine tools must always be operated by fully trained personnel in accordance with the manufacturer's instructions.

Patents

Features of the Renishaw HPMA, and other related products, are subject of one or more of the following patents and/or patent applications:

CN 1327188	US 6275053
CN 100455979	US 6519863
EP 0967455	US 7281336
EP 1092890	
EP 1537376	
JP 3627855	
JP 4444109	
JP 4444509	

EU declaration of conformity

CE

Renishaw plc declares under its sole responsibility that the HPMA high-precision motorised arm is in conformity with all relevant Union legislation.

The full text of the EU declaration of conformity is available at: **www.renishaw.com/mtpdoc**.

FCC Information to user (USA only)

47 CFR Section 15.19

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

1. This device may not cause harmful interference, and

2. This device must accept any interference received, including interference that may cause undesired operation.

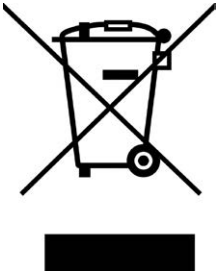
47 CFR Section 15.21

The user is cautioned that any changes or modifications not expressly approved by Renishaw plc, or authorised representative could void the user's authority to operate the equipment.

47 CFR Section 15.105

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference, in which case you will be required to correct the interference at your own expense.

WEEE directive



The use of this symbol on Renishaw products and/or accompanying documentation indicates that the product should not be mixed with general household waste upon disposal. It is the responsibility of the end user to dispose of this product at a designated collection point for waste electrical and electronic equipment (WEEE) to enable reuse or recycling. Correct disposal of this product will help to save valuable resources and prevent potential negative effects on the environment. For more information, please contact your local waste disposal service or Renishaw distributor.

Safety

Information to the user

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

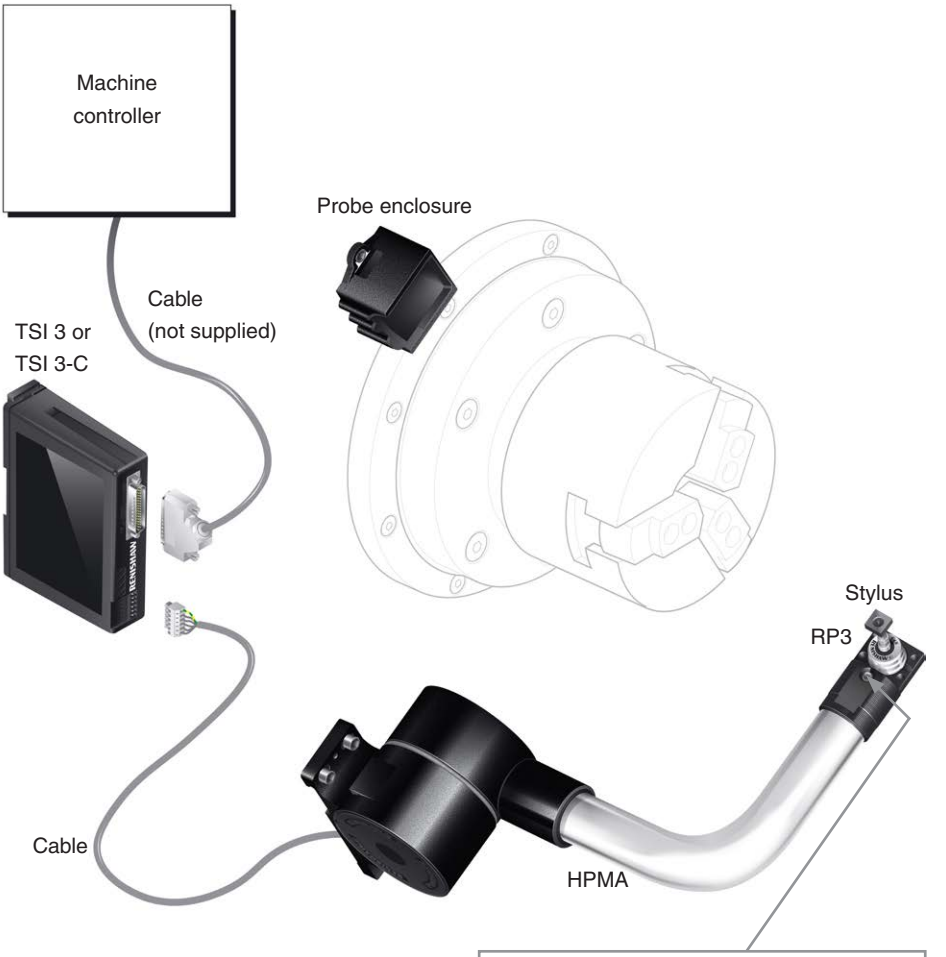
Refer to the machine supplier's operating instructions.

The HPMA system must be installed by a competent person, observing relevant safety precautions. Before starting work, ensure that the machine tool is in a safe condition with the power switched OFF and the power supply to the TSI 3 or TSI 3-C disconnected.

Information to the machine supplier

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 halt the movement of the machine.



Probe status LED	
Green	Arm ready for use and probe seated
Red	Triggered

NOTE: For part numbers, please refer to “Parts list” on page 55.

Variant		Standard rear exit	Standard side exit
Principal application		Tool measuring and broken tool detection on 2-axis and 3-axis CNC lathes.	
Transmission type		Hard-wired transmission	
Weight		≈ 5 kg (176 oz)	
Probe		RP3 (see notes 1 and 2)	
Compatible interfaces		TSI 3 or TSI 3-C	
Cable (to interface)	**Specification**	Ø7.3 mm (0.29 in), 5-core screened cable, each core 42 × 0.15 mm	Ø4.35 mm (0.17 in), 4-core screened cable, each core 7 × 0.2 mm
	Length	2 m (6.5 ft), 5 m (16.4 ft), 10 m (32.8 ft)	7 m (22.9 ft)
Sense directions		±X, ±Y, (probe), ±X, ±Z, (machine)	
Typical positional repeatability (see note 3)		5 µm (197 µin) 2σ X/Z (arms for machines with 6 in to 15 in chucks) 8 µm (315 µin) 2σ X/Z (arms for machines with 18 in to 24 in chucks)	
Stylus trigger force (see notes 4 and 5) XY low force XY high force +Z direction		 1.5 N, 153 gf (5.4 ozf) 3.5 N, 357 gf (12.59 ozf) 12 N, 1224 gf (43.16 ozf)	
Arm swing time		MRO ⟶ ARO ≈ 3 seconds ARO ⟶ MRO ≈ 3 seconds	
Arm sweep angle		90°/91° (If Renishaw probe enclosure is not used, note maximum arm sweep angle of 91°.)	
Sealing		IPX8, BS EN 60529:1992+A2:2013 (IEC 60529:1989+A1:1999+A2:2013)	
Mounting		M8 bolts (3 off)	
Operating temperature		+5 °C to +55 °C (+41 °F to +131 °F)	
Storage temperature		–25 °C to +70 °C (–13 °F to +158 °F)	

Note 1 Where the RP3 is to be used in the probe's Z-axis (the lathe Y-axis), a five-faced stylus is available to order from Renishaw Styli and Fixturing Products.

Note 2 Performance specification is tested at a standard test velocity of 480 mm/min (18.9 in/min) with a 35 mm stylus. Significantly higher velocity is possible depending on application requirements.

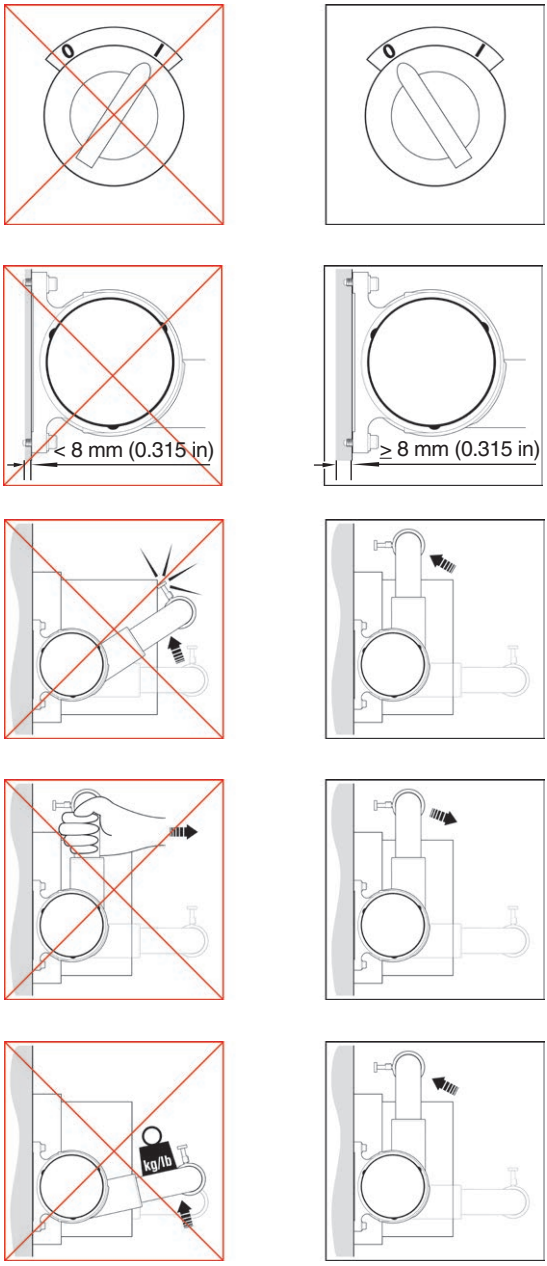
Note 3 Test conditions:

Stylus length:	22 mm (0.87 in)
Stylus velocity:	36 mm/min (1.42 in/min)
Stylus force:	factory settings

Note 4 Trigger force, which is critical in some applications, is the force exerted on the component by the stylus when the probe triggers. The maximum force applied will occur after the trigger point i.e. overtravel. The force value depends on related variables including measuring speed and machine deceleration.

Note 5 These are the factory settings, manual adjustment is not possible.

Installing the HPMA

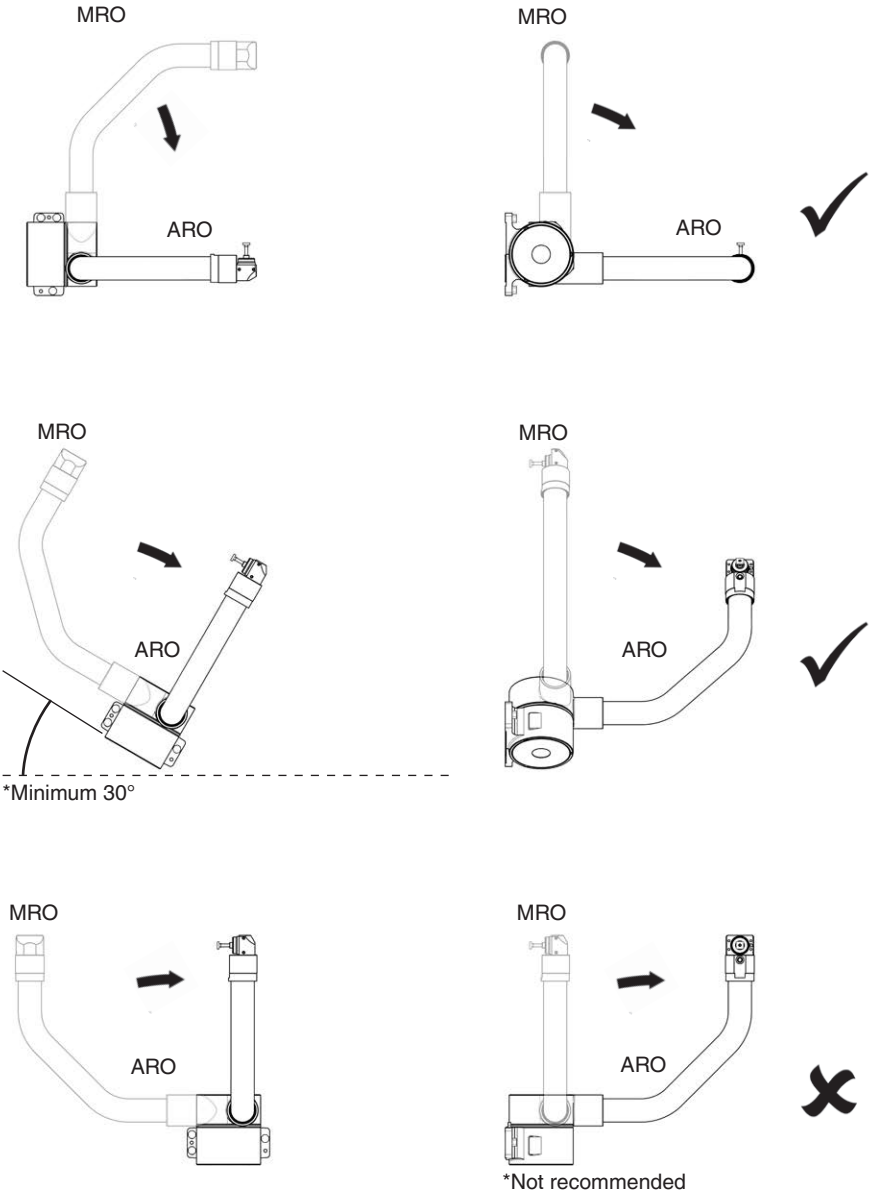


HPMA installation

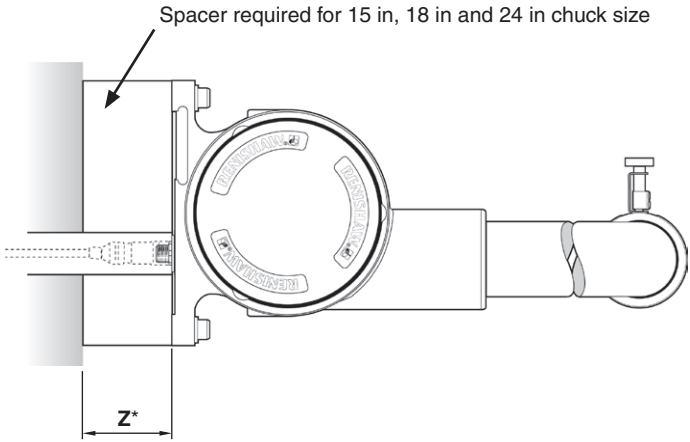
For best performance of the HPMA, the following installation guidelines are recommended:

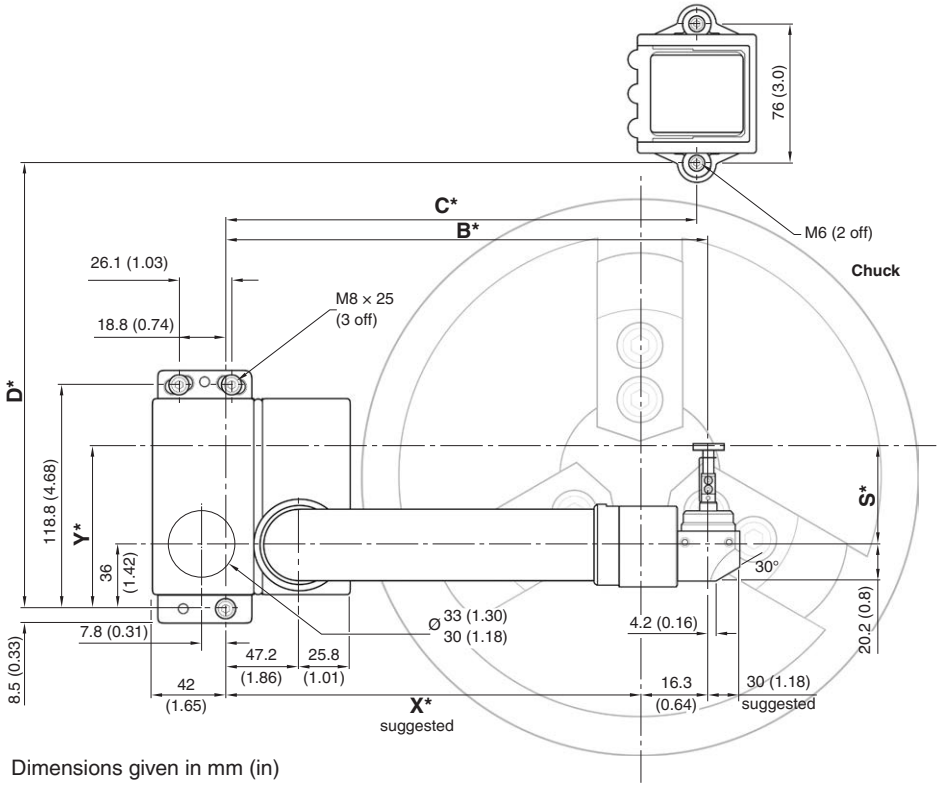
- HPMA is ideally mounted on a solid fixed part of the machine tool, such as a casting. If mounting brackets or plates are used, these must be designed to maximise stiffness with minimal joints. If mounted onto a moving part of the machine tool, repeatability performance may be adversely affected.
- HPMA can be orientated at any angle between 0° and 60° from the vertical, with the arm lowering into “arm ready position”. Performance can be compromised if the HPMA is orientated with the arm rising vertically into “arm ready position” and this should be avoided unless the installation is approved by Renishaw.
- HPMA is sealed to IPX8 and designed for the harsh environments inside a machine tool. However, high-pressure jets and reflected jets can exceed this specification and must not spray directly onto the HPMA. If it is not possible to position the HPMA away from these jets, the hub and base should be protected with suitable guarding. Guarding is not supplied by Renishaw.
- Like all metrology systems, repeatability can be adversely affected by thermal effects on the machine tool. Renishaw recommends thermal compensation routines are incorporated into the measurement software cycles to counteract these effects.

Acceptable orientation of hub and base



*For applications < 30° contact Renishaw.



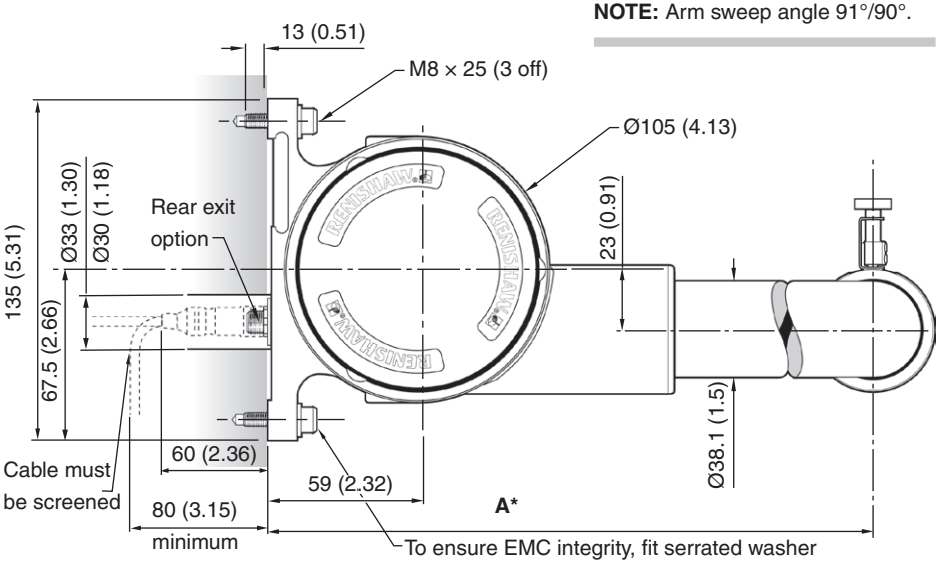


Dimensions given in mm (in)

* A variety of standard length, rear and side exit arms are available. See the table on page 16 for further information.

Overall dimensions and wiring configuration (rear cable exit)

NOTE: Arm sweep angle 91°/90°.

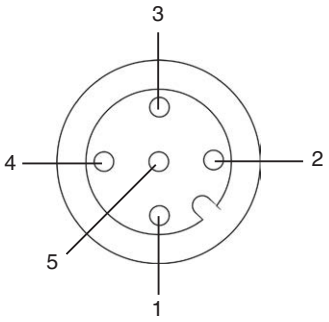


Dimensions given in mm (in)

* A variety of standard length, rear and side exit arms are available. See the table on page 16 for further information.

Rear exit wiring

5-way M12 panel mount connector

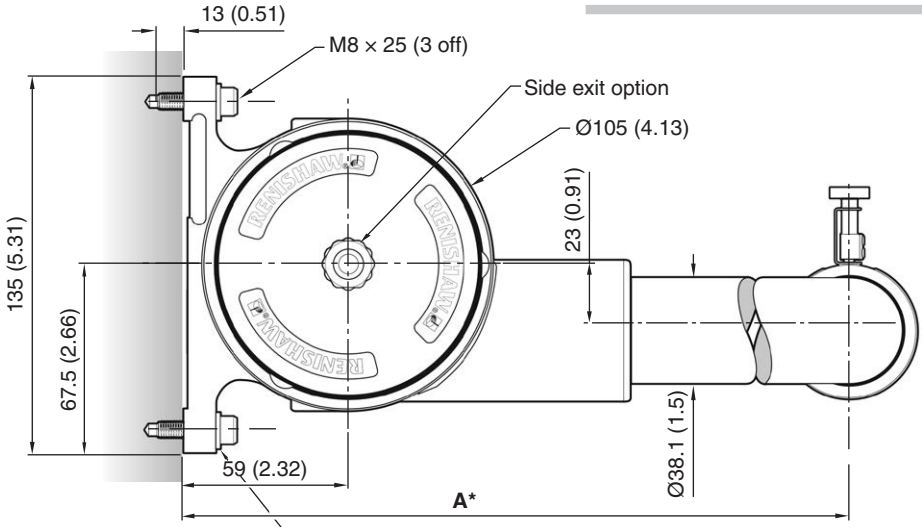


NOTE: Connect the cable before fitting the HPMA.

Pin	Function
1 = P+	Probe +
2 = P–	Probe –
3 = N/C	Not connected
4 = Mot+	Motor +
5 = Mot–	Motor –
Case	Screen

Overall dimensions (side exit)

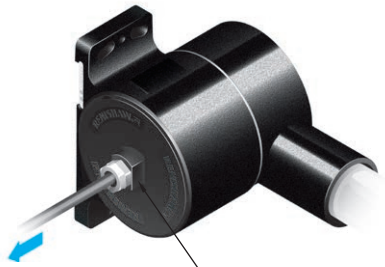
NOTE: Arm sweep angle 91°/90°.



Dimensions given in mm (in)

* A variety of standard length, rear and side exit arms are available. See the table on page 16 for further information.

Side exit wiring



Cable to TSI 3
or TSI 3-C
7 m (23 ft)

Colour	Function
Blue	Probe +
Grey/black	Screen
Green	Probe –
Red	Motor +
Yellow	Motor –

19 mm A/F adaptor suitable for a Ø12 steel tube or Ø11 flexible conduit. Renishaw recommended flexible conduit is Anamet™ Sealtite HFX (5/16 in) polyurethane.

Dimensions table

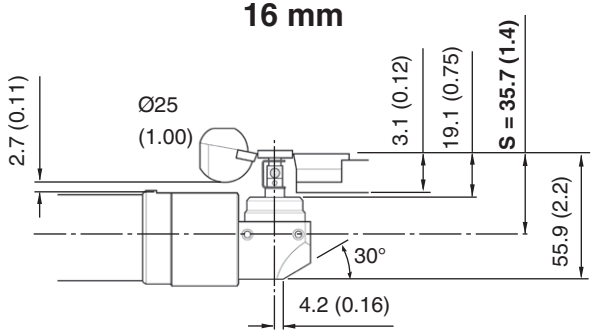
Chuck size	Tooling size	Arm size		C	D	S*	X	Y	Z
		A	B						
6 in	16 mm 20 mm 25 mm 32 mm	250 (9.84)	219.2 (8.63)	212 (8.35)	212 (8.35)	35.7 (1.40) 41 (1.61) 51 (2.01) 56 (2.20)	189.2 (7.45)	71.7 (2.82) 77 (3.03) 87 (3.42) 92 (3.62)	N/A
8 in	16 mm 20 mm 25 mm 32 mm	286 (11.26)	249.2 (9.81)	242 (9.53)	248 (9.76)	35.7 (1.40) 41 (1.61) 51 (2.01) 56 (2.20)	219.2 (8.63)	71.7 (2.82) 77 (3.03) 87 (3.42) 92 (3.62)	N/A
10 in	16 mm 20 mm 25 mm 32 mm 40 mm	335 (13.19)	298.2 (11.74)	291 (11.46)	297 (11.69)	35.7 (1.40) 41 (1.61) 51 (2.01) 56 (2.20) 61 (2.40)	268.2 (10.56)	71.7 (2.82) 77 (3.03) 87 (3.42) 92 (3.62) 97 (3.82)	N/A
12 in	16 mm 20 mm 25 mm 32 mm 40 mm 50 mm	368 (14.49)	298.2 (11.74)	291 (11.46)	320 (12.60)	35.7 (1.40) 41 (1.61) 51 (2.01) 56 (2.20) 61 (2.40) 71 (2.80)	268.2 (10.56)	71.7 (2.82) 77 (3.03) 87 (3.42) 92 (3.62) 97 (3.82) 107 (4.21)	N/A
15 in	20 mm 25 mm 32 mm 40 mm 50 mm	400 (15.75)	343.2 (13.51)	336 (13.23)	362 (14.25)	41 (1.61) 51 (2.01) 56 (2.20) 61 (2.40) 71 (2.80)	313.2 (12.33)	77 (3.03) 87 (3.42) 92 (3.62) 97 (3.82) 107 (4.21)	60 (2.36)
18 in	25 mm 32 mm 40 mm 50 mm	469 (18.46)	383.2 (15.09)	376 (14.80)	431 (16.97)	51 (2.01) 56 (2.20) 61 (2.40) 71 (2.80)	353.2 (13.91)	87 (3.42) 92 (3.62) 97 (3.82) 107 (4.21)	60 (2.36)
24 in	25 mm 32 mm 40 mm 50 mm	555 (21.85)	458.2 (18.04)	451 (17.76)	517 (20.35)	51 (2.01) 56 (2.20) 61 (2.40) 71 (2.80)	428.2 (16.86)	87 (3.42) 92 (3.62) 97 (3.82) 107 (4.21)	120 (4.72)

Dimensions given in mm (in)

* Stylus height, S, is adjustable by ±1.5 mm.

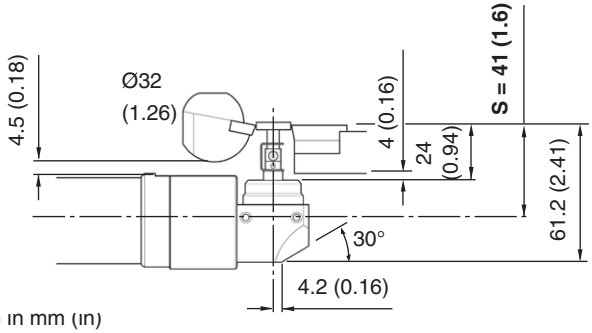
Stylus dimensions by tool size

16 mm



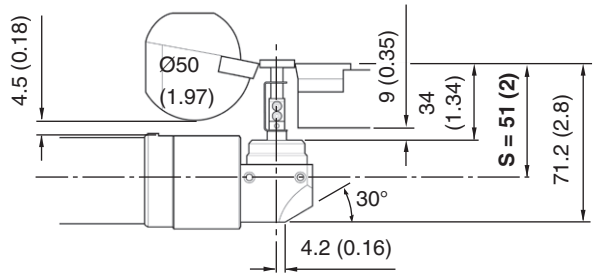
Dimensions given in mm (in)

20 mm



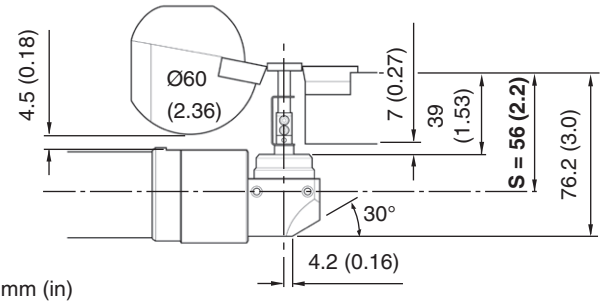
Dimensions given in mm (in)

25 mm



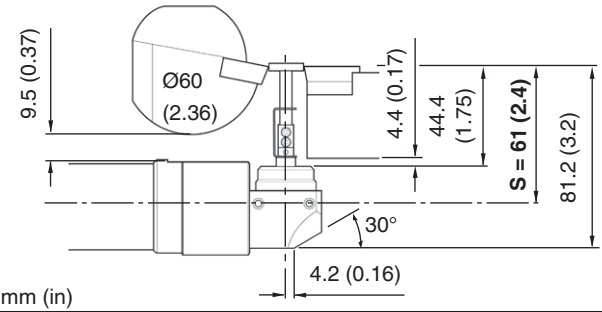
Dimensions given in mm (in)

32 mm



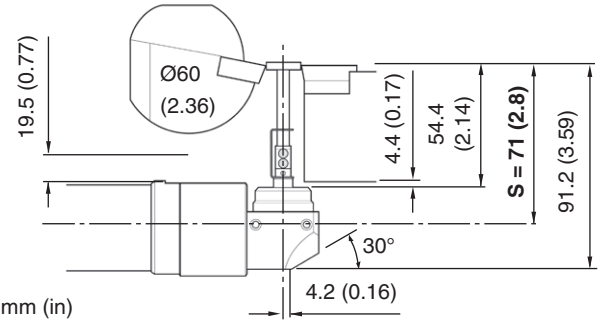
Dimensions given in mm (in)

40 mm



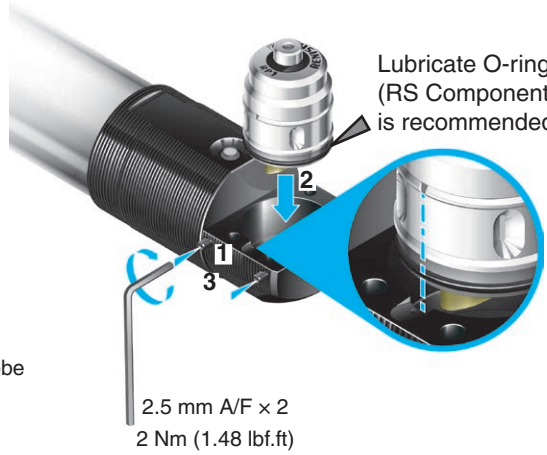
Dimensions given in mm (in)

50 mm



Dimensions given in mm (in)

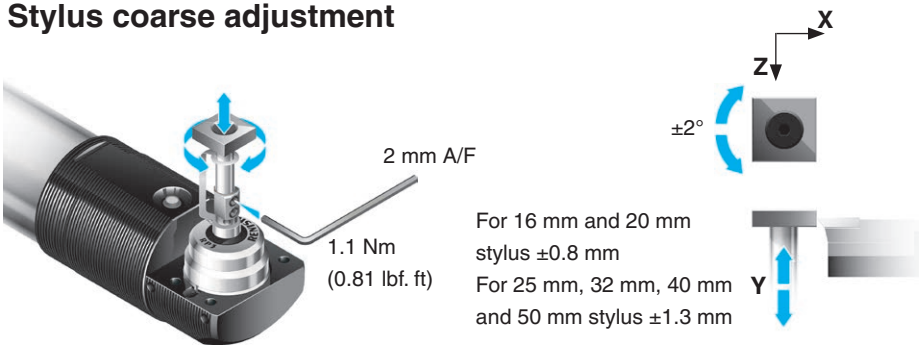
Fitting the probe to the arm



1. Loosen
2. Insert probe
3. Tighten

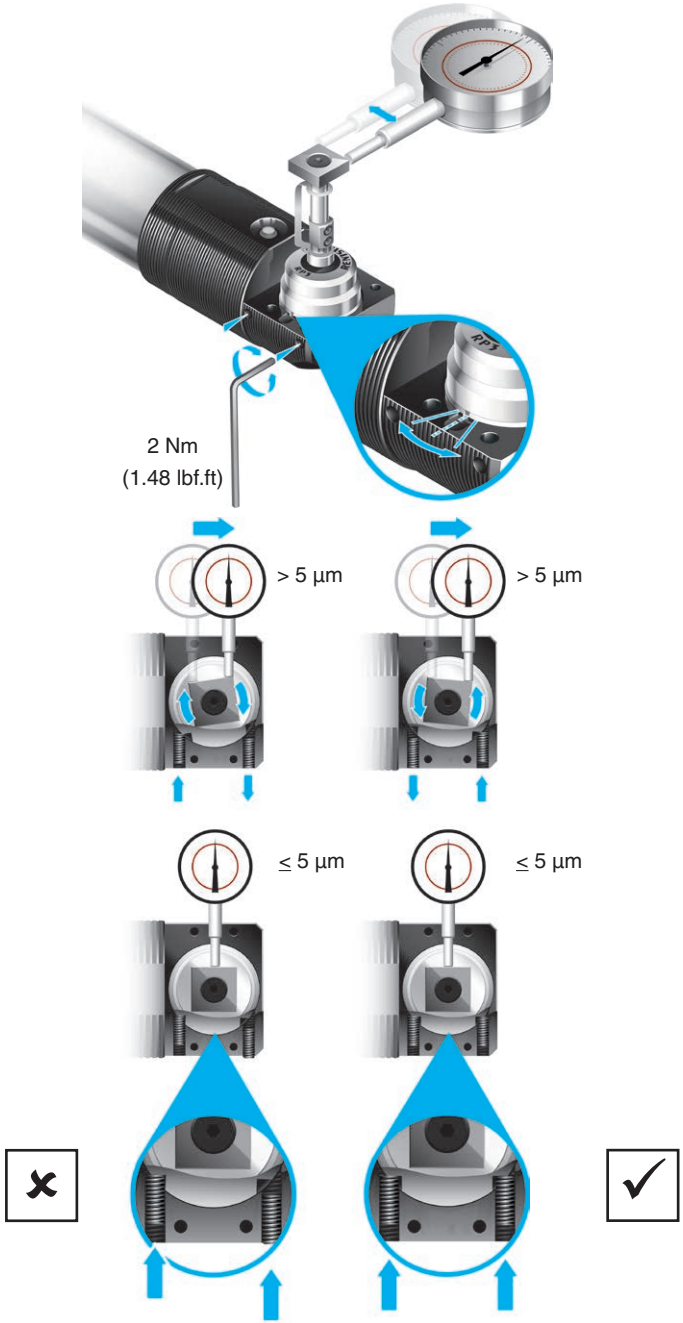
Stylus fitting

Stylus coarse adjustment

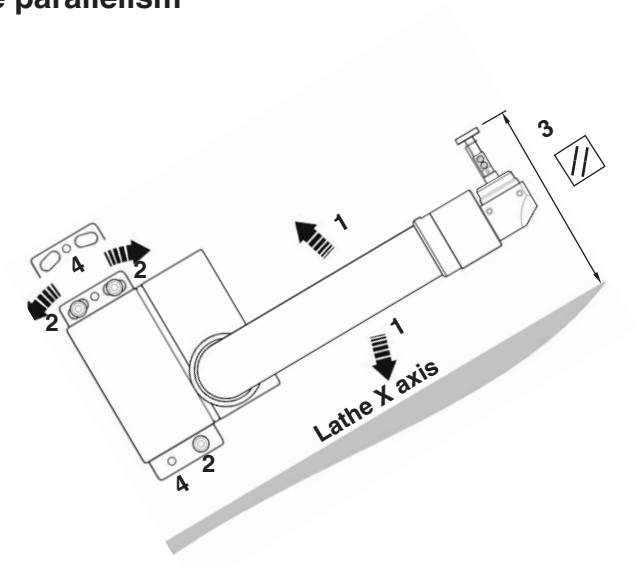


Set approximately parallel with X-Z axes

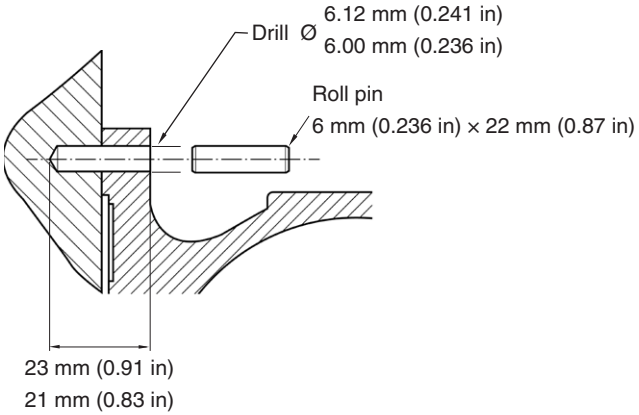
Stylus fine adjustment



Top face parallelism

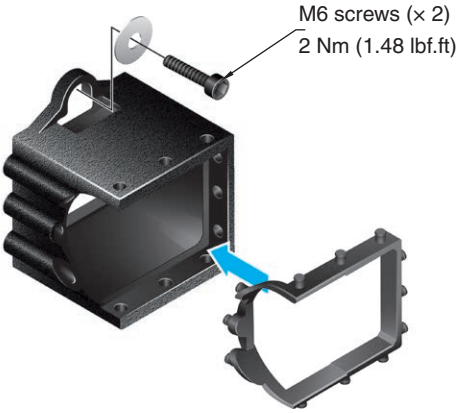


1. Rotate arm on bottom mounting screw to set stylus alignment.
2. Tighten all screws to 10 Nm (7.38 lbf.ft).
3. Check that stylus alignment has not moved after tightening.
4. If required, fit dowel base in position. Drill through base into mounting using pilot holes as a guide. Fit roll pins supplied in base fixing kit. Apply corrosion inhibitor to pins after fitting.



Installing the probe pocket

Also see “Mounting details” on page 13.



1. Fit the probe pocket using the probe pocket fixing kit supplied (M6 screws and washers). Ensure the screws are loose (finger tight).

2. Cycle the arm to the machine ready position.

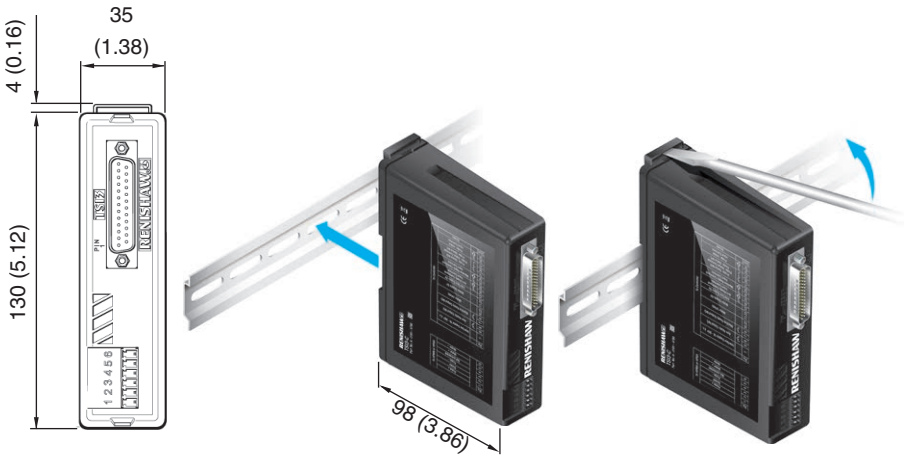
3. Ascertain the optimum position for the probe pocket by repositioning the pocket until it is aligned to the probe holder, then securely tighten the M6 screws.

   This step is necessary to ensure the probe holder exerts equal pressure on all sides of the probe pocket.

4. Check that the probe pocket position is correct and does not inhibit the movement of the arm by cycling the arm to the arm ready position then back to the machine ready position.

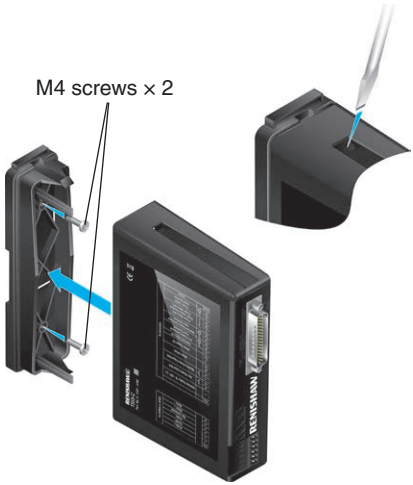
Installing the TSI 3 or TSI 3-C interface

The TSI 3 or TSI 3-C interface unit should be installed in the CNC control cabinet. Where possible, site the unit away from potential sources of interference such as transformers and motor controllers.

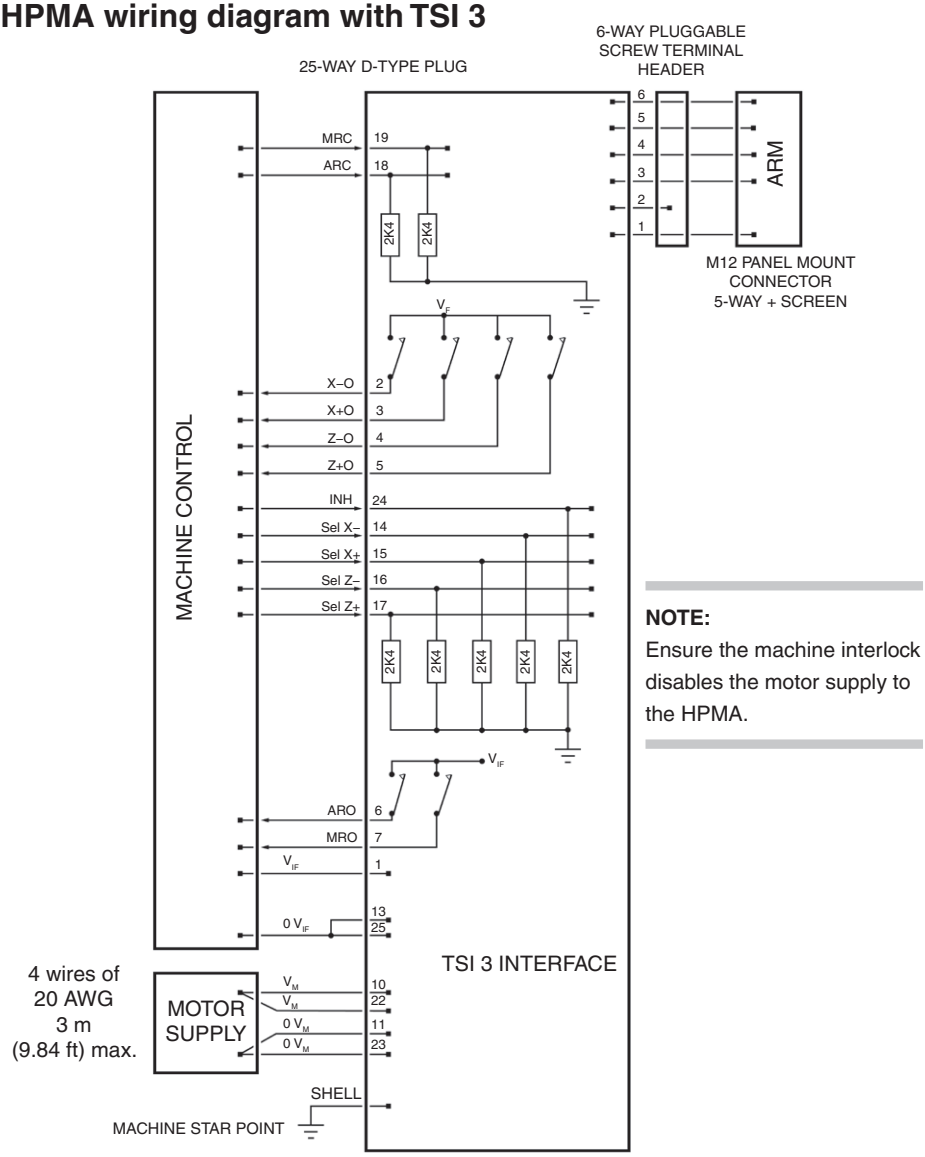


Dimensions given in mm (in)

Alternative mounting



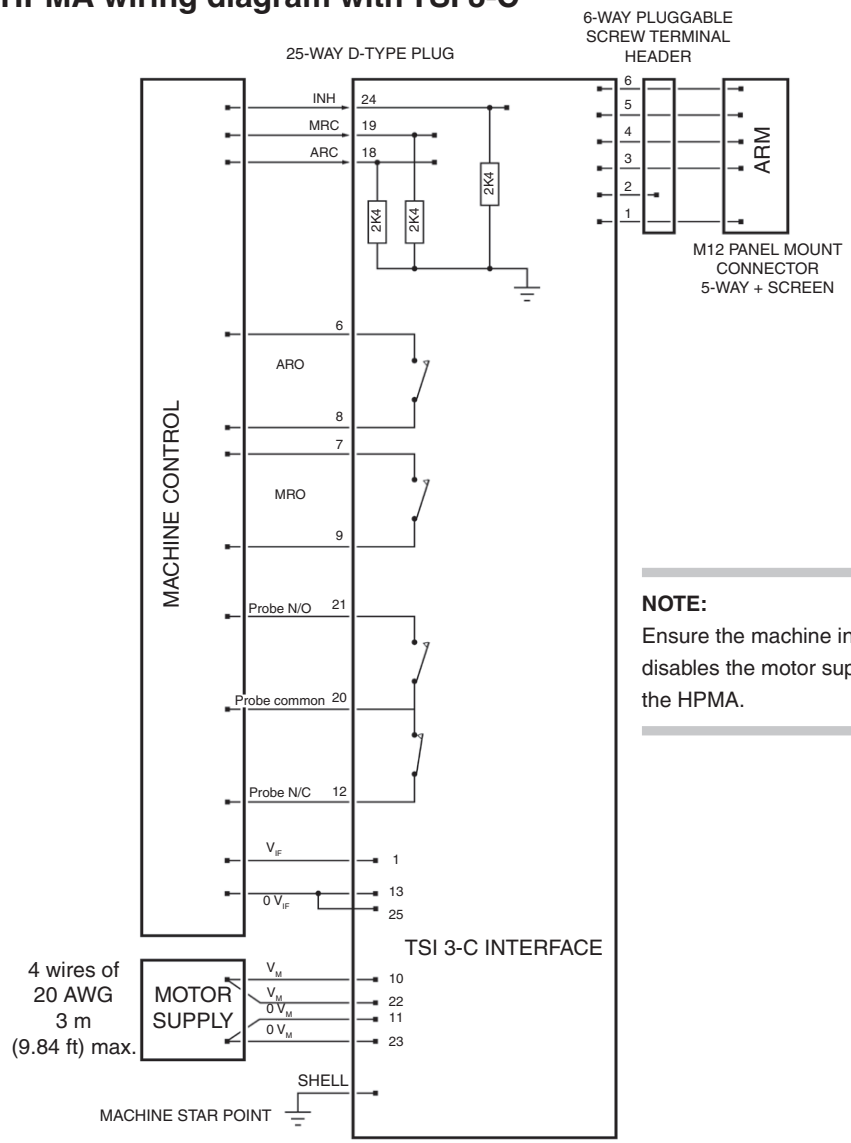
HPMA wiring diagram with TSI 3



NOTE:
Ensure the machine interlock disables the motor supply to the HPMA.

V_{IF} = 24 Vdc (18 Vdc to 30 Vdc).
This supplies the power to the system electronics which include the probe circuit.
I_{MAX} = 100 mA (not including output load currents).
V_M = 24 Vdc (22.8 Vdc to 28.8 Vdc). This supplies the motor drive.
I_{MAX} = 3 A, while the motor is running (typical 2 seconds).
Circuit protection: power supply protected against limited overcurrent and reverse connection.

HPMA wiring diagram with TSI 3-C

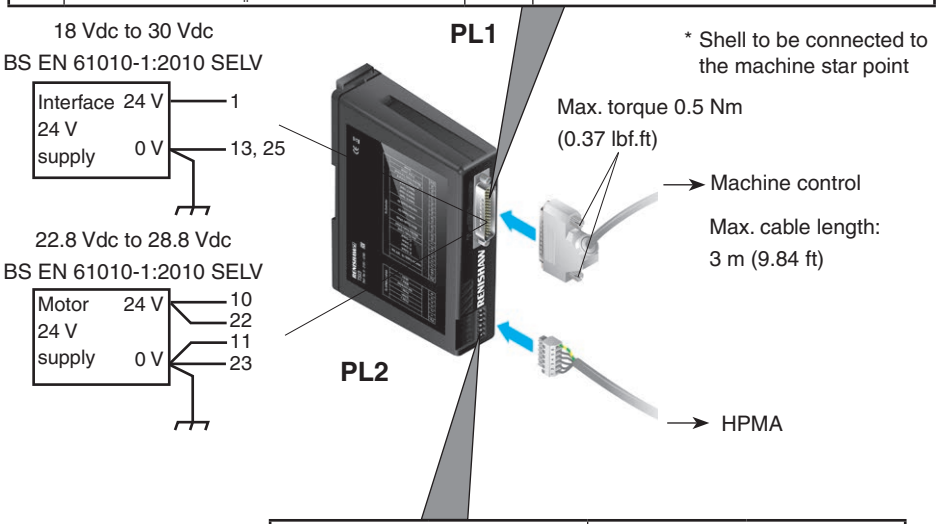


NOTE:
Ensure the machine interlock disables the motor supply to the HPMA.

V_{IF} = 24 Vdc (18 Vdc to 30 Vdc).
This supplies the power to the system electronics which include the probe circuit.
I_{MAX} = 100 mA (not including output load currents).
V_M = 24 Vdc (22.8 Vdc to 28.8 Vdc). This supplies the motor drive.
I_{MAX} = 3 A, while the motor is running (typical 2 seconds).
Circuit protection: power supply protected against limited overcurrent and reverse connection.

TSI 3 interface connections

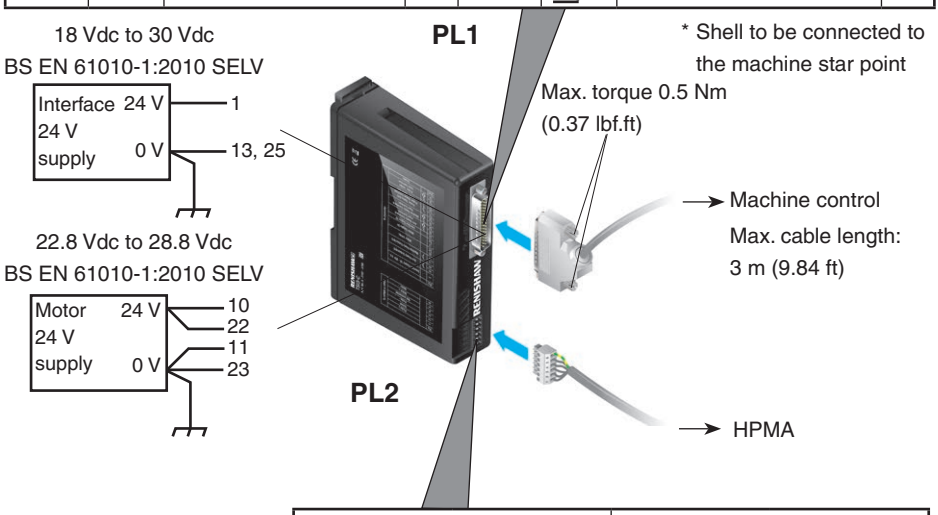
1	18 Vdc to 30 Vdc (V_{if})	14	Select X– input (Sel X–)
2	X– output (X–O)	15	Select X+ input (Sel X+)
3	X+ output (X+O)	16	Select Z– input (Sel Z–)
4	Z– output (Z–O)	17	Select Z+ input (Sel Z+)
5	Z+ output (Z+O)	18	Arm ready command (ARC)
6	Arm ready output (ARO)	19	Machine ready command (MRC)
7	Machine ready output (MRO)	20	No connection (N/C)
8	No connection (N/C)	21	No connection (N/C)
9	No connection (N/C)	22	Motor 24 Vdc (22.8 Vdc to 28.8 Vdc) (V_M)
10	Motor 24 Vdc (22.8 Vdc to 28.8 Vdc) (V_M)	23	Motor 0 Vdc (0 V_M)
11	Motor 0 Vdc (0 V_M)	24	Inhibit input (INH)
12	No connection (N/C)	25	0 V_{if} (GND)
13	0 V_{if} (GND)	Shell*	Screen (SCR)



		Rear exit version		Side exit version	
		Standard	Trigger delay	Standard	Trigger delay
1	Probe + (P+)	Brown	White	Blue	Green
2	Screen (SCR)	Screen	Screen	Grey/Black	Grey/Black
3	Probe – (P–)	White	Brown	Green	Blue
4	Not connected (N/C)	Blue	Blue	Not connected	Not connected
5	Motor + (Mot+)	Black	Black	Red	Red
6	Motor – (Mot–)	Grey	Grey	Yellow	Yellow

TSI 3-C interface connections

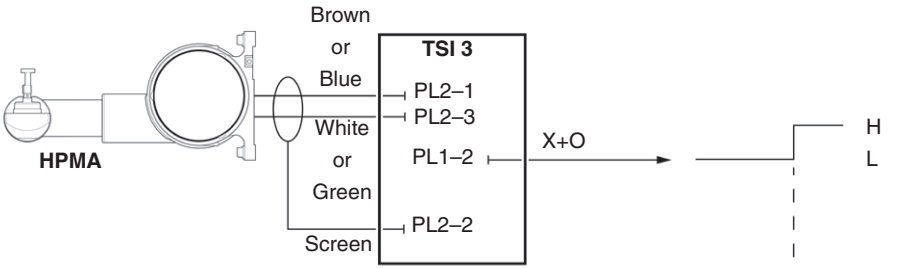
Shell		Screen*	To controller	18		ARC (arm ready command) (15 Vdc to 30 Vdc)	To controller
1		18 Vdc to 30 Vdc (V_{if})		25			
6		ARO (N/O) (arm ready output)		19		MRC (machine ready command) (15 Vdc to 30 Vdc)	
8				25			
7		MRO (N/O) (machine ready output)		21		Probe status (N/O)	
9				20		Probe common	
10, 22		Motor 24 Vdc (22.8 Vdc to 28.8 Vdc) (V_M)		12		Probe status (N/C)	
11, 23		Motor 0 Vdc		24		Probe inhibit (15 Vdc to 30 Vdc)	
13		0 V_{if} (GND)		25			



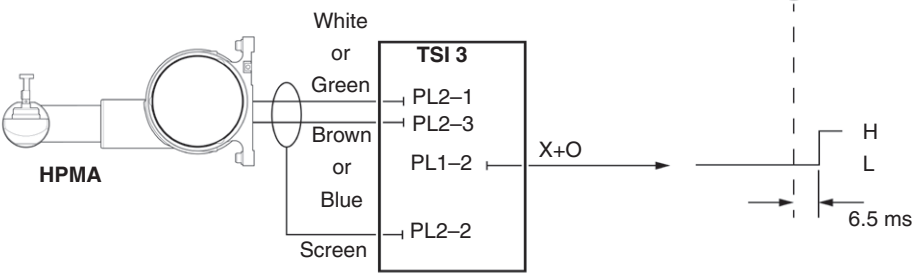
		Rear exit version		Side exit version	
		Standard	Trigger delay	Standard	Trigger delay
1	Probe + (P+)	Brown	White	Blue	Green
2	Screen (SCR)	Screen	Screen	Grey/Black	Grey/Black
3	Probe – (P–)	White	Brown	Green	Blue
4	Not connected (N/C)	Blue	Blue	Not connected	Not connected
5	Motor + (Mot+)	Black	Black	Red	Red
6	Motor – (Mot–)	Grey	Grey	Yellow	Yellow

HPMA with a TSI 3 interface

Brown/White (rear exit) or Blue/Green (side exit) wire configuration for DELAY OFF



Brown/White (rear exit) or Blue/Green (side exit) wire configuration for DELAY ON

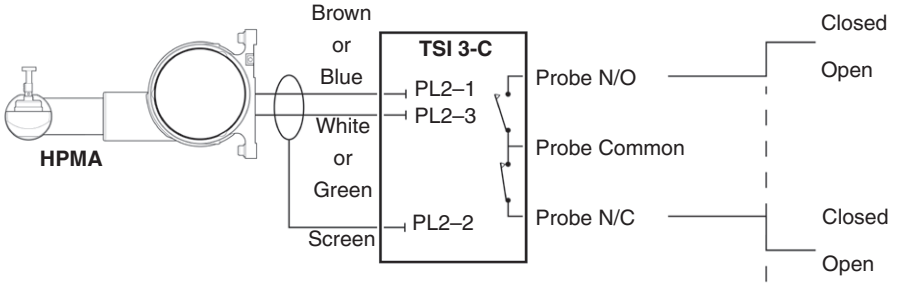


NOTE: See the TSI 3 interface connections on page 26 for more information on motor wiring instructions.

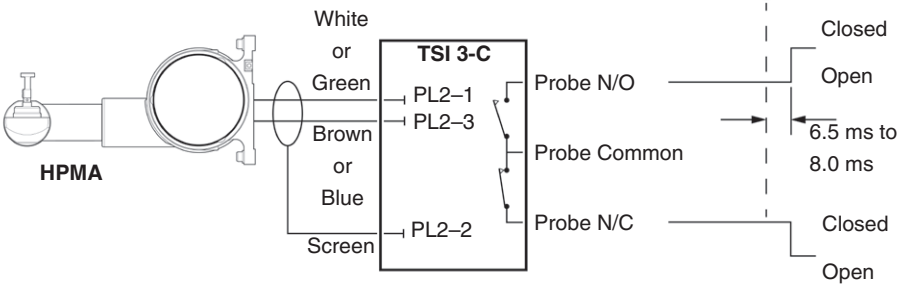
HPMA with a TSI 3-C interface

Brown/White (rear exit) or Blue/Green (side exit) wire configuration for DELAY OFF

Example below shows normally closed probe status output delay.

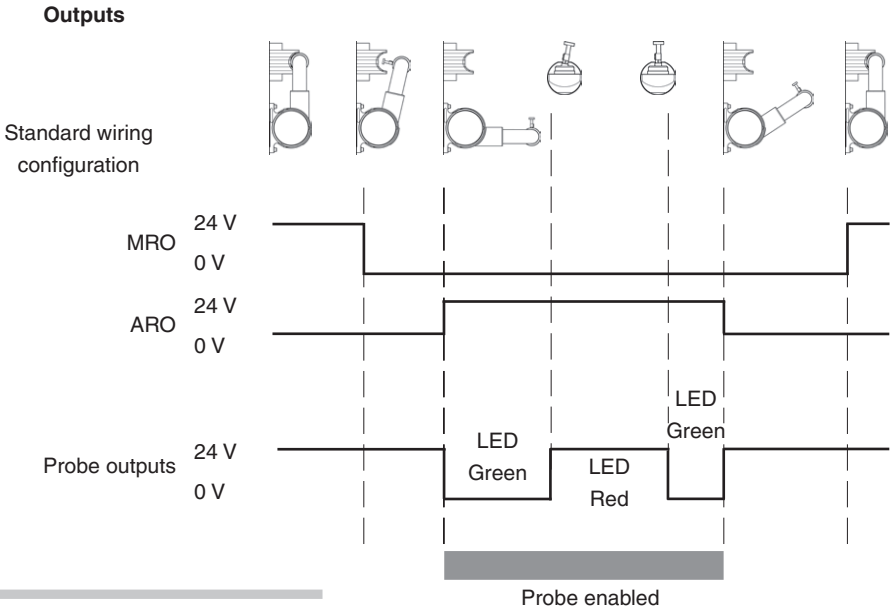


Brown/White (rear exit) or Blue/Green (side exit) wire configuration for DELAY ON

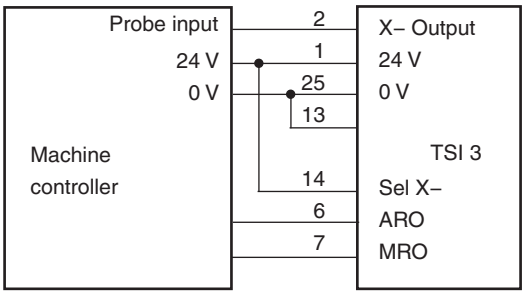


NOTE: See the TSI 3-C interface connections on page 27 for more information on motor wiring instructions.

HPMA and TSI 3 wiring configuration



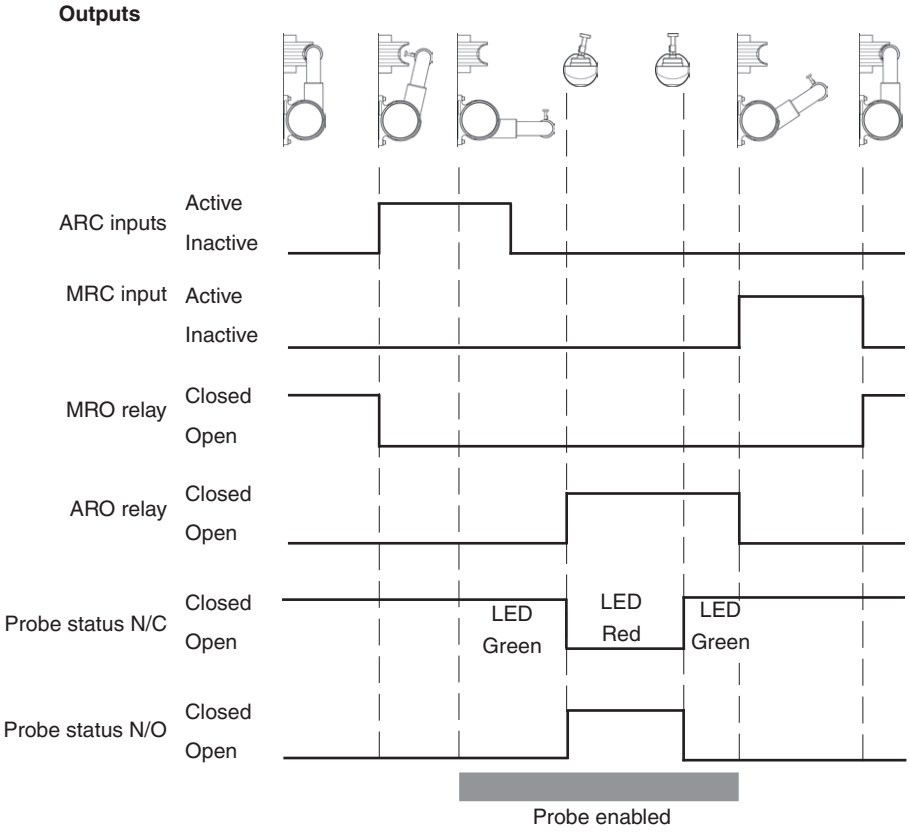
NOTE: These wiring diagrams assume the standard one-wire Renishaw probe output can be used. Where the four-wire option is required (i.e. Fanuc automatic length management input XAE, ZAE), the user must provide FOUR inputs from the control to indicate which axis is moving in order to obtain a probe trigger (Sel X–, Sel X+, Sel Z–, Sel Z+). This signal will instruct the TSI 3 to send the probe trigger output out through one of four possible channels (X–, X+, Z–, Z+).



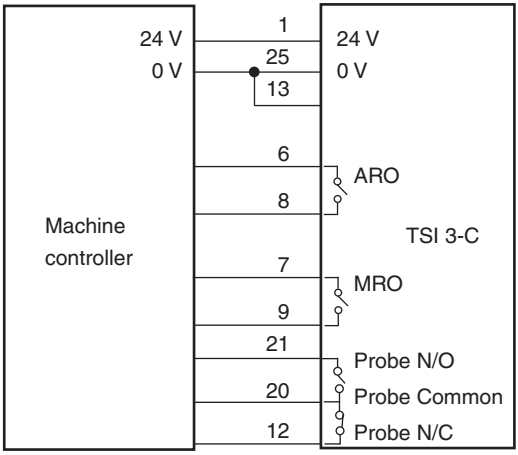
ARO (PL1-6) **MRO (PL1-7)**

Open Collector Transistor (OCT) ACTIVE HIGH outputs Vss – 2.4 V @ max. source 20 mA

HPMA and TSI 3-C wiring configuration



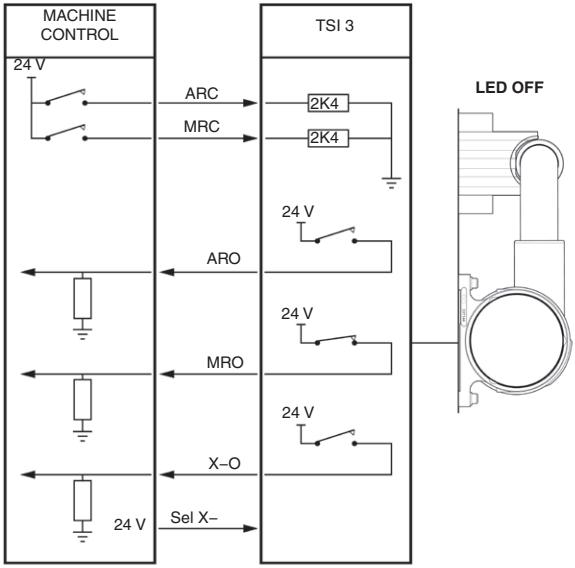
NOTE: These wiring diagrams assume the standard one-wire Renishaw probe output can be used. Where the four-wire option is required (i.e. Fanuc automatic length management input XAE, ZAE), the user must provide FOUR inputs from the control to indicate which axis is moving in order to obtain a probe trigger (Sel X–, Sel X+, Sel Z–, Sel Z+). This signal will instruct the TSI 3-C to send the probe trigger output out through one of four possible channels (X–, X+, Z–, Z+).



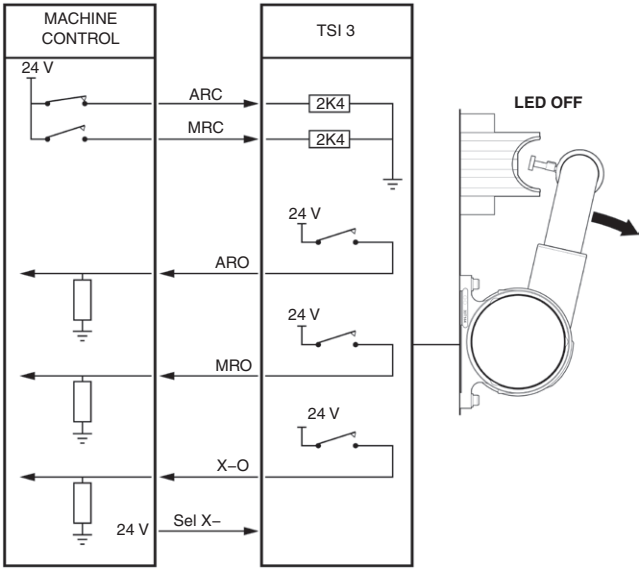
Arm control

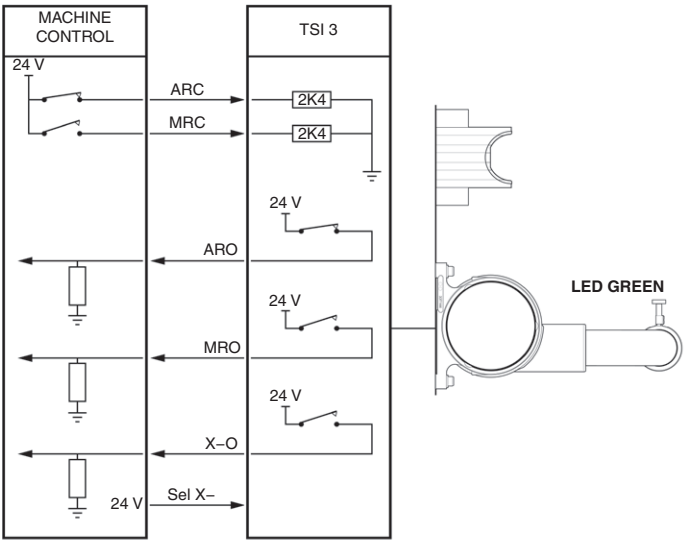
All I/O are “ACTIVE HIGH” configuration.

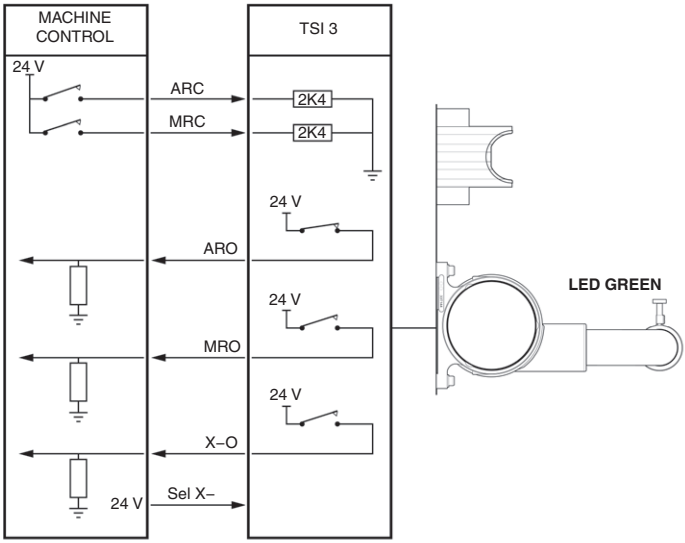
Two separate machine tool control outputs are required to command the arm to move to “machine ready position” (MRC) and “arm ready position” (ARC). The user must ensure that both outputs are never active at the same time. There must be a minimum time delay of 0.1 seconds (100 ms) between one command being deactivated and the other being activated. If both outputs are active at the same time then the arm is unable to determine what to do and will stop. This condition can only be overcome by deactivating both outputs.

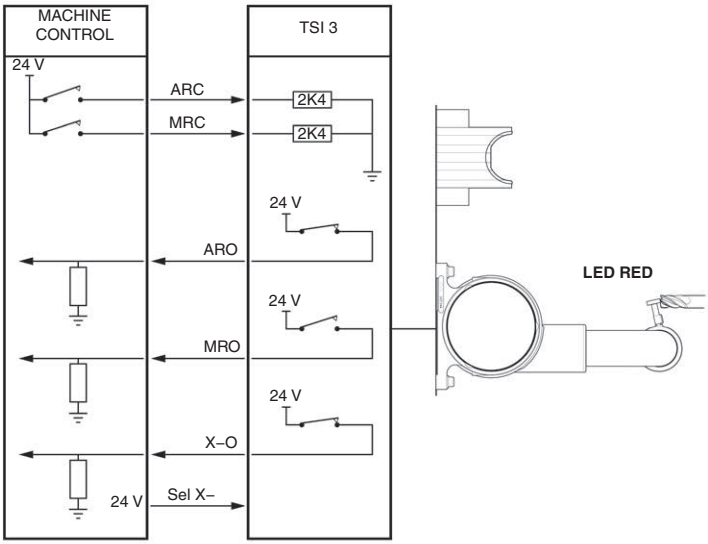


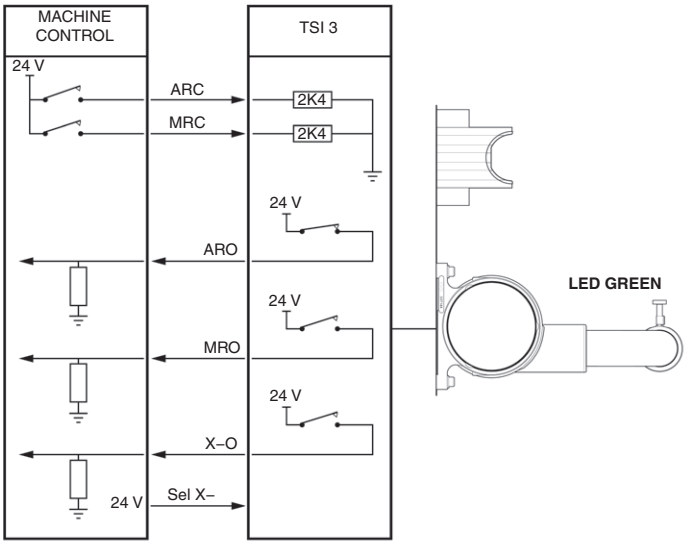
Two machine tool control inputs are required to receive arm position confirmation signals for “machine ready” (MRO) and “arm ready” (ARO).

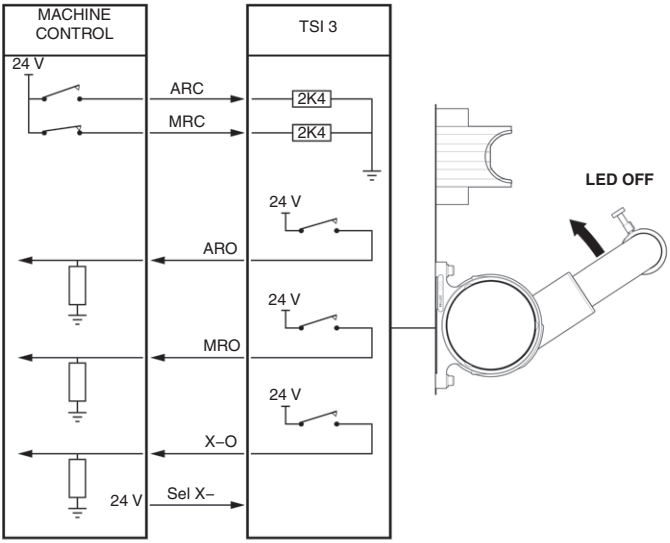


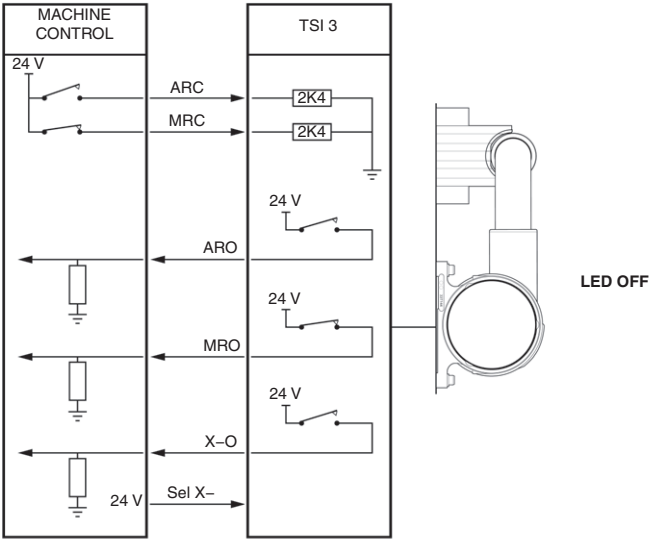

MACHINE CONTROL
TSI 3
24 V
ARC
MRC
2K4
2K4
24 V
ARO
24 V
LED GREEN
MRO
24 V
X–O
24 V
Sel X–

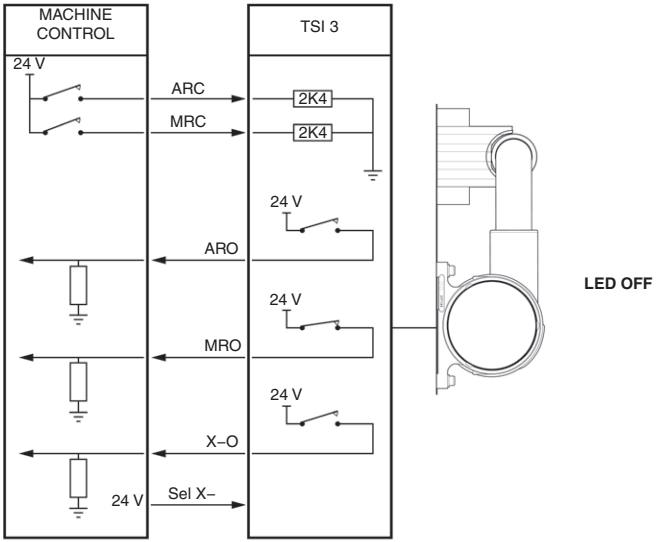

MACHINE CONTROL
TSI 3
24 V
ARC
MRC
2K4
2K4
24 V
ARO
24 V
LED GREEN
MRO
24 V
X–O
24 V
Sel X–


MACHINE CONTROL
TSI 3
24 V
ARC
MRC
2K4
2K4
24 V
ARO
LED RED
24 V
MRO
24 V
X–O
24 V
Sel X–


MACHINE CONTROL
TSI 3
24 V
ARC
MRC
2K4
2K4
24 V
ARO
LED GREEN
24 V
MRO
24 V
X–O
24 V
Sel X–

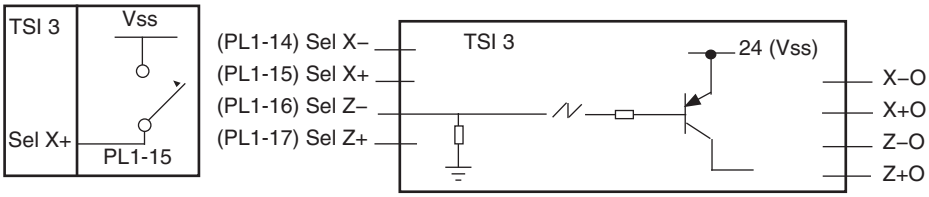

MACHINE CONTROL
TSI 3
24 V
ARC
MRC
2K4
2K4
LED OFF
24 V
ARO
24 V
MRO
24 V
X–O
24 V
Sel X–


MACHINE CONTROL
TSI 3
24 V
ARC
MRC
2K4
2K4
24 V
ARO
LED OFF
24 V
MRO
24 V
X–O
24 V
Sel X–



NOTE: These wiring diagrams above and on the previous pages assume that the standard one-wire Renishaw probe output can be used. Where the four-wire option is required (i.e. Fanuc automatic length management input XAE, ZAE), the user must provide FOUR inputs from the control to indicate which axis is moving in order to obtain a probe trigger (Sel X–, Sel X+, Sel Z–, Sel Z+). This signal will instruct the TSI 3 to send the probe trigger output out through one of four possible channels (X–, X+, Z–, Z+).

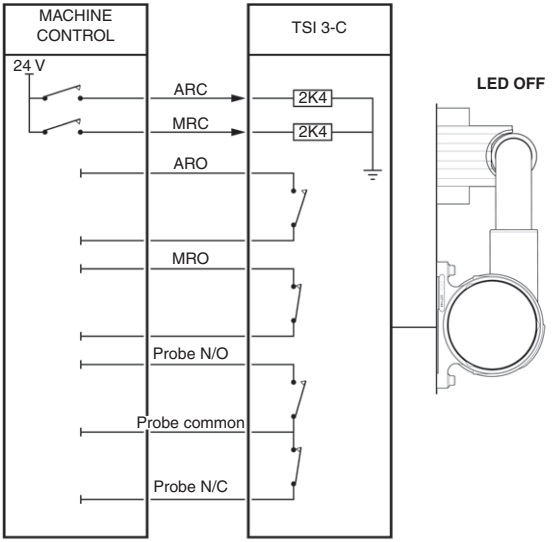
Probe select inputs (for arms used with TSI 3 only, not applicable for arms used with TSI 3-C)

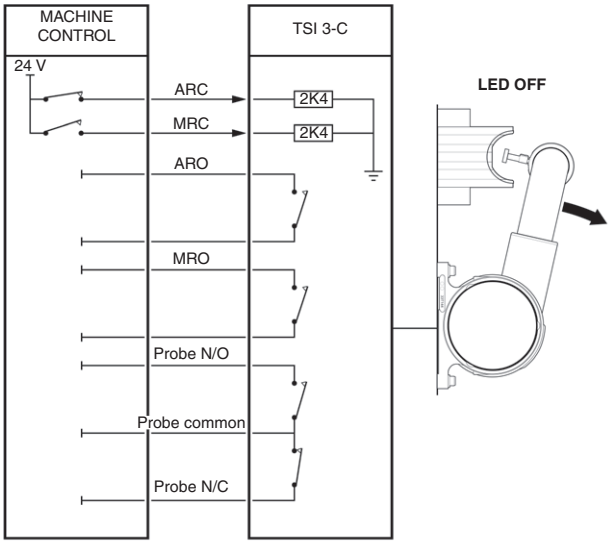


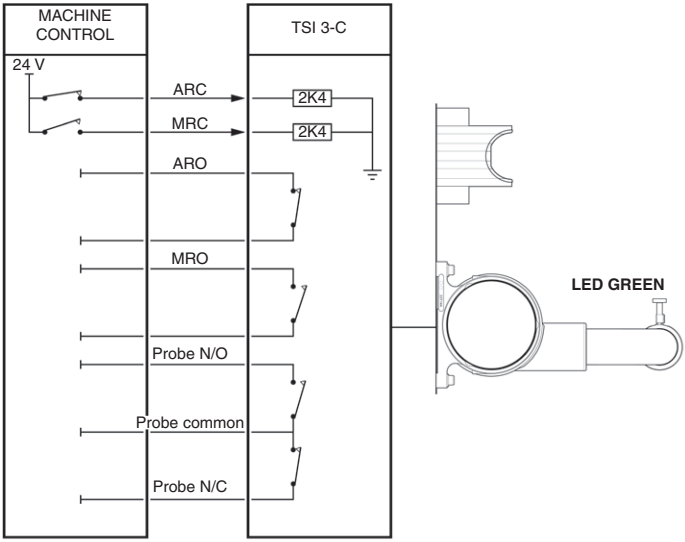
Sel X– → X–O
Sel X+ → X+O

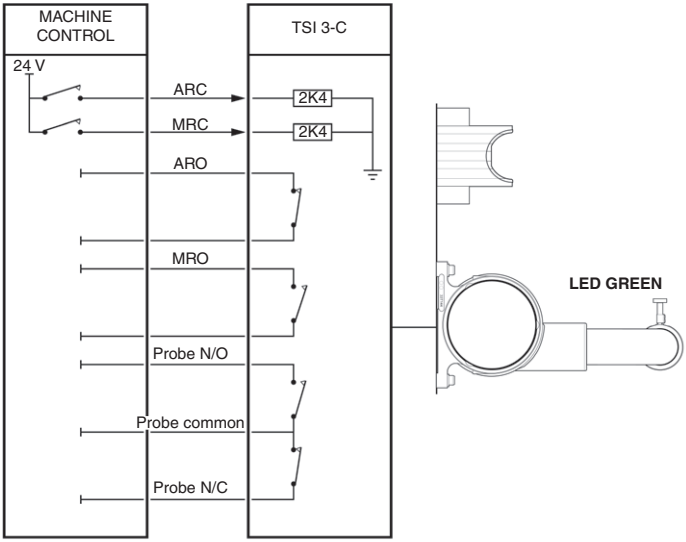
Sel Z– → Z–O
Sel Z+ → Z+O

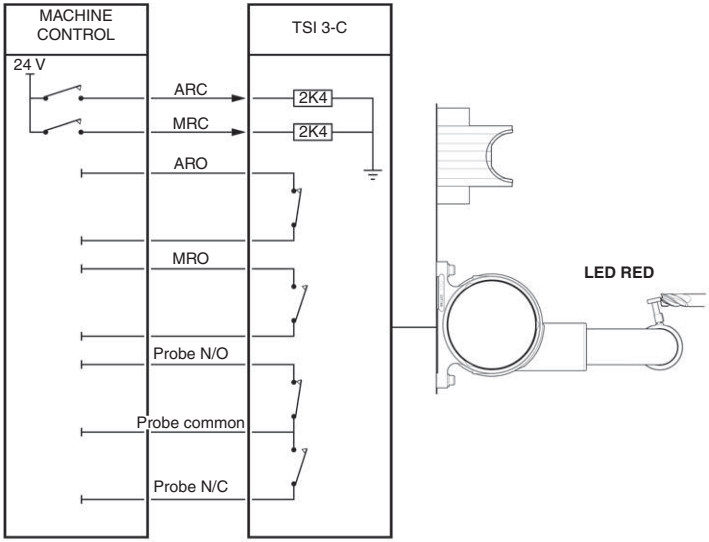
Arm control

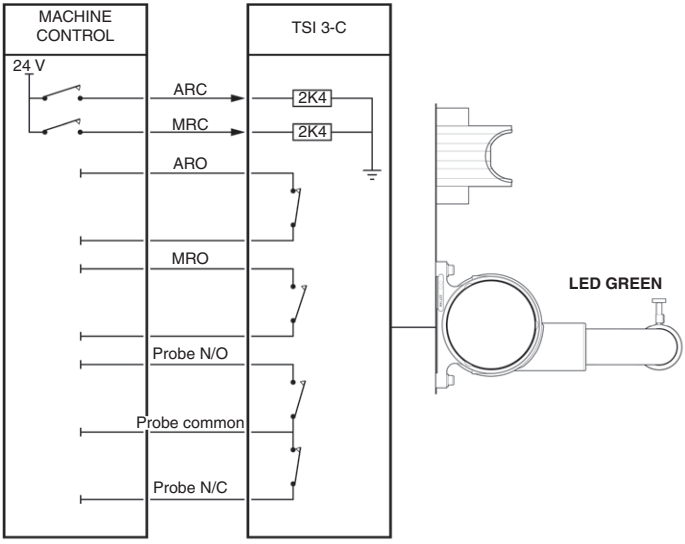

MACHINE CONTROL
TSI 3-C
24 V
ARC
MRC
ARO
MRO
Probe N/O
Probe common
Probe N/C
2K4
2K4
LED OFF

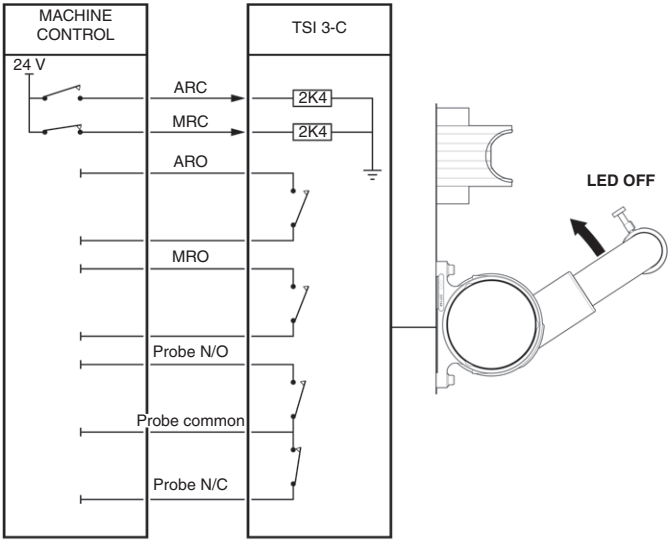

MACHINE CONTROL
TSI 3-C
24 V
ARC
MRC
ARO
MRO
Probe N/O
Probe common
Probe N/C
2K4
2K4
LED OFF

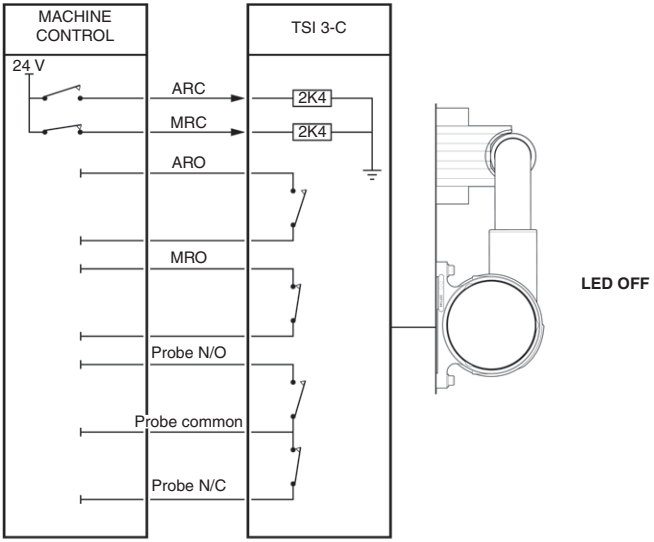

MACHINE CONTROL
TSI 3-C
24 V
ARC
MRC
ARO
MRO
Probe N/O
Probe common
Probe N/C
2K4
2K4
LED GREEN

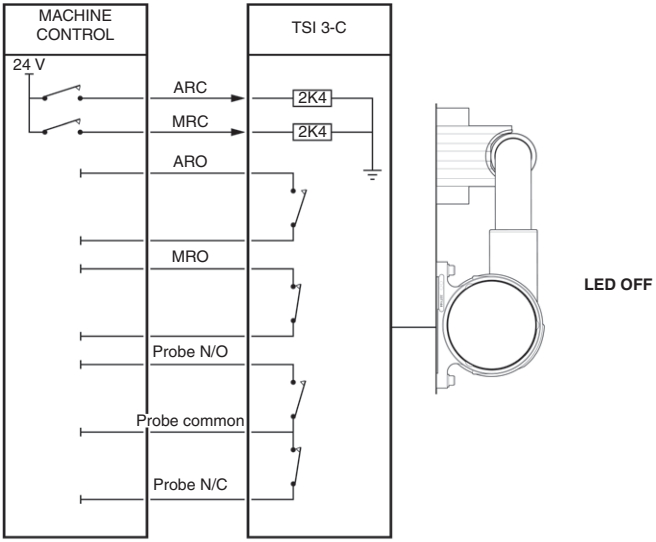

MACHINE CONTROL
TSI 3-C
24 V
ARC
MRC
ARO
MRO
Probe N/O
Probe common
Probe N/C
2K4
2K4
LED GREEN


MACHINE CONTROL
TSI 3-C
24 V
ARC
MRC
ARO
MRO
Probe N/O
Probe common
Probe N/C
2K4
2K4
LED RED


MACHINE CONTROL
TSI 3-C
24 V
ARC
MRC
ARO
MRO
Probe N/O
Probe common
Probe N/C
2K4
2K4
LED GREEN

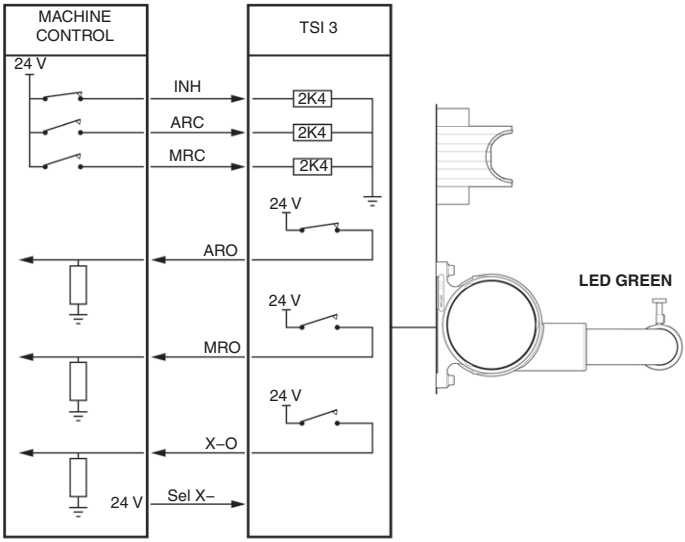

MACHINE CONTROL
TSI 3-C
24 V
ARC
MRC
ARO
MRO
Probe N/O
Probe common
Probe N/C
2K4
2K4
LED OFF

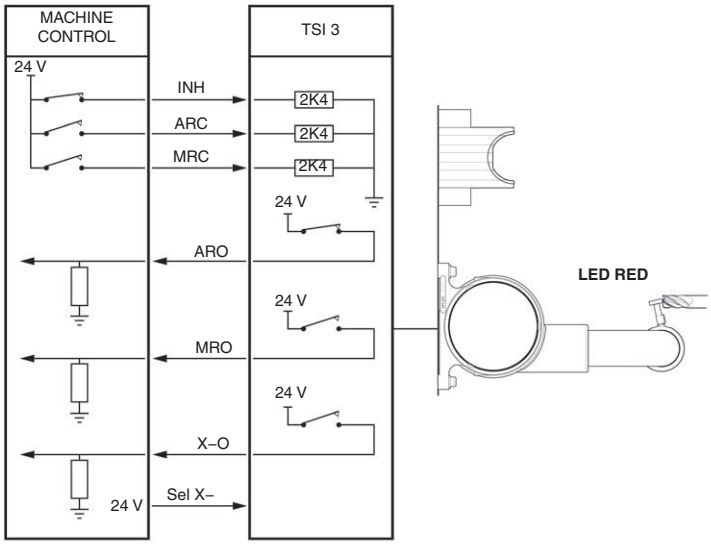

MACHINE CONTROL
TSI 3-C
24 V
ARC
MRC
ARO
MRO
Probe N/O
Probe common
Probe N/C
2K4
2K4
LED OFF


MACHINE CONTROL
24 V
TSI 3-C
ARC
MRC
ARO
MRO
Probe N/O
Probe common
Probe N/C
2K4
2K4
LED OFF

Probe inhibit with TSI 3

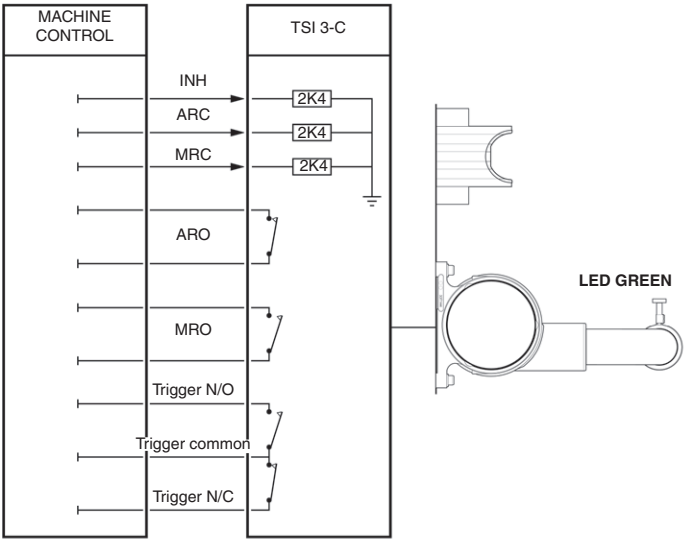
Shown as “ACTIVE HIGH” configuration.

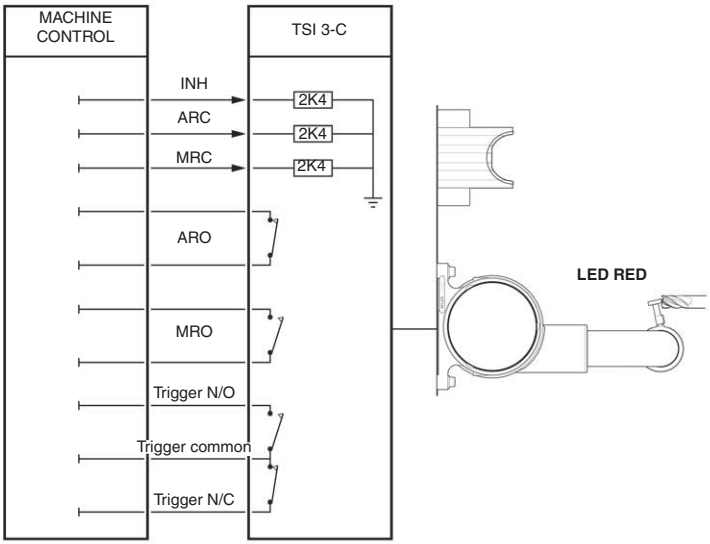




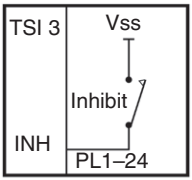
Probe inhibit with TSI 3-C

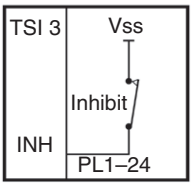
Shown as “ACTIVE HIGH” configuration.

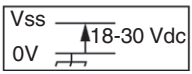


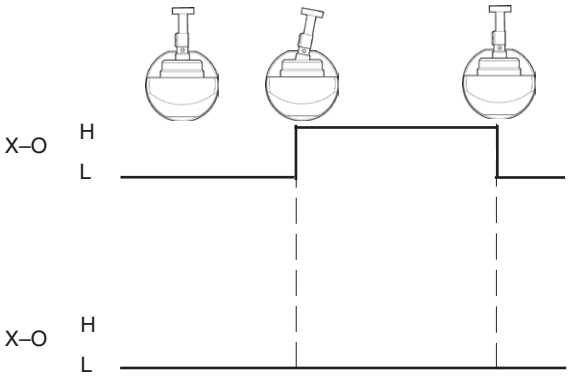


TSI 3 interface inputs





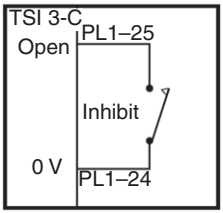


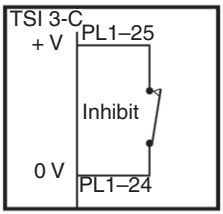


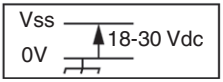
NOTE: Probe status LED will still function when inhibit is active.

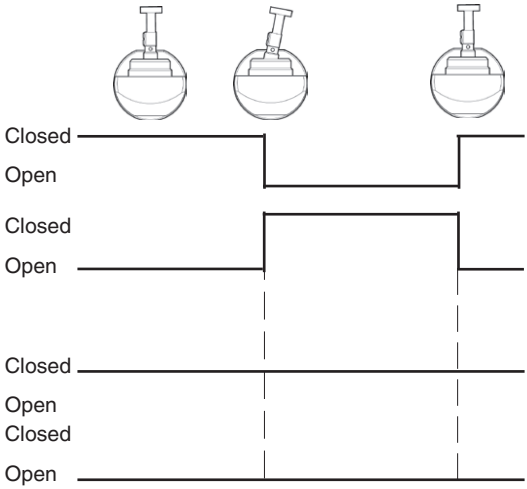
TSI 3-C interface inputs

The inhibit input is not polarity conscious. Apply a voltage of 15 Vdc to 30 Vdc across PL1-24 and PL1-25 to activate. The inhibit input presents a load of 12.5 mA max.
Probe inhibit disables the probe outputs.









NOTE: Probe status LED will still function when inhibit is active.

Input specification with TSI 3

INH
Sel X–
Sel X+
Sel Z–
Sel Z+
ARC
MRC

} Internally pulled down (2K4) ACTIVE HIGH inputs

Output specification with TSI 3

ARO and MRO are current limited.

X–O, X+O, Z–O, Z+O are protected by the supply fuse in the TSI 3 or TSI 3-C.

Probe signal outputs

(PL1-2) X–O
(PL1-3) X+O
(PL1-4) Z–O
(PL1-5) Z+O

} OCT ACTIVE HIGH outputs (one probe signal output only) V_{IF} – 3.8 V @ max. source 120 mA
V_{IF} – 2.4 V @ 20 mA

Arm ready (ARO) / Machine ready (MRO) outputs

ARO (PL1-6) **MRO (PL1-7)**

OCT ACTIVE HIGH outputs V_{IF} – 2.4 V @ 20 mA

Input specification with TSI 3-C

INH
ARC
MRC

} Internally pulled down (2K4) ACTIVE HIGH inputs

Output specification with TSI 3-C

ARO and MRO are solid-state relay (SSR) contacts.

Probe signal outputs

Active closed.

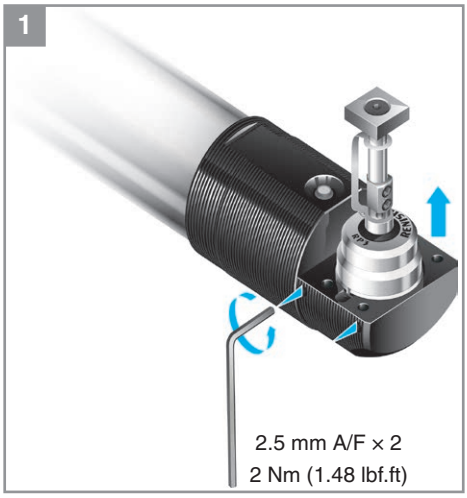
Active open.

Please refer to “TSI 3-C interface connections” on page 27.

RP3 probe removal

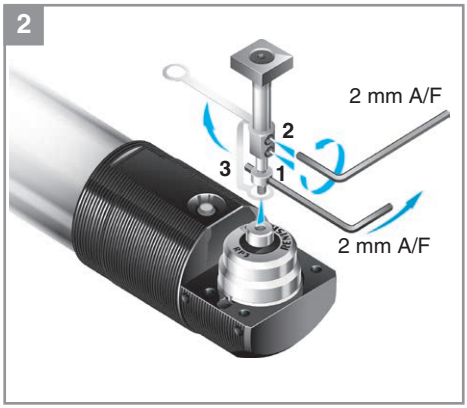
CAUTION: Ensure the area around the probe is dry and free of swarf and coolant before removing the probe.

1. Remove the M5 grub screws prior to cleaning to allow any coolant to escape.
2. Clean the probe and the area around the probe using clean dry air (Dust Remover clean air spray [RS Components no. 846-698] is recommended).
3. Remove the probe.



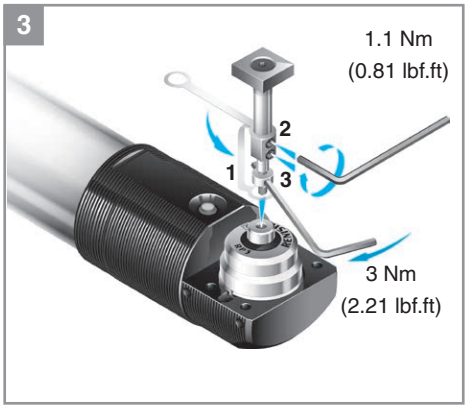
Stylus and break stem removal

1. Using a 2 mm hexagonal key fitted through the hole in the break stem (**1**), unscrew the stylus from the probe.
2. Using a 2 mm hexagonal key, unscrew the two M3 grub screws (**2**) that hold the break stem to the stylus.
3. Free the end of the captive link from the threaded end of the break stem (**3**) and remove the break stem.



Break stem and stylus fitting

1. Fit the free end of the captive link over the threaded end of the break stem (**1**).
2. Fit the break stem inside the stylus and secure it by tightening the two M3 grub screws (**2**).
3. Using a 2 mm hexagonal key fitted through the hole in the break stem (**3**), fit the stylus to the probe.



RP3 probe maintenance

RP3 probe care

The probe mechanism is protected from coolant and debris by a diaphragm. This provides adequate protection under normal working conditions.

Periodically clean the probe and check the diaphragm for signs of damage.

CAUTION: Do not remove the diaphragm. If the diaphragm is damaged, return the probe to your supplier for repair.

Cleaning and diaphragm inspection

1. Leaving the probe in the arm, use a screwdriver to release and remove the front cover.

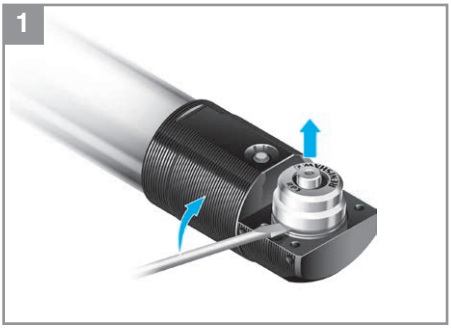
2. Clean the probe mechanism with low pressure clean coolant.

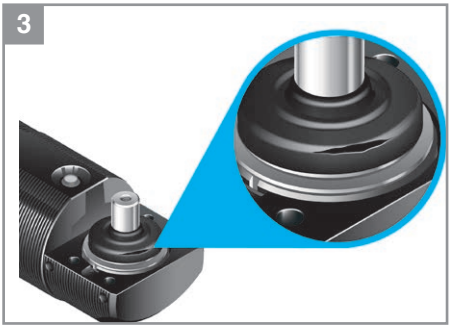
CAUTION: Do not use high-pressure water jets to clean the probe mechanism.

3. Inspect the diaphragm for damage. If it is damaged, return the probe to your supplier. DO NOT REMOVE THE INNER DIAPHRAGM AS THIS WILL INVALIDATE YOUR WARRANTY.

Fitting the cover

4. Fit the front cover by pressing it back into place with your hand.

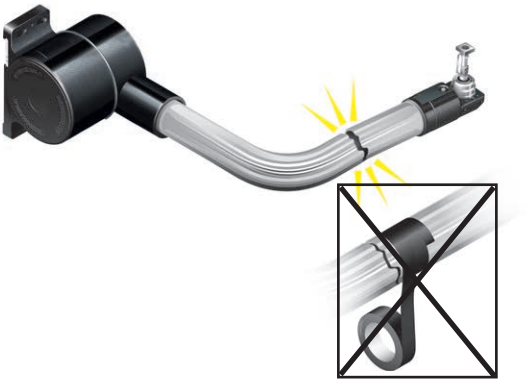




HPMA maintenance

HPMA inspection

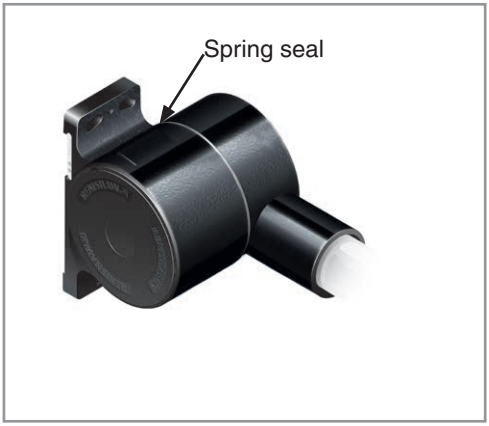
Periodically inspect the arm for signs of damage. If it is damaged, contact your supplier. DO NOT ATTEMPT TO FIX IT YOURSELF.



Spring seal inspection

Regularly clean the spring seal with a brush to prevent swarf build up.

CAUTION: Do not use high-pressure water jets to clean the spring seal.



Tool setting

Tool setting definitions

Probe datuming determines the relationship between the machine spindle and the stylus location, as well as the effective size of the tool setting stylus.

Your Renishaw tool setting probe can be datumed by measuring a ‘datum tool’ of known size and position.

Tool setting establishes the size and position of your cutting tools before you use them to machine a component.

This assists you to produce parts that are ‘right first time’.

With a Renishaw tool setting probe you can determine the size and position of your cutting tools quickly and easily.

Tool breakage detection checks the length of tools to see if the tool has chipped or broken since it was last set.

Probe datuming

Why datum the probe?

A Renishaw touch-trigger probe allows you to use your machine tool to determine the size and position of your tools. When the stylus contacts the surface of your tool, the positions of the machine axes should be recorded at that moment.

To determine the location of the surface of the tool, the software must know the size and position of the stylus.

Various probe datuming techniques allow you to determine the relationship between the stylus and the machine spindle.

Whilst the spindle/stylus relationship will not change under normal conditions, there are certain circumstances under which you should redatum the tool setting probe:

- Before using the probe for the first time on a machine.
- Whenever a new stylus is fitted.
- If you have made any adjustment to the probe alignment.
- If you suspect that the stylus has become distorted.

Setting tools

Setting tool lengths

Tools can be set for length in one of two ways:

- Static
- Rotating

Static length setting is suitable for tools whose cutting edges are located on the spindle centre line, for example, drills. Static length setting involves moving the tip of a tool to contact the stylus – see Figure 1.

Rotating length setting (for driven tools) is suitable for tools whose cutting edges are located around their circumference, for example slot drills. As with static length setting, rotating length setting involves moving the tip of a tool to contact the stylus but doing so while rotating, and doing so in the opposite direction to that which is used for cutting.

Rotating length setting ensures that the true high or low point of the tool is detected.

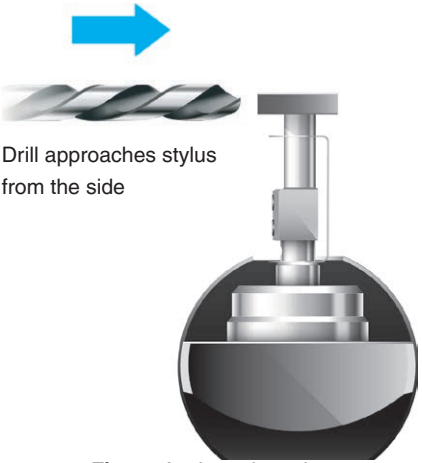


Figure 1 – Length setting

Setting tool diameters

Tools which are used to interpolate features, for example, slot drills, must be set for diameter.

Rotating diameter setting (for driven tools) is suitable for tools that are used to interpolate features, for example, slot drills, and which must be set for diameter. It involves moving the side of a tool to contact the stylus tip and, as with rotating length setting, the tool must be rotating in the opposite direction to that which is used for cutting (to protect the stylus) – see Figure 2.

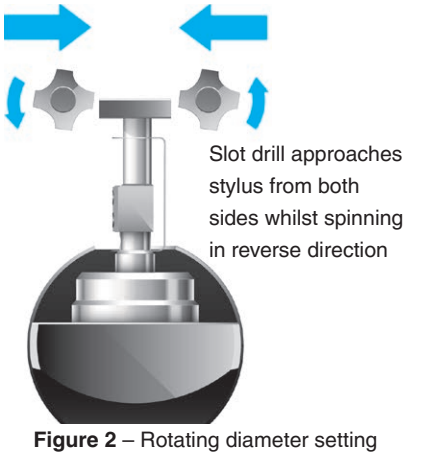


Figure 2 – Rotating diameter setting

Tool breakage detection

Tool breakage detection checks the lengths of your tools to identify tooling failures. By preventing damaged tools from being used for further machining, tool breakage detection forms a vital element of an automated machining process. Your Renishaw tool setting probe can be used to perform in-cycle checks on your tooling. By measuring the length of the tool before and after use you can be sure that damaged tools will not be used on subsequent machining operations. This reduces the risk of scrap, machine damage and broken tooling in subsequent operations, for example, taps.

Your tool breakage detection software should record the most recent tool length for each tool and compare this with the length measured during the tool breakage detection operation. If a significant difference is detected, the operator can be called to change the damaged tool.

Calibrating the tool setting probe

The exact procedure adopted is specific to each machine, control system and software package. However, certain rules are common.

Before setting tools, it is necessary to calibrate the stylus position to establish its trigger points in relation to a datum on the machine. This can be achieved by using a tool of known reference.

You should recalibrate the probe periodically (at least every 6 months), and in special circumstances, for example, if the arm has been subjected to a crash or if the stylus has been replaced.

The recommended frequency of normal recalibration is dependent on how frequently the arm is used. This may vary greatly depending on the application of the tool setting arm, for example, a typical jobbing shop may want to set tools twice per day and have eight tools to set. This would therefore result in two arm operations per day. A large volume manufacturer, however, may only wish to check for broken tools, but with a typical cycle time of 5 minutes and 24-hour working days, would operate the arm 288 times per day.

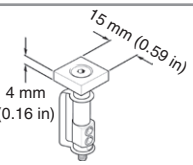
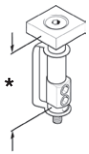
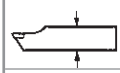
Use the table below to determine how frequently you should recalibrate your probe:

Recommended frequency of arm recalibration	
Arms operations per day	Recalibrate every ...
< 50	6 months
< 100	3 months
> 100	1 month

Symptom	Cause	Action
Poor system repeatability.	Mounting screws not fully tightened.	Tighten screws to specified torque.
	Loose probe.	Verify tightness of probe in arm assembly.
	Loose stylus.	Ensure tip of stylus is tight. Ensure M4 grub screw in stylus stem is tight. Ensure crash protection device is fully tightened into RP3 probe.
	Swarf on tool tip.	Remove swarf.
	Calibration and updating of offsets is not occurring.	Review software.
	Calibration and probing speeds are not the same.	Review software.
	Probing is being performed within the machine's acceleration/deceleration zones.	Review software.
	Arm not mounted as recommended i.e. on sheet metal guards.	Mount on solid base.
	Probing feedrate is too high for the machine controller.	Perform repeatability trials at various feedrates.
	Temperature variation is causing excessive movement of the machine and the HPMA.	Minimise machine and HPMA temperature changes. Increase the frequency of calibration.
	Machine has poor repeatability due to loose encoders, backlash, tight slideways and/or accidental damage.	Perform health check on machine.

Symptom	Cause	Action
Poor system repeatability (continued).	Excess machine vibration.	Eliminate vibration. Change wiring to enable probe trigger delay circuit.
	Minor collision.	Move arm to stow position and back to active position to reset arm to kinematic seating.
No probe output (probe status LED not lit).	Damaged or dirty probe contacts.	Check condition of probe contacts. If contacts are dirty, clean using compressed air and a clean lint-free cloth.
	Probe not connected.	Check wiring to machine. Check probe properly located in holder.
	Probe has failed.	Remove probe and check probe for continuity across probe contacts (resistance should be less than 1 KΩ).
Arm system not responding to commands.	Power supply not connected.	Check electrical connections (ensure motor and I/O supplies are connected). Check power supply (supplies) for voltage and polarity.
	Command not received.	Check machine control electrical outputs. Check electrical connections.
	TSI 3 or TSI 3-C not responding.	Remove power from TSI 3 or TSI 3-C (power machine down or alternatively disconnect 25-way D-type connector for 5 seconds minimum and reconnect).

Symptom	Cause	Action
Arm system responds to commands but does not acknowledge completion of move (MRO, ARO).	ARO or MRO not received by machine controller.	Check machine control inputs. Check electrical connections.
No probe output.	Probe not connected.	Check probe holder LED is green when probe is seated. Ensure probe is fully inserted in the probe holder (see page 22).
	Probe status (PS) or four-wire output not received by machine control.	Check machine control inputs/ outputs. Check electrical connections.

Recommended for:	 Stylus assembly	 * Stylus assembly	 Break stem
 16 mm	A-2197-0157	14.2 mm (0.56 in)	M-2197-0156
 20 mm	A-2197-0158	19.5 mm (0.77 in)	M-2197-0156
 25 mm	A-2197-0159	29.5 mm (1.16 in)	M-2197-0150
 32 mm	A-2197-0160	34.5 mm (1.36 in)	M-2197-0150
 40 mm	A-2197-0161	39.5 mm (1.55 in)	M-2197-0150
 50 mm	A-2197-0162	49.5 mm (1.95 in)	M-2197-0150

Item	Part number	Description
Tool kit	A-2176-0636	Standard HP arm tool kit.
Tool kit	A-2176-0639	Micro HP arm tool kit.
Base fixing	A-2275-0113	HPMA base fixing kit.
Front cover	A-2197-0006	RP3 probe front cover kit.
Spring seal	M-2275-0549	Spring seal for HPMA base.
Probe enclosure	A-2275-0098	HPMA arm probe enclosure.
TSI 3-C	A-2181-2239	TSI 3-C interface unit with DIN rail mounting.
TSI 3	A-2181-0465	TSI 3 interface unit with DIN rail mounting.
RP3 probe	A-2197-0004	RP3 probe assembly.
Cable	A-2181-1080	2 m SCR HPMA cable, 5 W M12 socket.
Cable	A-2181-1085	5 m SCR HPMA cable, 5 W M12 socket.
Cable	A-2181-1090	10 m SCR HPMA cable, 5 W M12 socket.
Publications. These can be downloaded from our website at **www.renishaw.com**.		
HPMA	H-2000-5141	Installation and user's guide: HPMA high precision motorised arm.
RP3	H-2000-5187	User guide: RP3 probe.
Software list	H-2000-2298	Data sheet: Probe software for machine tools – programs and features.

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