

# Probing systems for CNC machine tools

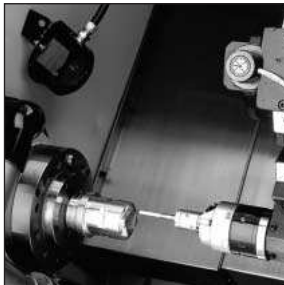


# Introduction



The invention of the touch trigger probe in the early 1970s revolutionised the development of the CMM (co-ordinate measuring machine) as the industry standard for 3D measurement.

Although the potential for applying probe routines on machine tools was quickly realised, it was not until the mid-1980s and development of more sophisticated machine controls, that probing became adopted by the world's largest machine tool builders.



Historically, there has been a marked reluctance by the users of machine tools to use probing, typical objections included "increased cycle times" and "machine tools are for cutting not for measuring". Both sentiments have been largely based on misconceptions as to the real applications and benefits of probing, and also entrenched attitudes to improvements in methods of machine tool operation.



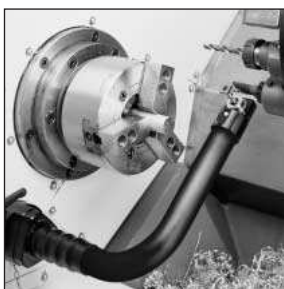
Today, the acceptance of quality control in the production environment, and drive towards maximising machine productivity, has finally seen probing accepted as standard practice in the field of production engineering.

## Applications

### Tool setting

Using slip gauges and entering offset data manually takes time and is prone to operator error. Tool setting probes are easily installed on machining centres and CNC (computer numerically controlled) lathes and allow automated operation with the following benefits:

- Significant time savings with reduced machine downtime
- Accurate tool length and diameter measurement
- Automatic tool offset calculation and correction
- Elimination of manual setting errors
- In-cycle tool breakage detection



### Part set-up

Probing eliminates the need for expensive fixtures and manual setting with dial indicators. Probes are spindle-mounted on machining centres and turret-mounted on lathes giving the following benefits:

- Reduced machine downtime
- Automatic fixture, part alignment and rotary axis set-up
- Elimination of manual setting errors
- Reduced scrap
- Increased productivity and batch size flexibility

### Part inspection

Spindle and turret-mounted probes can also be used for in-cycle gauging and 1st-off inspection - manual gauges rely on operator skill and the removal of parts to CMMs is not always practical. Benefits include:

- In-cycle part measurement with automatic offset correction
- Increased confidence in unmanned machining
- First-off inspection with automatic offset update
- Reduced machine downtime from awaiting 1st-off results

# Probing systems for CNC machine tools

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- 7.0** Machine interface units
- 8.0** Shanks and shank adaptors
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- 10.0** Software
- 11.0** Custom design service

## How to use this guide

**This document has been designed to help you to select the ideal probing system for your machine tool application.**

Renishaw's broad product range covers inspection and tool setting applications on CNC machining centres, lathes and grinders, and manual milling machines.

Comprehensive probing software, styli and accessories cater for every probing need. Where a standard product may not suit your exact requirements, Renishaw's custom design service is available to tailor a solution.

### Probe system selection

The type of probing system that you need will depend on your machine tool and the nature of the probing application.

This document contains sections that focus on the main applications for probing on machine tools (see sections 3, 4, 5 and 6). At the start of each section is an introduction to the use of probing for that application, plus guidance on selection of the most appropriate system. The remainder of the section contains technical information about each probe.

For inspection probing systems, you also need to consider the type of transmission system that you require. Once again, this decision will depend on the size and configuration of your machine tool.

### Selection procedure

#### Step 1

Which probing application do you require?

1. Inspection / part set-up  
Go to Step 2.
2. Tool setting / broken tool detection  
Go to Step 3.

#### Step 2

What type of transmission do you require for your inspection probing system?

Go to section 2 (Transmission selection), to identify the best transmission system for your machine tool. An overview will help you to choose, with a detailed specification of transmission performance on the subsequent data pages.

#### Step 3

##### Which probe is best for your application?

Go to the appropriate section (3, 4, 5 or 6) for your application. On the first page is an overview of Renishaw's products and a guide for probe selection. If no standard product meets your requirement, refer to section 11 (Custom design service).

#### Step 4

##### Check the probe details.

Check the technical information listed on the data page for the probe that you have selected to ensure that it meets your requirements. If yours is an inspection probing application, check that the probe can operate with the transmission system that you have chosen.

#### Step 5

##### Check the interface details.

The probe data page defines the compatible electrical interface unit for your chosen probe. Go to section 7 (Machine interface units) to check that the interface is suitable for your machine tool controller.

#### Step 6

##### Identify your shank adaptor requirements.

Section 8 (Shank adaptors) will help you either to make your own shank adaptor, or to choose from Renishaw's range of standard items.

### Other accessories

#### Styli

Renishaw probes are supplied with styli suitable for most applications. Section 9 (Styli and accessories) gives further information on Renishaw's stylus range. Refer to Renishaw's Styli and accessories guide (document H-1000-3200) for full details.

#### Software

Renishaw has a comprehensive range of probing software packages suitable for most probing applications. Check section 10 (Software) to see whether suitable probing software is available for your machine tool controller.

For more details of Renishaw's probing software, refer to the Probe software for machine tools data sheet (document H-2000-2289).

## Overview

A Renishaw probe must be able to communicate with the control system (CNC) of the machine on which it is fitted. Signals must pass from the probe to the machine's controller to register contact of the probe's stylus with the component or tool. Similarly, signals must pass from the machine's controller to probe to control the functioning of the probe.

The passage of these signals is handled by a **transmission system**. The choice of transmission system depends on the type of probe and the type of machine tool to which it is fitted.

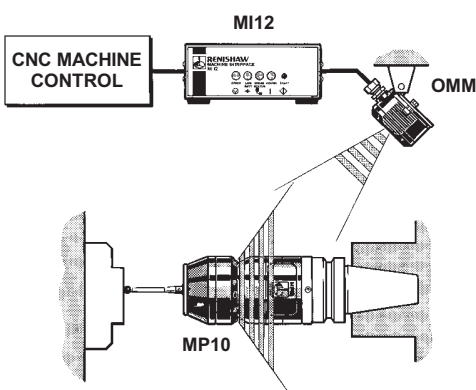
**Inspection** probes for machining centres are typically located in a tool carousel and are interchanged like conventional tools. On lathes, the probe is typically a semi-permanent feature of a rotating turret. In both cases, signalling between probe and CNC generally has to be remote.

For **tool setting** applications, typically the probe is mounted in a fixed location, thereby allowing direct communication between probe and CNC.

Renishaw probes use four main types of transmission systems:

- Optical
- Radio
- Inductive
- Direct or 'hard-wired'

The following sections show typical examples of each of these systems:



### Optical transmission systems

An optical transmission system uses infra-red technology for communicating between the probe and the CNC controller and comprises the following:

#### ▪ Probe module

The probe receives machine control signals and transmits probe status signals. There are two active modes, "stand by" and "operating". In "stand by" mode the probe is a receiver waiting for a signal to switch to operating mode. In operating mode it transmits probe information to the OMM receiver. Probe battery status information is also transmitted in the same manner.

#### ▪ Optical machine module (OMM)

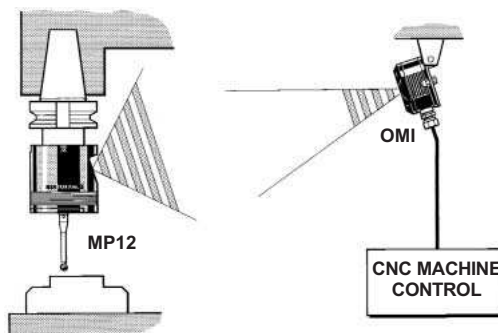
The OMM is the reception/transmission communication partner for the probe module. It is hard-wired to a machine interface unit.

#### ▪ Machine interface unit (MI12)

The interface converts probe signal information into a form which is compatible with the machine controller. In addition it has visual and/or audible indicators for probe status, system power, battery status and error diagnostics.

#### ▪ Optical machine interface (OMI)

The functions of the OMM and MI12 have been combined into a single module, the **optical machine interface (OMI)** offering functionality specifically optimized for the needs of smaller machine tools.



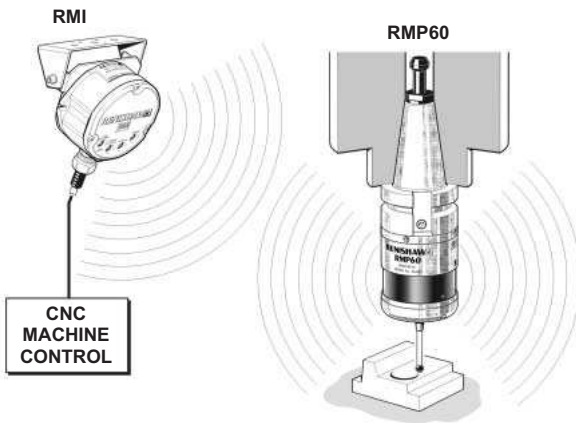
### Applications

- Inspection systems on small to large sized machining centres and lathes.

(See pages 2-4 to 2-13 for further information).



## Radio transmission systems



### Overview

A radio transmission system provides long range (up to 15m path length) of communication between the probe and the machine's controller. The system hops between channels, within the designated frequency band. The use of unique identifiers allow multiple radio systems to operate in close proximity. Radio probes are classified as short range devices and meet the requirements for licence free operation.

A radio transmission system comprises the following:

- **Probe**

The probe receives machine control signals and transmits probe status signals. There are two active modes, "stand-by" and operating. In "stand-by" mode the probe is a receiver waiting for a signal to switch to "operating mode". In "operating mode" it transmits probe status information to the RMI receiver.

Probe battery status information is also transmitted in the same manner.

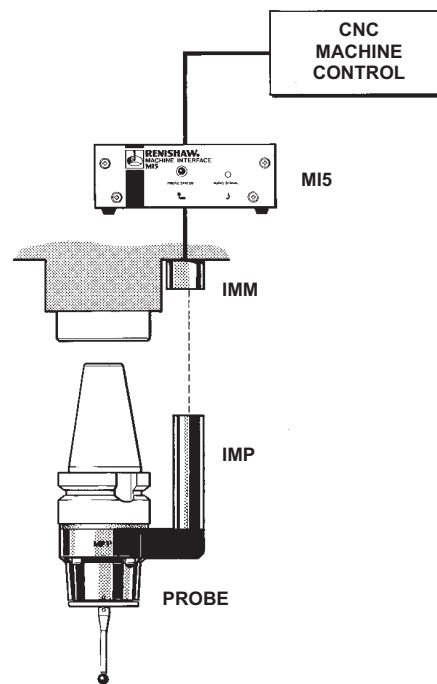
- **Machine interface (RMI)**

The combined interface and antenna converts probe signal information into a form which is compatible with the machine's controller. In addition, it has visual indicators for start, low battery, probe status, error and signal strength.

### Applications

- Workpiece measurement and job set-up on medium to large horizontal, vertical and gantry machining centres, 5 axis machines, twin spindle machines and vertical turret lathes (VTL).

## Inductive transmission systems



### Overview

Inductive transmission works by passing power and probe signals across a small air gap between two induction modules. Typically, a probe fitted with an inductive transmission system comprises the following:

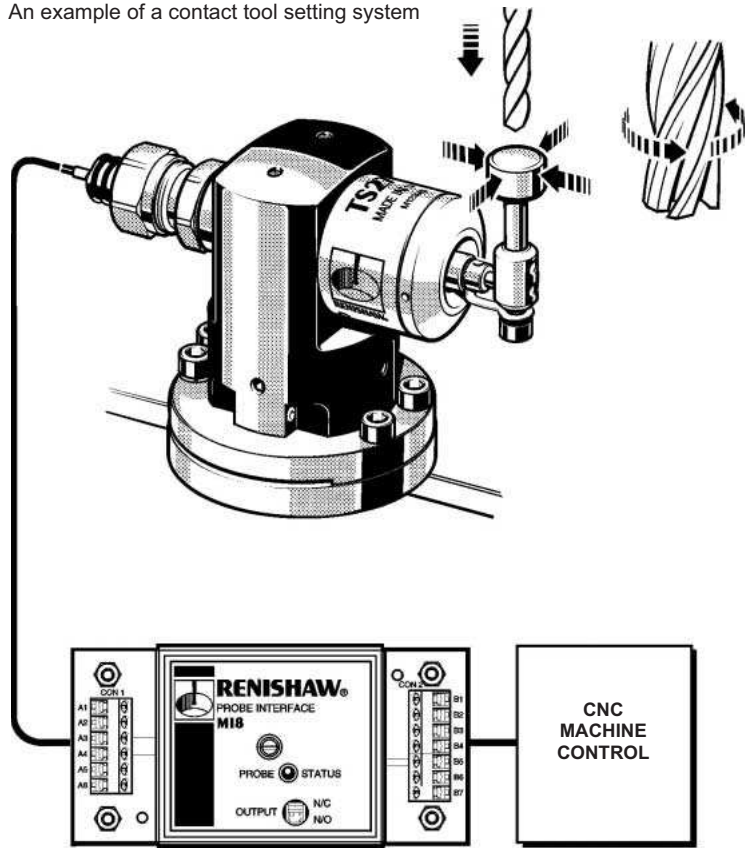
- **Probe and inductive probe module (IMP)**, mounted on a shank. The IMP receives power from, and passes probe signals to, the IMM.
- **Machine module (IMM)** communicates with the IMP. Mounted on the machine tool's spindle nose, the IMM is 'hard-wired' to a Machine Interface Unit.
- **Machine interface unit (MI5)** converts probe signals into a form which is compatible with the machine tool's controller. The interface also has visual and audible indicators of probe status.

### Applications

- Inspection systems on machining centres and lathes. Inductive transmission is only suitable for fitting by machine builders.

## Hard-wired transmission systems

An example of a contact tool setting system



### Overview

A hard-wired probe system has the simplest form of transmission system and typically, comprises the following elements:

- **Signal cable** connects the probe to a machine interface unit, carrying power and probe signals.
- **Machine Interface unit (M18)** converts probe signals into a form which is compatible with the machine tool's controller. The interface also has visual indicators for probe status and error diagnostics.

### Applications

Hard-wired transmission systems are ideal for the following applications:

- Tool setting on machining centres and lathes where the probe remains in a fixed location. (See page 4-3)
- Inspection on milling machine's where the probe is manually placed in the machine spindle. (See page 3-7)

For further details of hard-wired transmission systems, refer to section 7 (Interfaces).

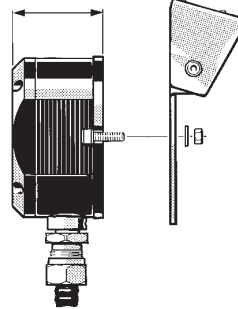
## OMI/OMM/OMME

The OMI and OMM are optical transmitter/receivers which convey signals between a probe system and the CNC machine's control.

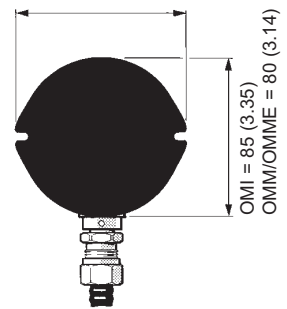
The OMI differs from the OMM by including machine interface circuitry which processes signals and can therefore be connected directly to the machine's control. The physically identical OMM requires an additional MI12 interface unit. 2 x OMME are typically used in conjunction with a MI12E interface.

All units contain LEDs which transmit and receive signals to and from the probe. There are also LEDs which indicate probe status, start signal status, battery condition and error condition.

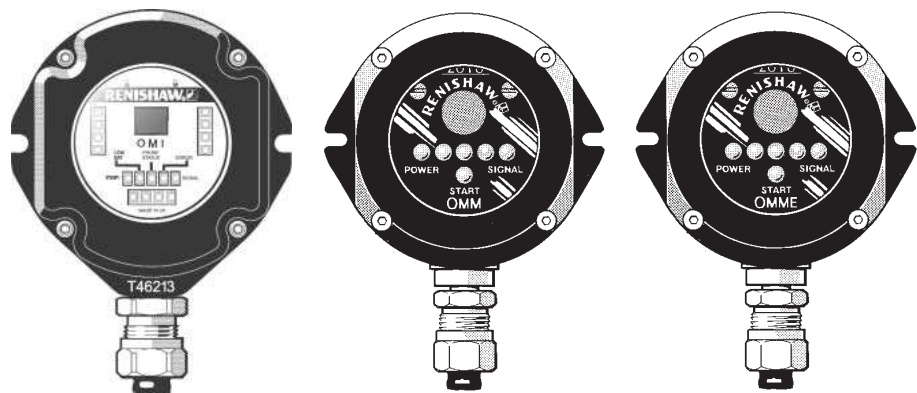
OMI = 46.7 (1.84)  
OMM/OMME = 46.5 (1.83)



OMI = 84 (3.30)  
OMM/OMME = 86 (3.38)



All dimensions are in mm (in).



	OMI	OMM	OMME
PRINCIPAL APPLICATION	Small sized machining centres and lathes	Medium sized machining centres and lathes	Large and 5 axis machining centres
TRANSMISSION TYPE	Infra-red optical transmission	Infra-red optical transmission	Infra-red optical transmission
CABLE	Screened, 12 core x 8 m long	Screened, 5 core x 25 m long	Screened, 5 core x 25 m long
MOUNTING	A mounting bracket is available allowing directional setting		
SEALING	IPX8	IPX8	IPX8
COMPATIBLE INTERFACE*	OMI does not require an additional interface	OMM requires MI12 Note that 2 OMMs can be connected to a single MI12	OMME requires MI12E Note that 2 OMMEs can be connected to a single MI12E
SUITABLE PROBES†	OMP40, MP10, MP12, and MP700 for machining centre inspection applications LTO2S, LTO2T, LTO3T and LTO2 for lathe inspection applications		MP10E and MP700E

\* See INTERFACES section for more details.

† See relevant application sections for more details.



## RMI interface for the RMP60 probe

The RMI is a combined transmitter and receiver for use with the RMP60 radio probe.

It is designed to be easily mounted within, or close to the machine resulting in a quick and simple installation.

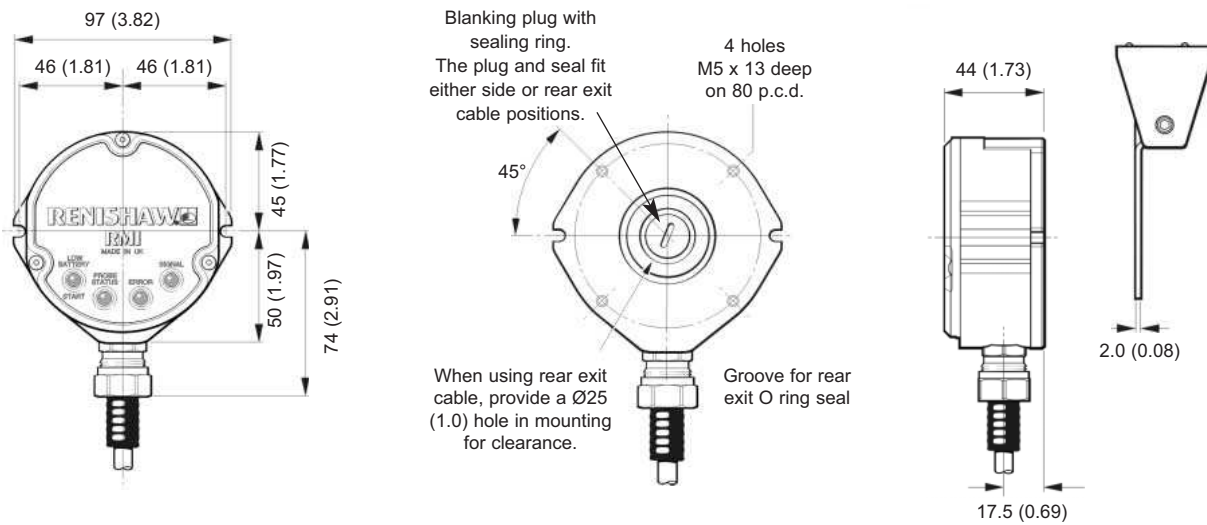
The RMP60 RMI system is ideal for retrofitting to existing machines.

A visual indication of system status is provided by LED's. Status is continuously updated and indication is provided for start, low battery, probe status, error and signal strength.



RMI interface

All dimensions are in mm (in).



### RMI

PRINCIPAL APPLICATION	Workpiece measurement and job set-up on medium to large horizontal, vertical and gantry machining centres, 5 axis machines, twin spindle machines and vertical turret lathes
TRANSMISSION TYPE	Frequency hopping spread spectrum radio (FHSS)
CABLE	Ø7.5 mm (0.29 in), 13 core screened cable, each core 18 x 0.1 mm
MOUNTING	An optional mounting bracket is available allowing directional setting. RMI cable can be reconfigured for rear exit.
SEALING	IPX8
COMPATIBLE INTERFACE*	The RMI does not require an additional interface
SUITABLE PROBES†	The RMP60 radio transmission probe

\* See INTERFACES section for more details.

† See relevant application sections for more details.

### OMP40 transmission range

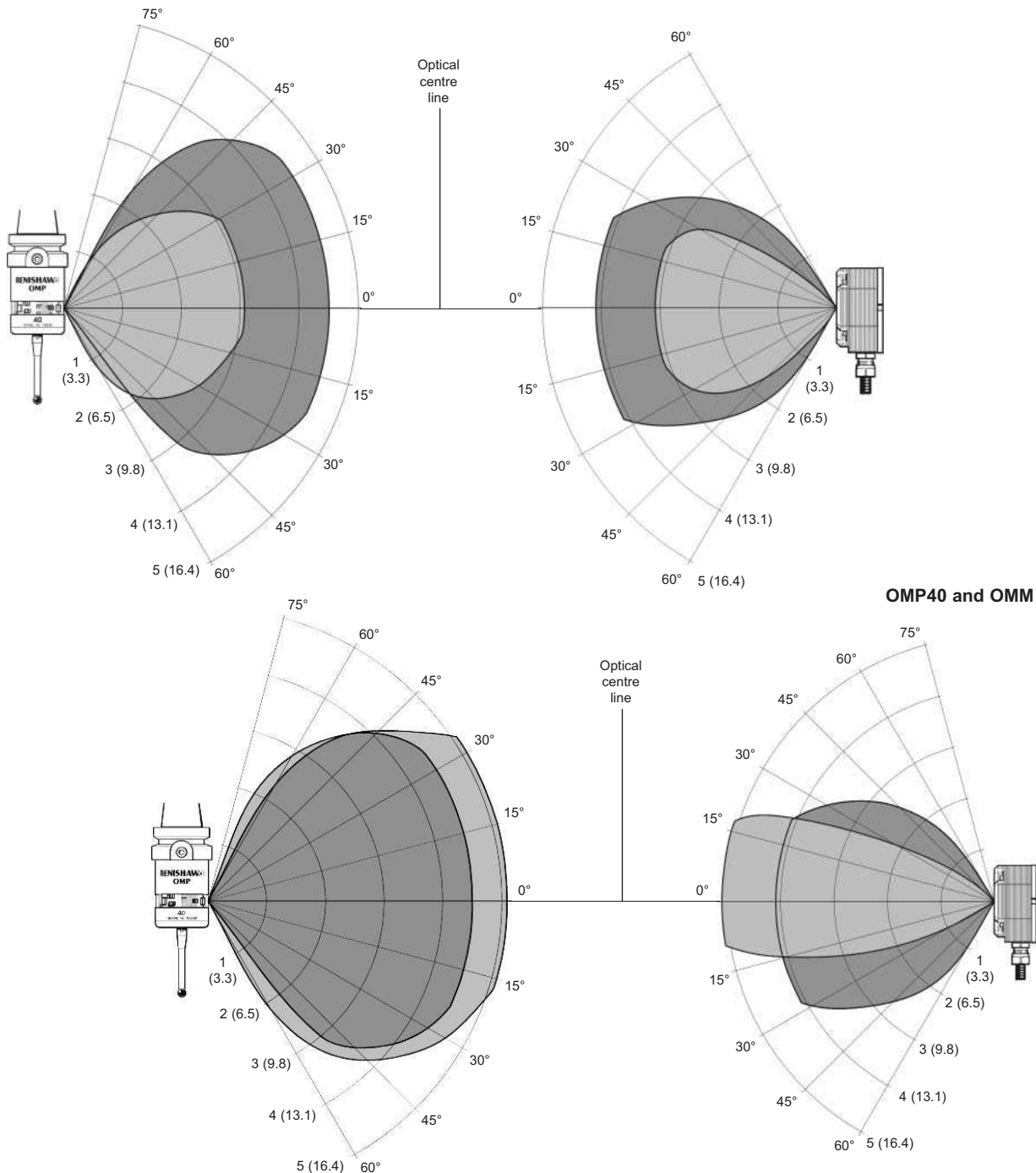
The location of the probe and receiver (OMM/OMI) may deviate from the optical centre line, providing opposing light cones always overlapping with transmitters and receivers in each other's field of view. Natural reflective surfaces in the machine may increase the signal transmission range.

The OMP40 has 360° optical transmission and “switch on”. The optical range values quoted below apply for any spindle orientation.

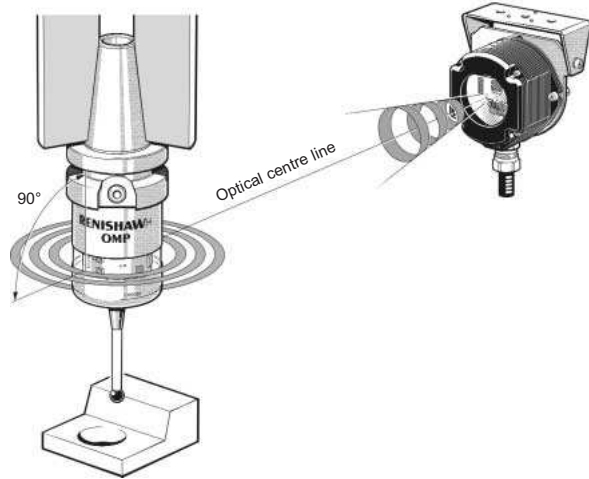
The OMI has a slightly different optical range from an OMM, offering a wider field of view but a shorter transmit/receive range. This makes it ideal for small machine installations.

■ Switch on/off □ Operating

#### OMP40 and OMI



#### Transmission angles



#### OMP40 and OMM

## MP10/MP700 transmission range with OMI

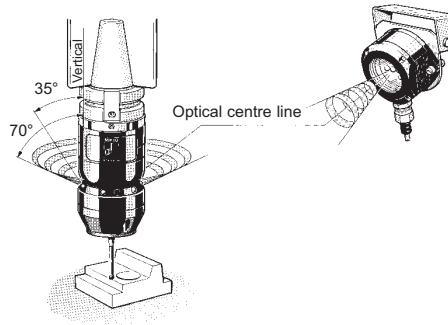
The location of the probe and OMI may deviate from the optical centre line, providing opposing light cones always overlapping with transmitters and receivers in each other's field of view. Natural reflective surfaces in the machine may increase the signal transmission range.

The MP10 and MP700 both have 360° optical transmission and "switch on". The optical range values quoted below apply for any spindle orientation.

The OMI has a slightly different optical range than OMM, offering a wider field of view but a shorter transmit/receive range. This makes it ideal for small machine installations.

■ Switch on/off □ Operating

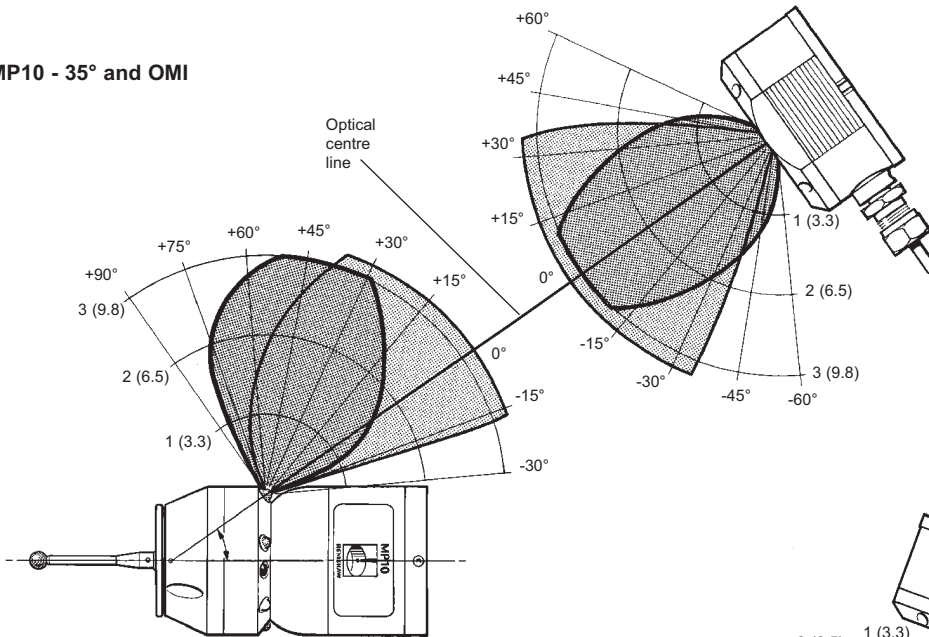
### Transmission angles



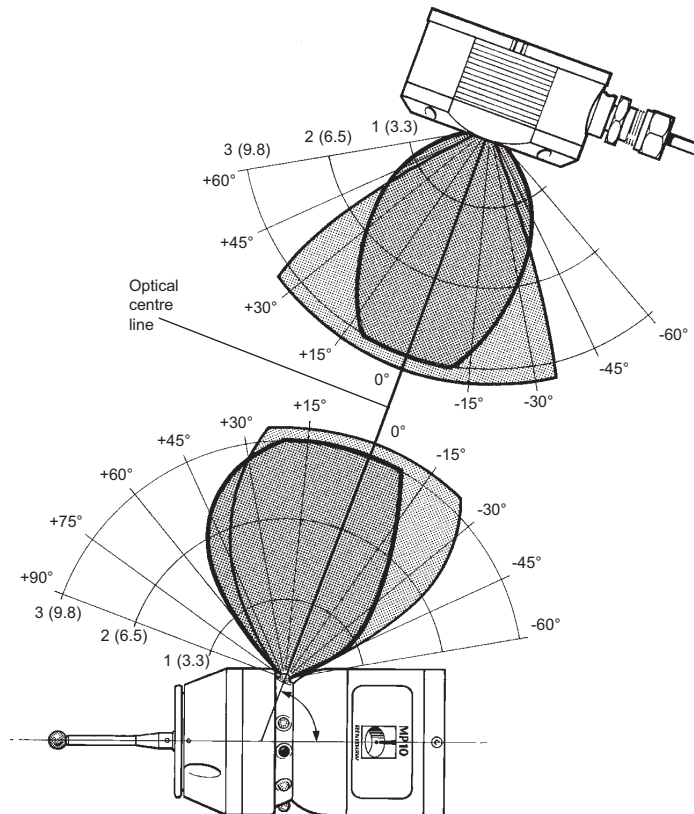
Optical transmission performance

2.7

### MP10 - 35° and OMI



### MP10 - 70° and OMI



The MP10 and MP700 probes can be supplied with optical transmission at either 35° or 70° to the spindle axis.

### MP10/MP700 transmission range with OMM

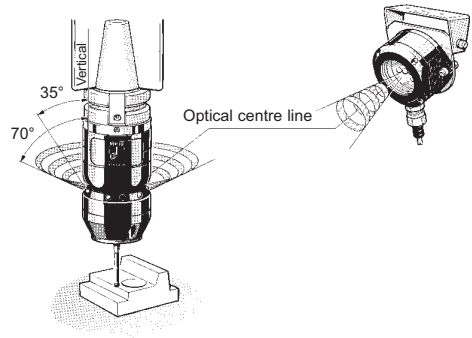
The position of the probe and OMM may deviate from the optical centre line, providing opposing light cones always overlapping with transmitters and receivers in each other's field of view. Natural reflective surfaces in the machine may increase the signal transmission range.

The MP10 and MP700 both have 360° optical transmission and "switch on". The optical range values quoted below apply for any spindle orientation.

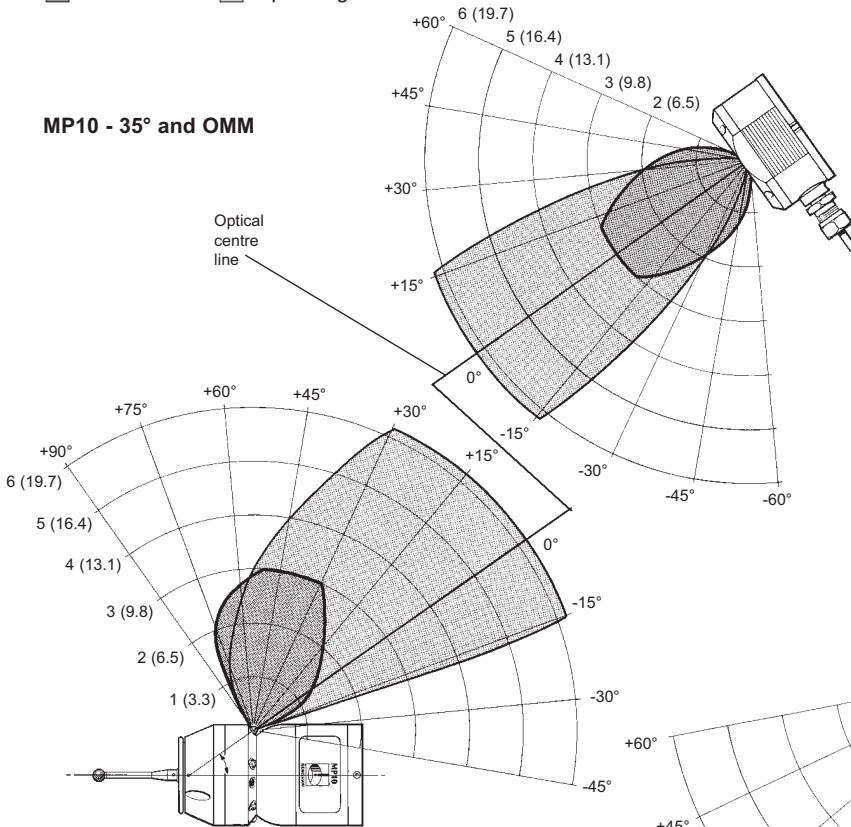
Two OMMs can be fitted on a single machine where sufficient coverage cannot be provided by a single receiver.

■ Switch on/off □ Operating

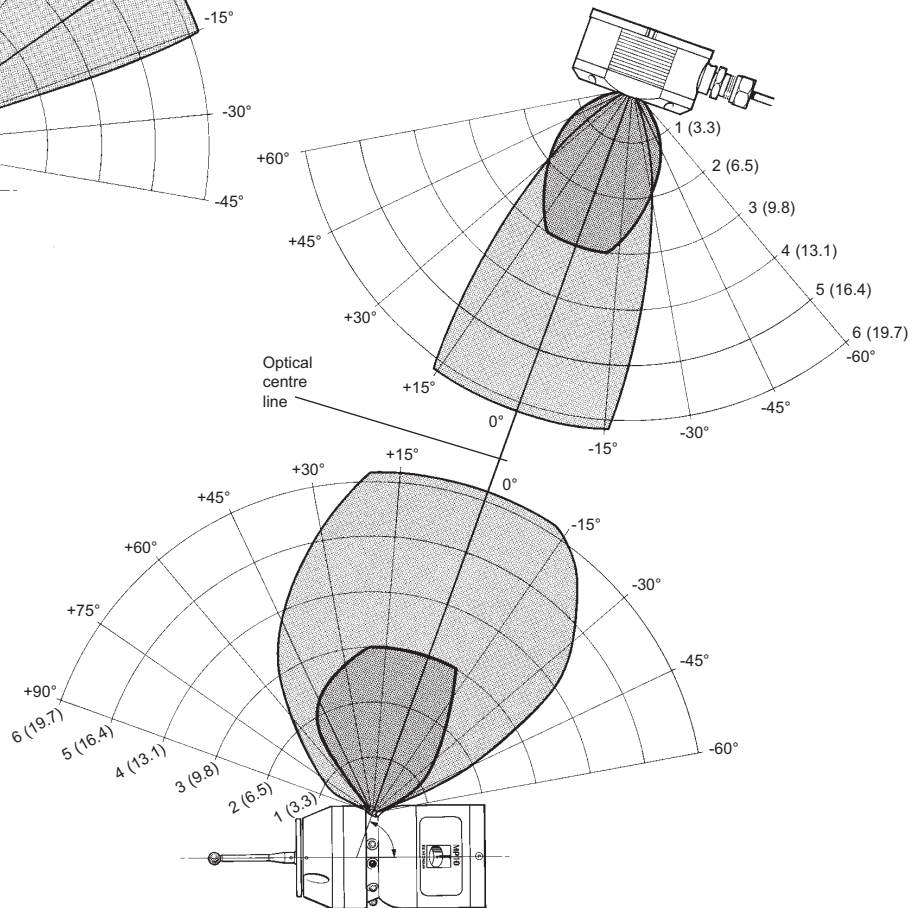
### Transmission angles



#### MP10 - 35° and OMM



#### MP10 - 70° and OMM



The MP10 and MP700 probes can be supplied with optical transmission at either 35° or 70° to the spindle axis.



## MP10E/MP700E transmission range with OMME

The MP10E/MP700E has a 360° transmission envelope over the ranges shown below. Two OMME's can be fitted on a single machine where sufficient coverage cannot be provided by a single receiver.

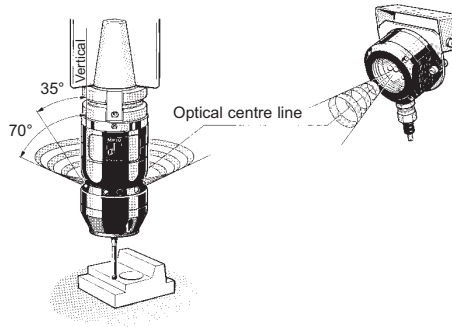
The probe system should be positioned such that the optimum range can be achieved over the full travel of the machine's axis.

The probe and OMME may deviate from the optical centre line, provided opposing light cones always overlap with transmitters and receivers in each others field of view.

Absolute minimum (no reflection) plot shown.

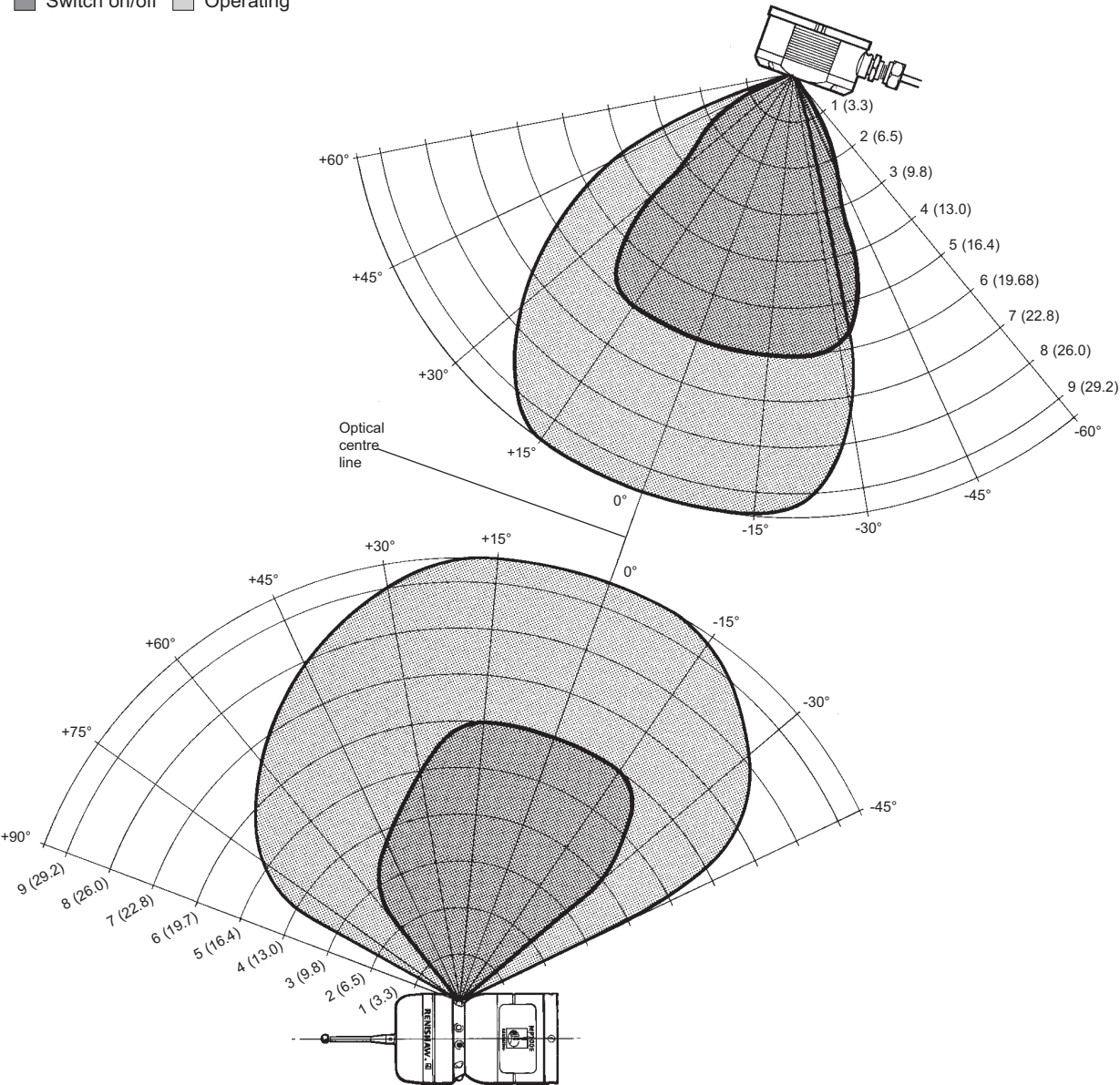
■ Switch on/off □ Operating

### Transmission angles



Optical transmission performance

2.9



The MP10E and MP700E probes are only supplied with optical transmission at 70° to the spindle axis.

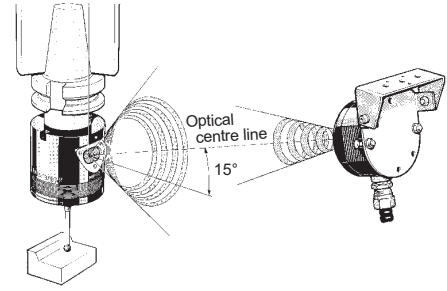


### MP12 transmission range

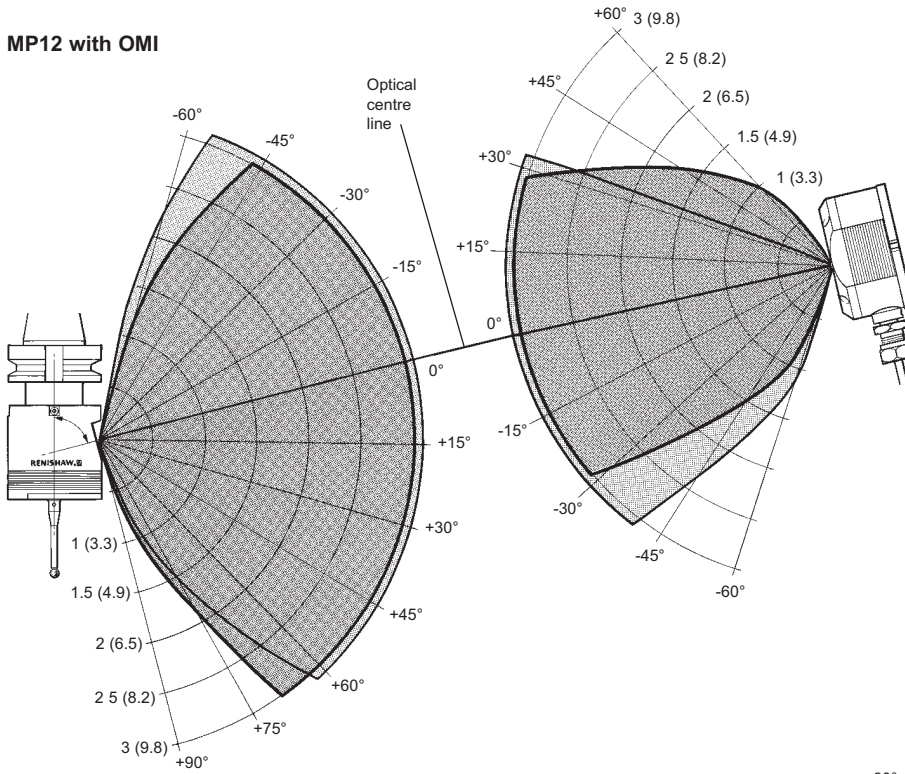
The MP12 features a uni-directional optical transmission which requires the machine's spindle to be orientated so the probe window is facing the receiver. The data given below assumes that the probe and receiver (OMM or OMI) are aligned.

■ Switch on/off    □ Operating

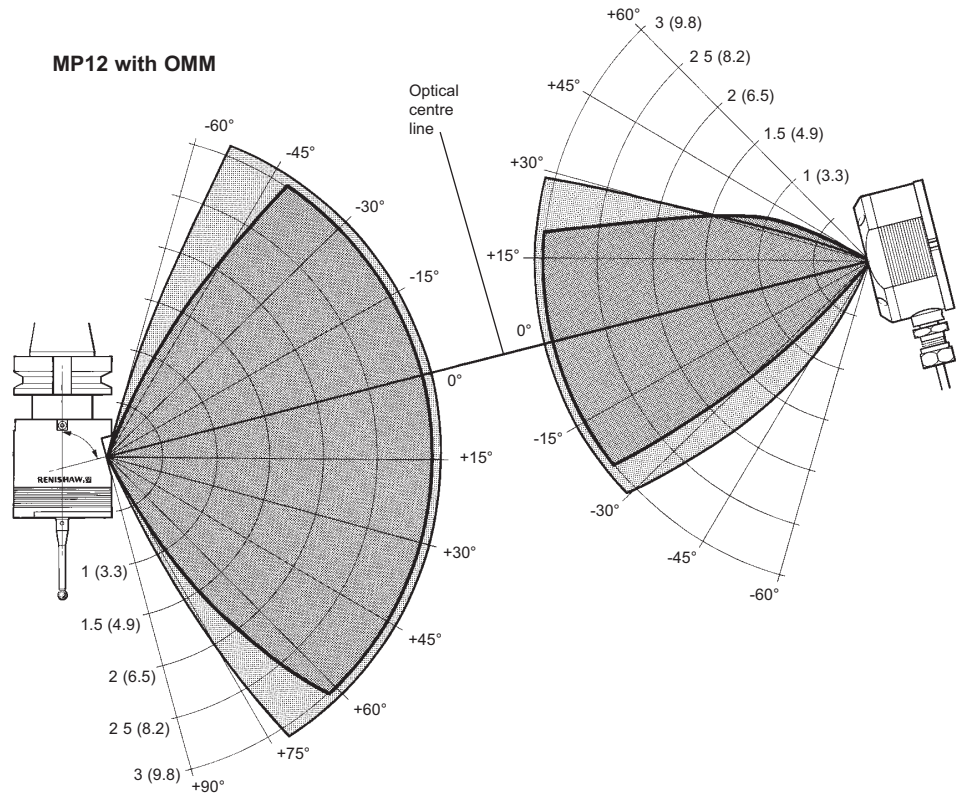
### Transmission angles



### MP12 with OMI



### MP12 with OMM



**LTO2/LTO2T/LTO3T/LTO2S  
transmission range**

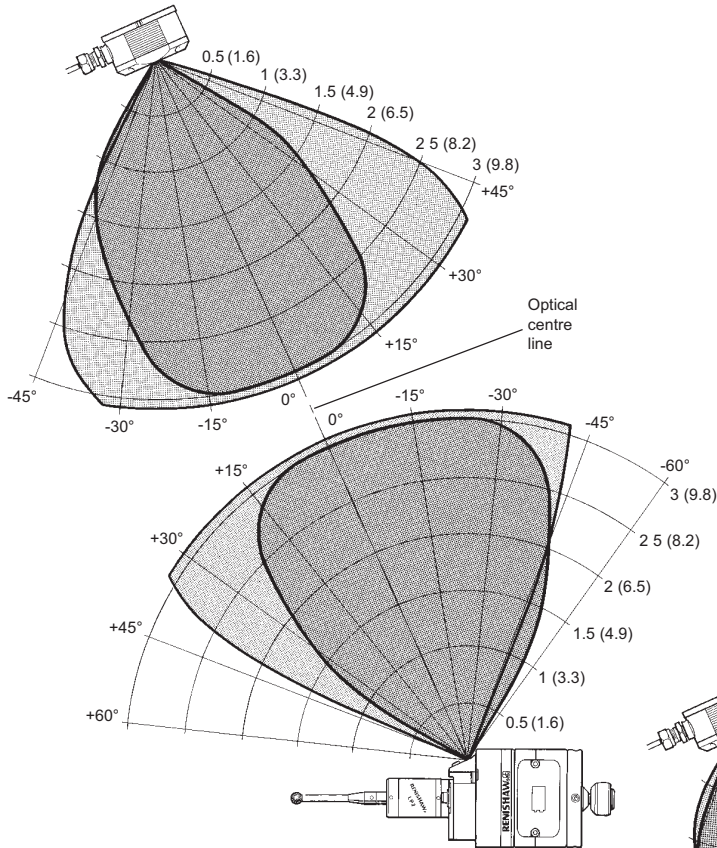
The LTO2 range is designed for lathe applications and uses a uni-directional optical transmission system

This requires the transmitter and receiver (OMM or OMI) to be approximately aligned when the probe is to be operated. The data given below assumes that the transmitter and receiver are aligned.

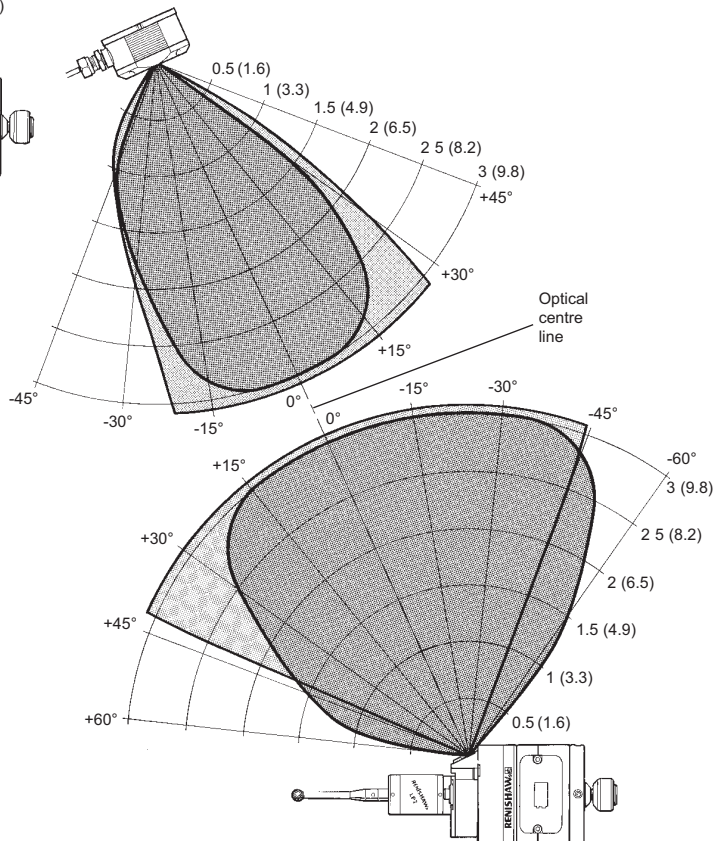
All distances are in metres (feet).

■ Switch on/off □ Operating

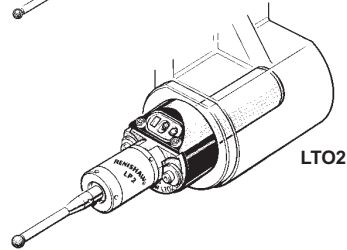
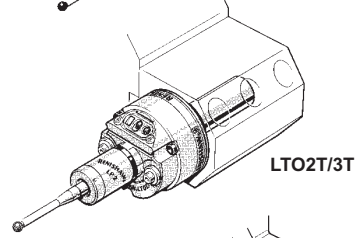
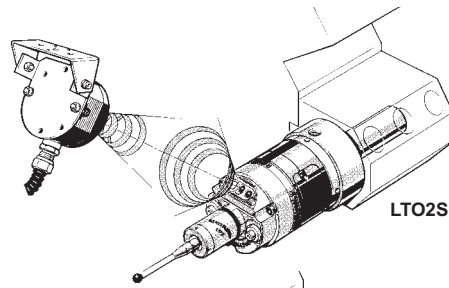
**LTO2 family typical operating envelope with OMI**



**LTO2 family typical operating envelope with OMM**



Note: For LTO2 truncate transmission plots to 2 metres (6.5).



Optical transmission  
performance

2.11

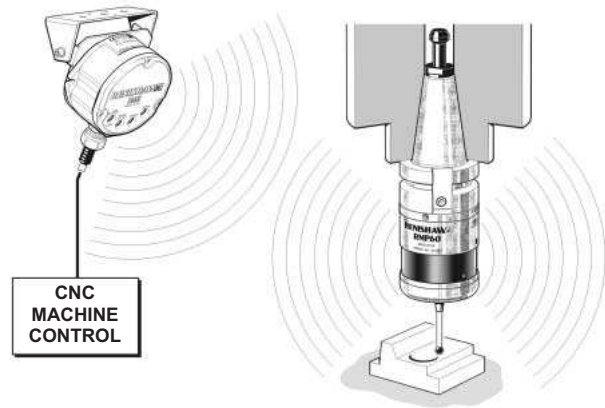
### RMP60 transmission range with RMI

RMP60 and RMI must be within each others operating envelope. The operating envelope shows line-of-sight performance, however radio transmission does not require line-of-sight as long as any reflected signal path is less than the 15 m (49.2 ft) system operating range.

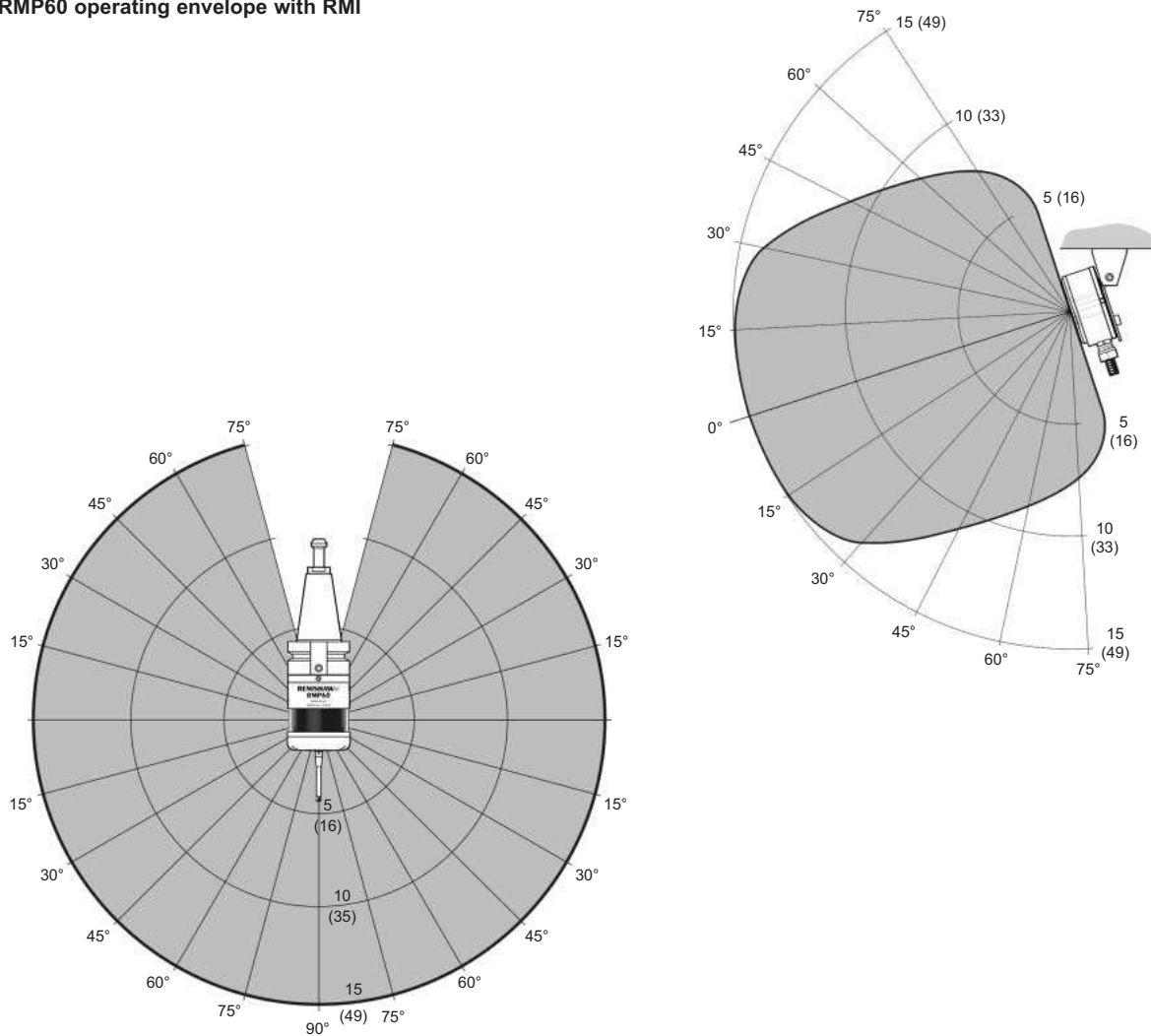
All distances are in metres (feet).

- Operating and switch on/off

Transmission angles



RMP60 operating envelope with RMI





## IMM

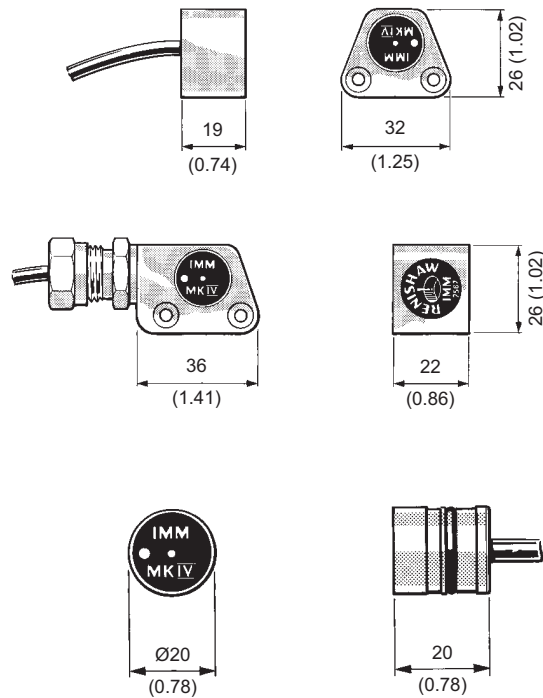
The IMM is an inductive module that may be attached to the spindle nose of a CNC machining centre. The preferred configuration has a rear exit cable.

An alternative configuration uses a side exit cable which can be supplied with various conduits to suit the application.

The IMM may also be fitted to the main casting at the rear of a tool turret on a CNC lathe. In this instance, the unit is cylindrical with a rear exit cable.

Inductive transmission is not recommended for retrofit installations. Machine builders should contact their Renishaw supplier for further details.

The IMM is also available with a ceramic face for applications where swarf may cause erosion to the standard face.



All dimensions are in mm (in).

### IMM

PRINCIPAL APPLICATION	Machining centres and lathes
TRANSMISSION TYPE	Electromagnetic induction
INDUCTIVE MODULE AIR GAP	0.1 mm (0.004 in) to 2.1 mm (0.08 in)
INDUCTIVE MODULE ECCENTRICITY	2.0 mm (0.08) max
CABLE	Screened, 3 core, 7/0.2
Standard	Ø4.3 mm (Ø0.17 in) x 5 m (16.4 ft) long
Extension	Various 5.5 m (18.0 ft) to 25.5 m (83.6 ft) Max length permitted = 100 m (328 ft) Exposed cables <b>must</b> be located in protective conduit
CONDUIT (Side exit units only)	Ø11 mm (Ø0.43 in) flexible conduit Ø8 mm (Ø0.31 in) steel conduit
SEALING	IPX8
COMPATIBLE INTERFACE*	MI5
SUITABLE PROBES†	MP1 or MP3 for machining centre applications LP2 for lathe applications

\* See INTERFACES section for more details.

† See relevant application sections for more details.

## CNC machining centre and milling machine inspection probing systems

### Applications

Renishaw probes can be used on machining centres and milling machines for component setting and inspection applications.



### Component setting

The probe identifies the position of the workpiece, automatically updating work offsets, enabling parts to be made right first time.

This can also be used for:

- part identification for FMS installations.
- component location and also misload detection to avoid scrap.
- excess material identification to bring the cutter to the component quickly and safely.

### First-off inspection

Inspection of the first component in a batch on the machine tool to:

- reduce the time the machine is idle awaiting feedback from an off-line inspection device.
- correct any errors automatically.

### In-process inspection

Measure components following rough machining to:

- ensure critical final cuts are correct.
- highlight errors before they become faults.

The frequency of inspection will depend on the value of the component and confidence in the machine's performance. Inspection of key features on high value components is usually essential for unmanned machining operations.

### Post process inspection

Inspection of the part once the machining is completed can be used to:

- provide information to certify that the component is within its specification.
- record part dimensions for statistical process control.

### Probe selection

On machining centres, probes require a remote transmission system (see section 2 Transmission selection).

The following pages show some of the most common types of inspection probe applications on machining centres:

1. The **OMP40** has been designed specifically to meet the demands for small machining centres and the growing family of high-speed machines fitted with small HSK and small taper spindles.
2. A small, vertical machining centre fitted with an **MP12** compact inspection probe using optical transmission.
3. A horizontal machining centre fitted with an **MP10** probe featuring 360° optical transmission. The MP10 is also suitable for larger vertical machines.
4. The **RMP60** probe has been designed for use on all medium to large machines, particularly when non line of sight is required.

Other common applications include:

- Where high precision is required, Renishaw's **MP700** 'strain gauge' probe is recommended. Using optical transmission, the MP700 is ideal for inspection of contoured components and components requiring long styli reach.
- On milling machines, simple hard-wired probes and 'job contact' probes are available.
- The **MP10E/MP700E** systems have been specifically designed for 5-axis and large machining centres.

Machine	Small	Medium	Large
<b>CNC machining centres</b>			
Vertical	OMP40/MP12	MP10/RMP60	RMP60/MP10E
Horizontal	OMP40/MP10	MP10/RMP60	RMP60/MP10E
High accuracy	MP700	MP700	MP700E
<b>Milling machines</b>			
CNC machines	MP15	MP11	MP11
Manual machines	Job contact probe		



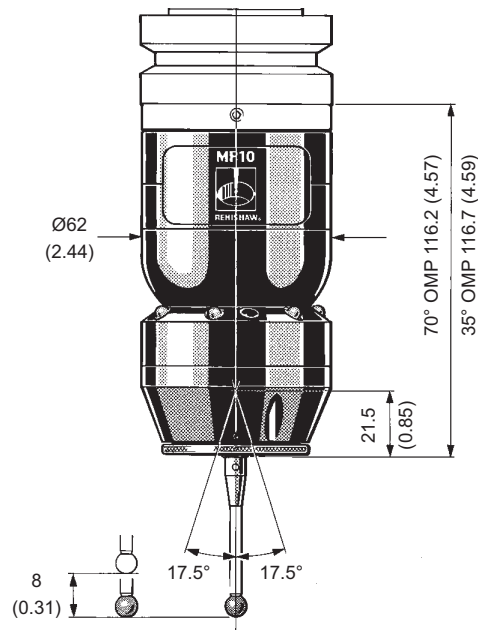
## MP10/MP10E

The MP10 is a robust inspection probe for workpiece set-up and workpiece inspection on small to medium sized CNC machining centres.

The MP10E has been designed for use on large and 5 axis machines and is available with a high powered optical transmission range up to 9.5 m.

### MP10 features and benefits:

- Ideal for a wide range of machining centres
- Available with either 35° or 70° output and features wide beam transmission – up to 130°
- Continuous battery life of up to 140 hrs
- Full 360° signal transmission and up to 6 m (19.6 ft) range.
- Adjustable trigger force



All dimensions are in mm (in).

### MP10 / MP10E

PRINCIPAL APPLICATION	Vertical and horizontal machining centres
TRANSMISSION TYPE†	360° infra-red optical transmission
MAXIMUM RANGE	35° and 70° angles (MP10E – 70° only) MP10 OMI 3 metres (9.84 ft) MP10 OMM/MI12 6 metres (19.69 ft) MP10E OMME/MI12E 9.5 metres (31.17 ft)
TURN ON/OFF METHOD	Optical on/optical off <b>or</b> optical on/time out
SENSE DIRECTIONS	Omni-directional: ±X, ±Y, +Z
UNI-DIRECTIONAL REPEATABILITY MAX (2σ) AT STYLUS TIP‡	1.0 µm (0.00004 in)
WEIGHT	730 g (26 oz)
TRIGGER FORCE (factory setting)	Adjustable
XY Plane - lowest force	0.75 N (75 gf) 2.64 ozf
XY Plane - highest force	1.40 N (140 gf) 4.92 ozf
+Z Direction	4.20 N (420 gf) 14.8 ozf
STYLUS OVERTRAVEL	
XY Plane	±17.5°
+Z Direction	8 mm (0.31 in)
STANDARD STYLUS LENGTH	50 mm (1.97 in)
MAXIMUM STYLUS LENGTH	100 mm (3.94 in)
BATTERY LIFE	1 X 6LR61 (PP3 9V alkaline)
Stand-by	365 days
5% usage	98 days
Continuous life	140 hours
SEALING	IPX8
SHANKS§	Various
COMPATIBLE INTERFACE *	OMI or OMM/MI12 (MP10E OMME / MI12E)

† See TRANSMISSION SYSTEMS section for more details.

‡ Test conditions:

stylus length: 50mm 1.97 in

§ See SHANKS section for more details.

stylus velocity: 480 mm/min 18.90 in/min

¥ See INTERFACES section for more details.

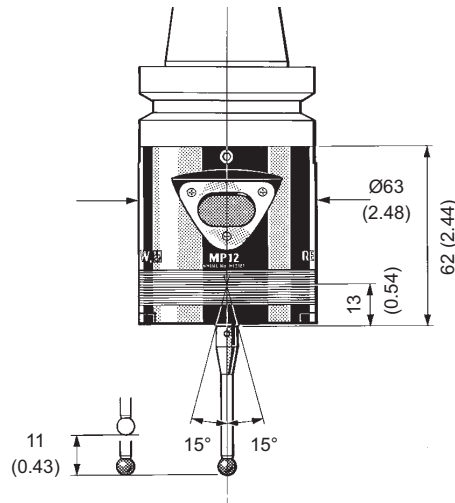
stylus force: factory settings

## MP12

The MP12 is a compact 3D touch trigger inspection probe, designed for workpiece set-up and inspection on small to medium sized CNC machining centres.

### MP12 features and benefits:

- Typical battery life of 205 days at 5% usage
- Ideal for use on small to medium machining centres
- Stylus on-centre adjustment
- Sealed to IPX8 for reliable operation in the machine tool environment



All dimensions are in mm (in).

## MP12

PRINCIPAL APPLICATION	Small vertical machining centres
TRANSMISSION TYPE†	Uni-directional infra-red optical transmission MP12 OMI 3 metres (9.84 ft) MP12 OMM / MI12 3 metres (9.84 ft)
TURN ON/OFF METHOD	Optical on/optical off or optical on/time out
SENSE DIRECTIONS	Omni-directional: ±X, ±Y, +Z
UNI-DIRECTIONAL REPEATABILITY MAX (2σ) AT STYLUS TIP‡	1.0 µm (0.00004 in)
WEIGHT	420 g (15 oz)
TRIGGER FORCE (factory setting)	Not adjustable
XY Plane - lowest force	0.65 N (65 gf) 2.29 ozf
XY Plane - highest force	1.60 N (160 gf) 5.64 ozf
+Z Direction	8.00 N (800 gf) 28.22 ozf
STYLUS OVERTRAVEL	
XY Plane	±15°
+Z Direction	11 mm (0.43 in)
STANDARD STYLUS LENGTH	50 mm (1.97 in)
MAXIMUM STYLUS LENGTH	100 mm (3.94 in)
BATTERY LIFE	4 x LR6 (AA 1.5V alkaline)
Stand-by	471 days
5% usage	205 days
Continuous life	425 hours
SEALING	IPX8
SHANKS§	Various
COMPATIBLE INTERFACE *	OMI or OMM/MI12

† See TRANSMISSION SYSTEMS section for more details.

§ See SHANKS section for more details.

¥ See INTERFACES section for more details.

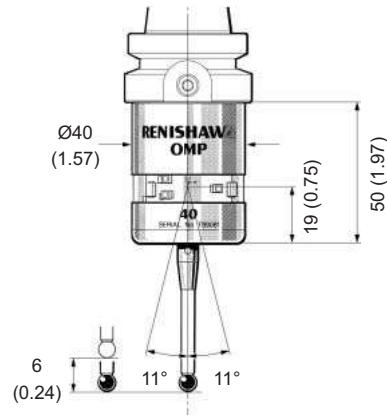
‡ Test conditions: stylus length: 50mm 1.97 in  
stylus velocity: 480 mm/min 18.90 in/min  
stylus force: factory setting

## OMP40

The OMP40 has been designed specifically to meet the demands for small machining centres and the growing family of high-speed machines fitted with small HSK and small taper spindles.

### OMP40 features and benefits:

- Miniturisation of electronics without compromising performance
- Simplified installation - ideal for retrofit
- Long battery life, minimal downtime, industry leading economy
- Shock and vibration resistant



All dimensions are in mm (in).

### OMP 40

PRINCIPAL APPLICATION	Small machining centres and drill / tap machines	
TRANSMISSION TYPE†	360° infra-red optical transmission	
MAXIMUM RANGE	3 m (9.84 ft)	
TURN ON/OFF METHOD	Optical on/optical off <b>or</b> optical on/time out	
SENSE DIRECTIONS	Omni-directional ±X ±Y +Z	
UNI-DIRECTIONAL REPEATABILITY MAX (2σ) AT STYLUS TIP‡	1.0 µm (0.00004 in)	
WEIGHT	262 g (9.2oz)	
TRIGGER FORCE (factory setting)	Not adjustable	
XY Plane - lowest force	0.5 N (50 gf) 1.76 ozf	
XY Plane - highest force	0.9 N (90 gf) 3.17 ozf	
Z Direction	5.85 N (585 gf) 20.6 ozf	
STYLUS OVERTRAVEL		
XY Plane	±11°	
Z Direction	6 mm (0.23 in)	
STANDARD STYLUS LENGTH	50 mm (1.97 in)	
MAXIMUM STYLUS LENGTH	100 mm (3.94 in)	
BATTERY LIFE (2 x Lithium 1/2 AA)	Standard	(Low power mode)
Stand-by	1900 days	(1900)
5% usage	170 days	(250)
Continuous life	200 hours	(300)
SEALING	IPX8	
SHANKS§	Various	
COMPATIBLE INTERFACE*	OMI or OMM/MI12	

† See TRANSMISSION SYSTEMS section for more details.

§ See SHANKS section for more details.

¥ See INTERFACES section for more details.

‡ Test conditions:	stylus length:	50mm	1.97 in
	stylus velocity:	480 mm/min	18.90 in/min
	stylus force:	factory settings	

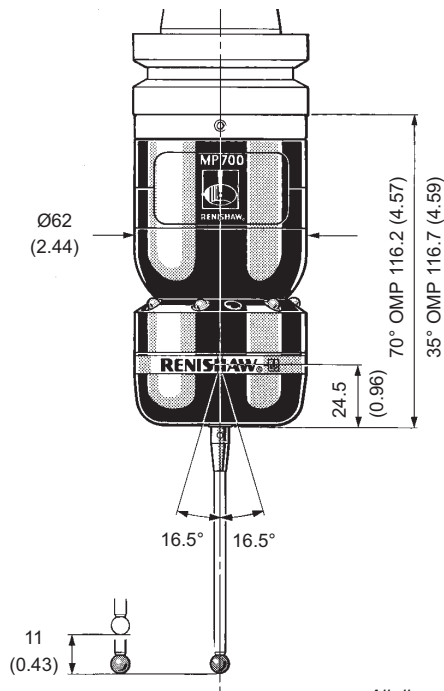
## MP700 / MP700E

The MP700 high accuracy probe uses solid state strain gauge technology to sense contact between the stylus and the surface of a workpiece.

The MP700 allows probing with a low constant trigger force in any direction, after simple probe calibration.

### MP700 features and benefits:

- Superior 3D measurement performance probe repeatability of 0.25 µm (2σ)
- Provides improved accuracy even with long styli
- Significantly longer life due to proven solid state technology
- Designed for use on large and 5 axis machines
- High resistance to shock and vibration



All dimensions are in mm (in).

### MP700 / MP700E

PRINCIPAL APPLICATION	High accuracy inspection on vertical and horizontal machining centres
TRANSMISSION TYPE†	360° infra-red optical transmission 35° and 70° angles (MP700E 70° only)
MAXIMUM RANGE	MP700 OMI 3 metres (9.84 ft) MP700 OMM/MI12 6 metres (19.69) MP700E OMME/MI12E 9.5 metres (31.17)
TURN ON/OFF METHOD	Optical on/optical off <b>or</b> optical on/time out
SENSE DIRECTIONS	Omni-directional: ±X, ±Y, +Z
UNI-DIRECTIONAL REPEATABILITY MAX (2σ) AT STYLUS TIP‡	0.25 µm (0.00001 in)
PRE-TRAVEL VARIATION‡	
XY Plane	±0.25 µm (±0.00001 in)
XYZ (Variation from a true sphere)	±1.0 µm (±0.00004 in)
WEIGHT	700 g (25 oz)
TRIGGER FORCE (factory setting)	Not adjustable
XY Plane – constant force	0.02 N (2 gf) 0.07 ozf
+Z Direction	0.15 N (15 gf) 0.53 ozf
STYLUS OVERTRAVEL	
XY Plane	±16.5°
+Z Direction	11 mm (0.43 in)
STANDARD STYLUS LENGTH*	100 mm (3.94 in)
MAXIMUM STYLUS LENGTH*	200 mm (7.87 in)
BATTERY LIFE	1 x 6LR61 (PP3 9V alkaline)
Stand-by	381 days
5% usage	36 days
Continuous life	43 hours
SEALING	IPX8
SHANKS§	Various
COMPATIBLE INTERFACE¶	OMM/MI12 or OMI (MP700E – OMME / MI12E)

† See TRANSMISSION SYSTEMS section for more details.

\* M4 carbon fibre styli are recommended. See STYLI section

§ See SHANKS section for more details.

¶ See INTERFACES section for more details.

‡ Test conditions:	stylus length:	50mm	1.97 in
	stylus velocity:	240 mm/min	9.45 in/min
	stylus force:	factory settings	

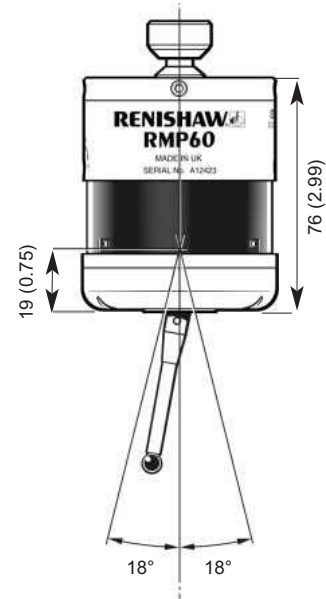
## RMP60 radio transmission probe

The RMP60 inspection probe is the first to use frequency hopping spread spectrum (FHSS) transmission and offers rapid part set-up and part verification on machining centres of all sizes. It is paired with the RMI a combined transmitter and receiver unit.

The RMP60's unique transmission system does not have a dedicated radio channel. Instead, the probe and receiver "hop" together through a sequence of frequencies.

### RMP60 features and benefits:

- Compact probe measuring just Ø63 mm x 76 mm in length
- Stainless steel body to withstand harsh machine tool environments
- No channel selection requirements
- Operating range of up to 15 m (49.21 ft)



All dimensions are in mm (in).

### RMP60

PRINCIPAL APPLICATION	Workpiece measurement and job set-up on medium to large horizontal, vertical and gantry machining centres, 5 axis machines, twin spindle machines and vertical turret lathes.
TERRITORY	EU, USA, Japan, Canada, Switzerland. Others pending
TRANSMISSION TYPE†	Frequency hopping spread spectrum radio (FHSS)
NOMINAL FREQUENCY	2.402 - 2.481 GHz
TURN ON/OFF CONTROL	
Turn ON	Radio 'M' code, spin, shank switch
Turn OFF	Radio 'M' code, time out, spin, shank switch
OPERATING RANGE	Up to 15 m (49.21 ft)
SENSE DIRECTIONS	Omni-directional: ±X, ±Y, +Z
UNI-DIRECTIONAL REPEATABILITY	1.0 µm (0.00004 in) 2 σ
WEIGHT	901 g (32 oz)
TRIGGER FORCE	
XY Plane - lowest force	0.75 N (75 gf) 2.64 ozf
XY Plane - highest force	1.40 N (140 gf) 4.92 ozf
+Z axis	4.90 N (490 gf) 17.3 ozf
STYLUS OVERTRAVEL	
XY Plane	±18°
+Z Direction	11 mm (0043 in)
MAX SPIN SPEED	1000 rev/min
MAXIMUM STYLUS LENGTH	100 mm (3.94 in)
BATTERY QUANTITY AND TYPE	2 x AA 1.5 V alkaline (alternative 2 x AA 3.6 V lithium thioyl chloride)
BATTERY LIFE MAXIMUM	
Stand by	1,538 days
5 % usage	115 days
Continuous life	144 hrs
SEALING	IPX8
SHANKS§	Various
COMPATIBLE INTERFACE *	RMI

† See TRANSMISSION SYSTEMS section for more details.

§ See SHANKS section for more details.

¥ See INTERFACES section for more details

‡ Test conditions	stylus length:	50mm	1.97 in
	stylus velocity:	480 mm/min	18.90 in/min
	stylus force:	factory settings	



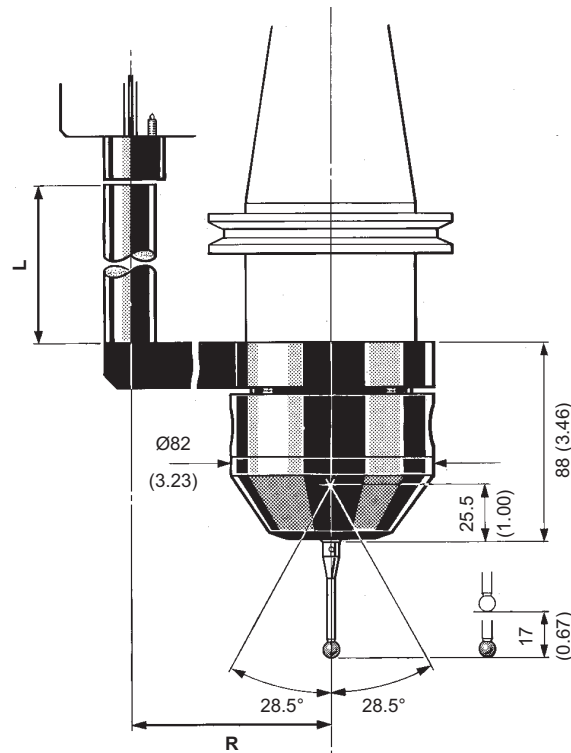
## MP3 inductive

Supplied with an inductive transmission system, the MP3 Inductive probe system has been designed for fitting by machine builders.

Battery-free, the probe offers generous overtravel for robust operation.

A range of IMP arms (defined by 'L' and 'R' dimensions) is available to suit different machine installations.

Inductive transmission is not recommended for retrofit installations. Machine builders should contact their Renishaw supplier for further details.



All dimensions are in mm (in).

### MP3 Inductive

PRINCIPAL APPLICATION	Vertical and horizontal machining centres
TRANSMISSION TYPE†	Electromagnetic induction
PROBING DIRECTIONS	Omni-directional: ±X, ±Y, +Z
UNI-DIRECTIONAL REPEATABILITY MAX (2σ) AT STYLUS TIP‡	1.0 μm (0.00004 in)
WEIGHT	Varies depending on IMP arm dimensions
TRIGGER FORCE (factory setting)	Adjustable
XY Plane – lowest force	0.75 N (75 gf) 2.6 ozf
XY Plane – highest force	1.50 N (150 gf) 5.2 ozf
+Z Direction	4.90 N (490 gf) 17.3 ozf
STYLUS OVERTRAVEL	
XY Plane	±28.5°
+Z Direction	17 mm (0.67 in)
DIMENSION 'L'	5 mm (0.20 in) to 60 mm (2.36 in)
DIMENSION 'R'	55 mm (2.16 in) to 115 mm (4.52 in)
STANDARD STYLUS LENGTH	100 mm (3.94 in)
MAXIMUM STYLUS LENGTH	150 mm (5.91 in)
SEALING	IPX8
SHANKS§	Various
COMPATIBLE INTERFACE *	IMM/MI5

† See TRANSMISSION SYSTEMS section for more details.

‡ Test conditions: stylus length: 50mm 1.97 in  
stylus velocity: 480 mm/min 18.90 in/min  
stylus force: factory settings

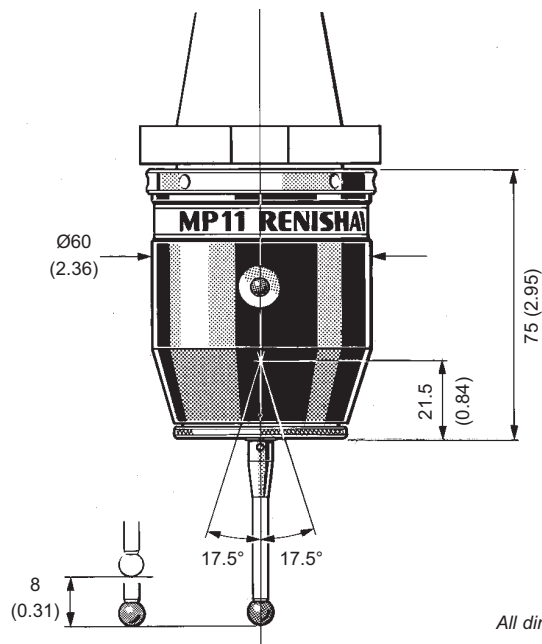
§ See SHANKS section for more details

\* See INTERFACES section for more details

## MP11

Designed for CNC milling machines, with manual tool change, the MP11 can be inserted manually into the machine's spindle.

The MP11 features an integral interface which processes signals between the probe and the CNC machine's control. Signals are transmitted through the curly cable, which connects to the probe via a plug.



All dimensions are in mm (in).

### MP11

PRINCIPAL APPLICATION	CNC milling machines
TRANSMISSION TYPE†	Hard-wired
SENSE DIRECTIONS	Omni-directional: ±X, ±Y, +Z
UNI-DIRECTIONAL REPEATABILITY MAX (2σ) AT STYLUS TIP‡	1.0 μm (0.00004 in)
WEIGHT	540 g (19 oz)
TRIGGER FORCE (factory setting)	Adjustable
XY Plane – lowest force	0.5 N (50 gf) 1.76 ozf
XY Plane – highest force	1.5 N (150 gf) 5.29 ozf
+Z Direction	1.8 N to 7.0 N (180 gf to 700 gf) 6.35 ozf to 24.69 ozf
STYLUS OVERTRAVEL	
XY Plane	±17.5°
+Z Direction	8 mm (0.31 in)
STANDARD STYLUS LENGTH	50 mm (1.97 in)
MAXIMUM STYLUS LENGTH	100 mm (3.94 in)
SEALING	IP 66
SHANKS§	Various
COMPATIBLE INTERFACE¶	Integral interface

§ See SHANKS section for more details.

† See TRANSMISSION SYSTEMS section

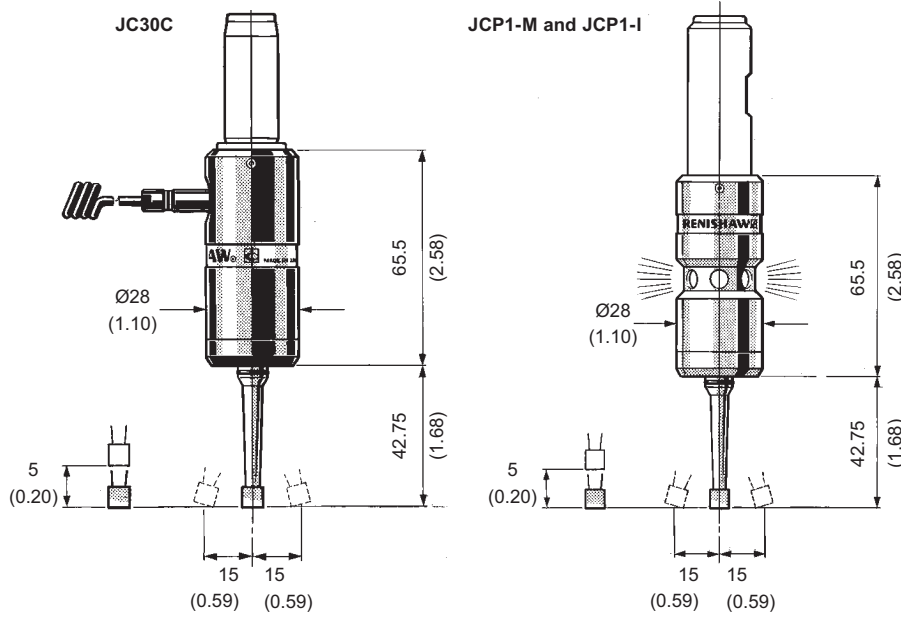
‡ Test conditions: stylus length: 50 mm 1.97 in  
stylus velocity: 1000 mm/min 39.37 in / min  
stylus force: factory settings

## Job contact probes

Job contact probes have been designed for use on manual machines and are ideal for workpiece set-up and simple inspection.

The JCP1, available with metric and imperial shanks, uses electrical conductivity to sense contact with a metallic workpiece. An LED is illuminated when the stylus touches the surface.

The JC30C variant provides a cable connection to digital readout counters with touch sensor inputs.



All dimensions are in mm (in).

### JC30C / JCP1-M / JCP1-I

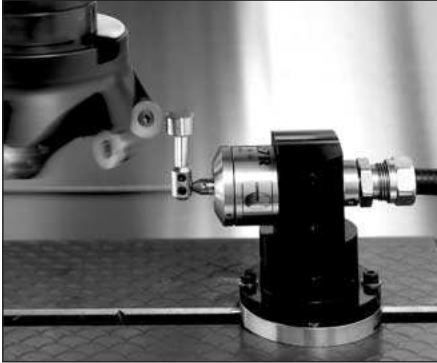
PRINCIPAL APPLICATION	Manual milling machines	
TRANSMISSION TYPE	None or hard-wired to touch sensor inputs	
SENSE DIRECTIONS	Omni-directional: ±X, ±Y, +Z	
UNI-DIRECTIONAL REPEATABILITY MAX (2σ) AT STYLUS TIP†	1.0 μm (0.00004 in)	
WEIGHT	240 g (8.5 oz)	
STYLUS OVERTRAVEL		
XY Plane	±15 mm (±0.59 in)	
+Z Direction	5 mm (0.20 in)	
STYLUS DIMENSIONS	JC30C / JCP1-M:	JCP1-I:
Fixed length	42.75 mm	1.68 in
Diameter	6 mm	0.24 in
BATTERY LIFE	2 X LR1 1.5V	
Continuous life	30 hours	
SEALING	IP 44	
SHANKS	JC30C Ø16 mm	JCP1-I Ø0.75 in
	JCP1-M Ø20 mm	
COMPATIBLE INTERFACE	None required: JC30C version wires directly into Digital Readout touch sensor input	

† Test conditions: stylus length: 50mm 1.97 in  
 stylus velocity: 480 mm/min 18.90 in/min  
 stylus force: factory settings

## CNC machining centre tool setting probing systems

### Applications

Renishaw probes can be used on machining centres for tool setting, tool verification and tool breakage detection applications.



**TS27R contact tool setter**

### Tool setting

Tools are driven against the probe's stylus with the tool either static or rotating:

- Static length setting for drills, taps etc.
- Rotating length setting for face mills and other large cutters.
- Rotating diameter setting for slot drills, boring bars etc.

### Tool verification

Tool lengths and diameters can be checked before use to guard against errors in tool selection.

### Tool breakage detection

Rapid checking of tool lengths to ensure that tools are still intact after machining.

### Probe selection

On a typical machining centre, a tool setting probe can be located on the bed of the machine.

However, more complex machines may require an arm to introduce the probe to the tools.

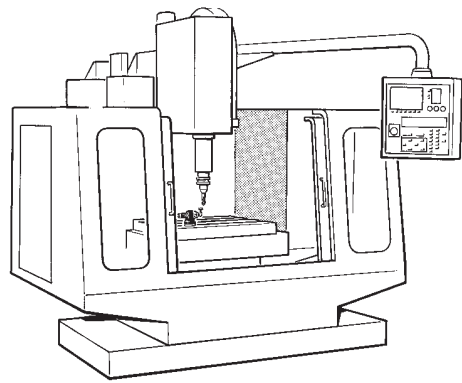
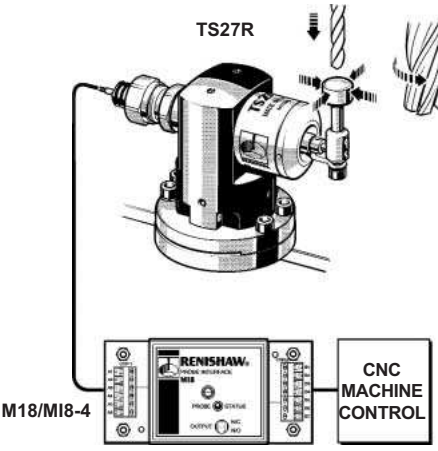
The following page shows some of the most common tool setting probe applications on machining centres.

1. A typical vertical machining centre fitted with a **TS27R** compact tool setting probe. This simple probing system uses a hard wired transmission.
2. A typical vertical machining centre fitted with a fixed **NC4** non-contact tool setting system. This system includes an adjuster pack for simple alignment to the machine's axes. Also available are NC1 and NC3 - compact non-contact tool setters and broken tool detection systems and the NC2 offering broken tool detection.
3. A **HPMA** automatic tool setting arm fitted to a horizontal machining centre with a multi-pallet changer. This solution is ideal for FMS applications. For details about HPMA refer to the CNC lathe tool setting probing systems section.

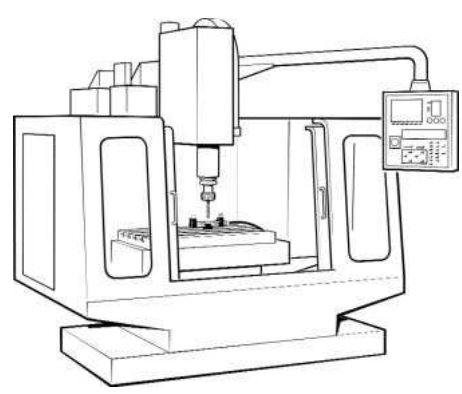
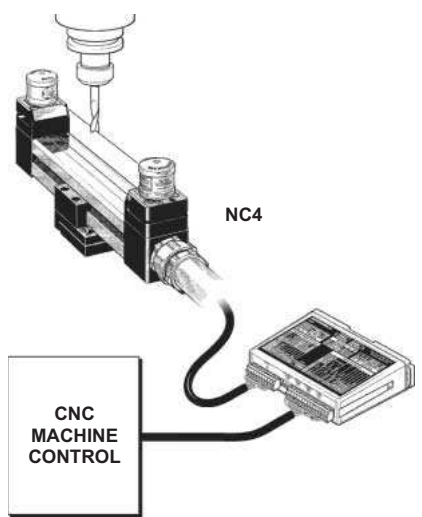
In addition to rotary arms like the HPMA, Renishaw can also provide a range of customised tool setting solutions. Refer to the Custom Products and Accessories section for more details.

Application	Probing system
Vertical or horizontal machine with fixed bed	TS27R NC1/NC2/NC3/ NC4
Horizontal machine with multi-pallet changer	HPMA/NC1/NC4

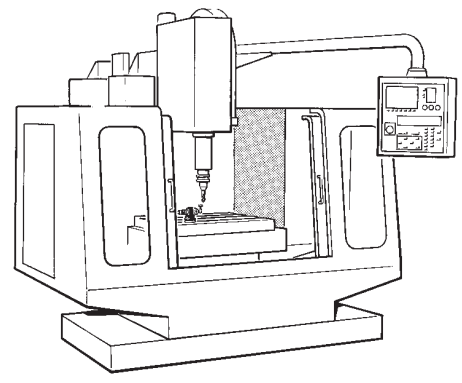
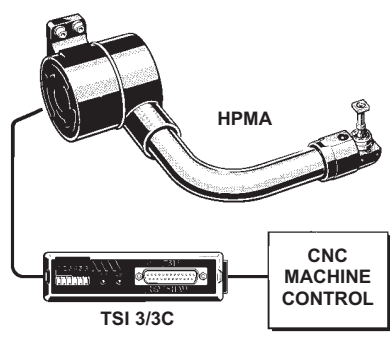
1. A **vertical machining centre** fitted with a TS27R tool setting probe. The TS27R is also available with styli to suit horizontal machining centre applications.



2. A **vertical machining centre** fitted with a fixed NC4 non-contact tool setting system, using laser-based transmitter and receiver units. NC4 is also available as a separate system.



3. A typical **FMS machine** fitted with a HPMA automatic tool setting. The HPMA provides an automated system with which the tool setting probe can be introduced to the tools exactly when required.



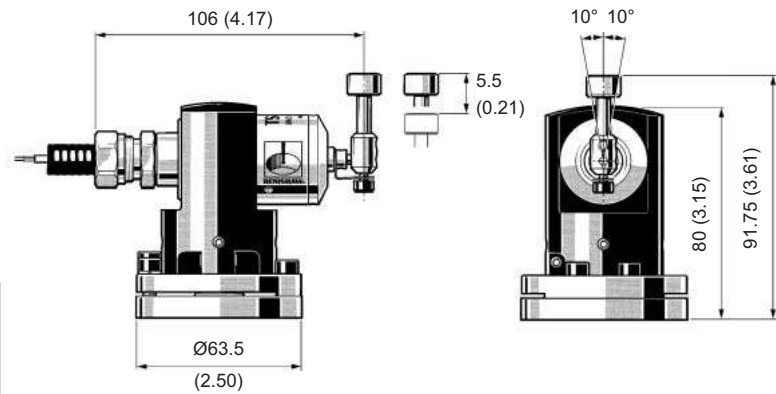


### TS27R

The TS27R is the standard contact tool setting probe for machining centre applications. A compact, robust design allows simple fitting to the machine bed or bracket mounting where appropriate.

#### TS27R features and benefits:

- Cost effective tool setting for all types of machining centres
- Tool length and diameter accurately measured on the machine
- Stylus protected by weak link preventing damage in the event of a collision



All dimensions are in mm (in).

#### TS27R

PRINCIPAL APPLICATION	Vertical machining centres
TRANSMISSION TYPE	Hard wired
PROBING DIRECTIONS	Omni-directional: ±X, ±Y, +Z
UNI-DIRECTIONAL REPEATABILITY MAX (2σ) AT STYLUS TIP†	1.0 μm (0.00004 in)
WEIGHT	650 g (23 oz)
TRIGGER FORCE (factory setting)	Not adjustable
lowest force	1.3 N (130 gf) 4.6 oz
highest force	2.4 N (240 gf) 8.5 oz
STYLUS OVERTRAVEL	
XY Plane	±10°
+Z Direction	5.5 mm (0.21 in)
MAX RECOMMENDED STYLUS LENGTH	Cranked stylus 27 x 33 mm (1.06 x 1.3 in)
SEALING	IPX8
MOUNTING	Ø12.7 mm (0.5 in) T bolt (not supplied) Optional spiral pins to allow accurate remounting
COMPATIBLE INTERFACE*	M18 or M18-4

¥ See INTERFACES section for more details.

‡ Test conditions: stylus length: 35 mm 1.38 in  
 stylus velocity in centre of stylus: 480 mm/min 18.90 in/min  
 stylus force: factory settings

## NC1 non-contact laser system

The NC1 non-contact tool setting system is for high-speed, high precision tool setting and broken tool detection. It uses compact and robust laser-based transmitter and receiver units.

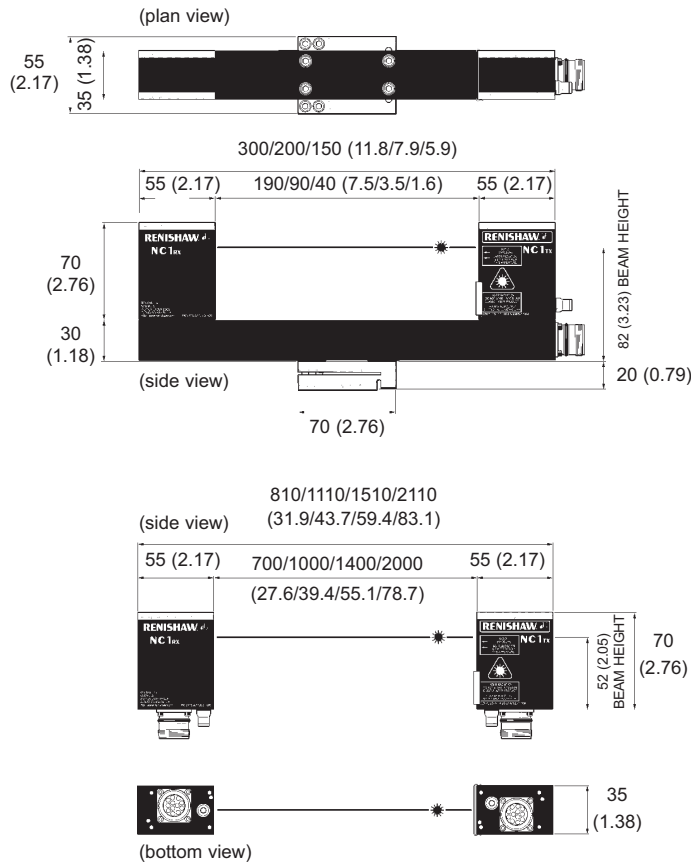
It is available as a fixed or separate system to suit different application types (see below for further details).

The NC1 uses MicroHole™ technology, a unique protection system, helping to protect the system against ingress of coolant and swarf.

The NCi-4 interface is used in conjunction with the NC1. Details on this interface can be found on page 7.4.

### NC1 features and benefits:

- Rapidly measure working tool length and diameter at normal spindle cutting speeds
- Non-contact – avoid possible wear and damage on delicate tools
- Options of NC1 fixed or NC1 separate with up to 2 m separation



All dimensions are in mm (in).

	FIXED	SEPARATES
PRINCIPAL APPLICATION	Rapid tool setting and broken tool detection on CNC machining centres	
LASER TYPE	Visible red light <1 mW 670 nm. Conforms to American (21 CFR 1040.10 and 1040.11 except for deviations pursuant to Laser Notice No. 50 dated July 26, 2001) and European (IEC 60852-1:1993 + A1: 1997 + A2: 2001) laser safety standards	
LASER BEAM ALIGNMENT	Adjuster pack (supplied)	Adjuster brackets
ELECTRICAL CONNECTION ARRANGEMENT	Connector: Fixed model options mounted on side or underside.	Connector: Separate model-mounted on base (underside).
TRANSMISSION TYPE	Hard wired via connector	Hard wired via connector
REPEATABILITY OF TRIGGER POINTS	±1 µm (40 µin) 2 σ	±2 µm (80 µin) 2 σ
SEALING	IPX8 with air on	IPX8 with air on
MOUNTING	Adjuster pack supplied with kit (see H-2000-2051)	Various options available (see H-2000-2051)
COMPATIBLE INTERFACE*	NCi-4	NCi-4
MINIMUM TOOL DIAMETER (MEASUREMENT)	Ø0.2 mm (0.008 in) or larger**	Ø0.2 mm (0.008 in) or larger**
MINIMUM TOOL DIAMETER (BREAKAGE DETECTION)	Ø0.1 mm (0.004 in)**	Ø0.1 mm (0.004 in)**
AIR PROTECTION SYSTEM	Supply pressure greater than 3 bar, air usage 8 litres/min. Supply must conform to ISO 8573-1: Air quality class 5.7 - Nylon piping with coil spring protector included	
POWER SUPPLY	12 - 24 Vdc, 175 mA	12 - 24 Vdc, 175 mA
OUTSIDE LENGTH/INTERNAL TRANSMITTER AND RECEIVER SEPARATION mm (in)	150 (5.9)/40 (1.6), 200 (7.9)/90 (3.5), 300 (11.8)/190 (7.5)	500 (19.7) to 700 (27.6), 700 (27.6) to 1000 (39.4), 1000 (39.4) to 1400 (55.1), 1400 (55.1) to 2000 (78.7)
TEMPERATURE LIMIT	Operating +10°C to + 40°C Storage -20°C to + 70°C	

\*\* Dependent on separation and mounting

\*See INTERFACES section for more details

## NC2 tool breakage detection

The NC2 is a compact 2 axis non-contact broken tool detection device, featuring the proven MicroHole™ technology.

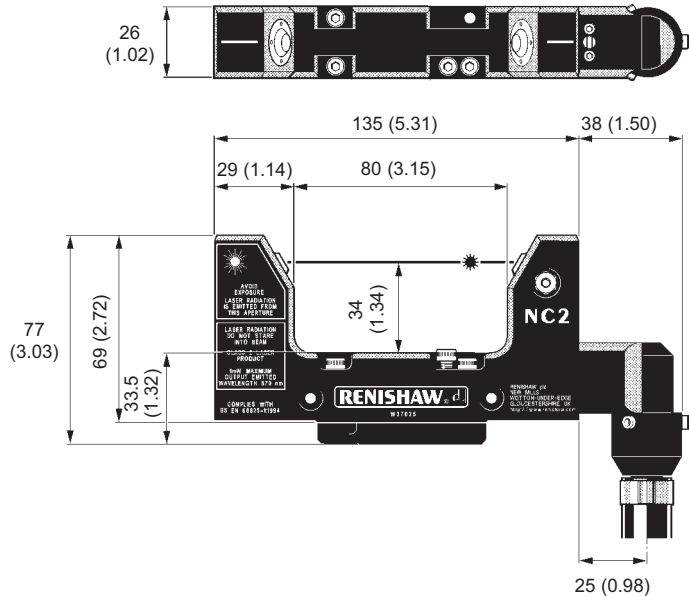
A cost-effective solution for many users, the NC2 is especially suitable for use in unmanned machining operations, where tool damage can cause costly scrap or re-work.

Broken tools as small as 0.15 mm diameter can be detected anywhere along the laser beam. Set-up is simple with the built-in adjuster block.

The NC2 features an integral interface which processes signals between the device and the CNC control.

### NC2 features and benefits:

- Detection of tools as small as Ø0.15 mm
- Short cycle times
- Ultra compact overall length of just 135 mm, with a laser beam length of 85 mm



All dimensions are in mm (in).

### NC2

PRINCIPAL APPLICATION	High speed, non-contact broken tool detection on vertical machining centres
LASER TYPE	Visible red light <1 mW 670 nm. Conforms to American (21 CFR 1040.10 and 1040.11 except for deviations pursuant to Laser Notice No. 50 dated July 26, 2001) and European (IEC 60852-1:1993 + A1: 1997 + A2: 2001) laser safety standards
LASER BEAM ALIGNMENT	Adjuster pack – supplied. Options available.
ELECTRICAL CONNECTION ARRANGEMENT	Hard-wired
TRANSMISSION TYPE	Hard-wired
SEALING	IPX8 with air on
MOUNTING	Single M10/M12 fixing. M4 mounting holes also provided
MINIMUM TOOL DIAMETER FOR BREAKAGE DETECTION	Ø0.15 mm (0.006 in) or larger
AIR PROTECTION SYSTEM	Supply pressure greater than 3 bar, air usage 6 litres / min. Supply must conform to ISO 8573-1 : Air quality class 5.7 – nylon piping included.
POWER SUPPLY REQUIRED	10 V DC to 30V DC 35 mA max.
OUTSIDE LENGTH/INTERNAL TRANSMITTER AND RECEIVER SEPARATION	135 mm (5.31 in)/80 mm (3.15 in)
TEMPERATURE LIMIT	Operating +5° C to +50° C Storage -10° C to +70° C
CURRENT CONSUMPTION	35 mA max
WEIGHT	0.75 kg (1.65lb)
POWER UP TIME	< 0.5 seconds

## NC3 compact laser system

The NC3 is a compact 2 axis non-contact tool setting system, with broken tool detection capability.

Tools as small as 0.2 mm diameter can be measured anywhere along the laser beam.

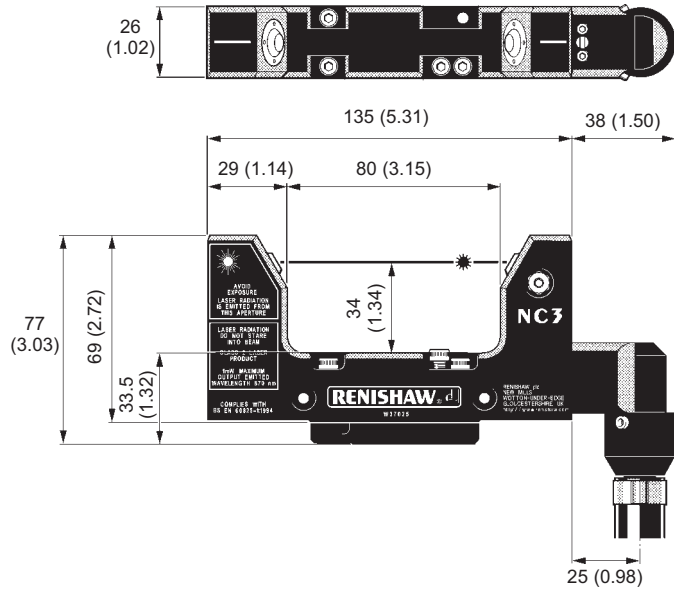
Set-up is simpler than focused laser systems as there is no focal point to identify.

It is hard-wired to the NCi-4 interface unit, which features a unique 'drip rejection mode'. This 'drip rejection' feature offers protection against unwanted trigger signals.

The NC3 offers improved repeatability, reduction in air consumption and an improved rapid tool-breakage detection cycle and with faster operation, gives greater repeatability.

### NC3 features and benefits:

- Impressive repeatability of  $\pm 0.15 \mu\text{m}$  ( $2 \sigma$ )
- High speed broken tool detection cycle
- Measure tools of  $\varnothing 0.2 \text{ mm}$  and larger.
- Detect broken tools as small as  $\varnothing 0.1 \text{ mm}$



All dimensions are in mm (in).

Machining centre  
tool setting

4.6

### NC3

PRINCIPAL APPLICATION	High precision/high speed, non-contact tool setting and tool breakage detection
LASER TYPE	Visible red light <1 mW 670 nm. Conforms to American (21 CFR 1040.10 and 1040.11 except for deviations pursuant to Laser Notice No. 50 dated July 26, 2001) and European (IEC 60852-1:1993 + A1: 1997 + A2: 2001) laser safety standards
LASER BEAM ALIGNMENT	Adjuster pack - supplied. Options available.
ELECTRICAL CONNECTION ARRANGEMENT	Hard-wired
REPEATABILITY OF TRIGGER POINTS	$\pm 0.15 \mu\text{m}$ ( $6 \mu\text{in}$ ) $2 \sigma$ .
SEALING	IPX8
MOUNTING	Single M10/M12 fixing. M4 mounting holes also provided
COMPATIBLE INTERFACE*	NCi-4
MINIMUM TOOL DIAMETER (MEASUREMENT)	$\varnothing 0.2 \text{ mm}$ (0.008 in)
MINIMUM TOOL DIAMETER (BREAKAGE DETECTION)	$\varnothing 0.1 \text{ mm}$ (0.004 in) or larger
AIR PROTECTION SYSTEM	Supply pressure greater than 3 bar, air usage 6 litres / min. Supply must conform to ISO 8573-1 : Air quality class 5.7. Nylon piping included.
POWER SUPPLY REQUIRED	12 V to 30 V, 120 mA.
OUTSIDE LENGTH/INTERNAL TRANSMITTER AND RECEIVER SEPARATION	135 mm (5.31 in)/80 mm (3.15 in)
TEMPERATURE LIMIT	Operating +5° C to +50° C Storage -10° C to +70° C
POWER UP TIME	< 0.5 seconds

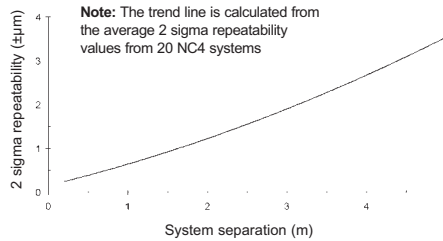
\*See INTERFACES section for more details

## NC4 laser system

The NC4 is a flexible laser system, with ultra-compact laser tool setting transmitter and receiver units that can be mounted onto separate brackets, or as a single fixed unit. The NC4 allows fast, non-contact tool setting and tool breakage detection on machines previously unsuitable for such applications.

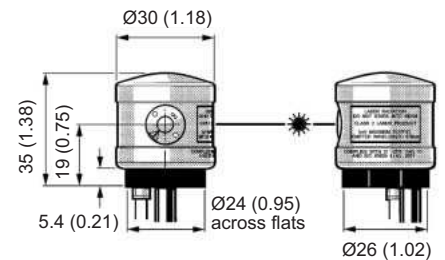
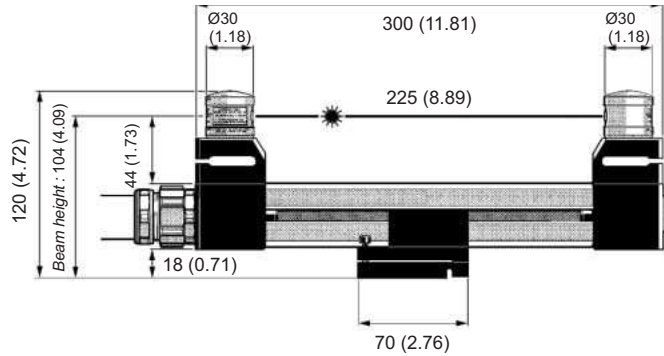
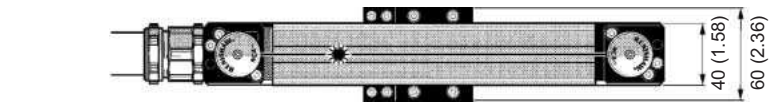
### NC4 features and benefits:

- Compact units measuring just Ø30 mm (1.18 in) and 35 mm (1.38 in) in height
- Separate systems available up to 5 metres
- New PassiveSeal™ protection device
- Simplified set-up and installation



Tx / Rx separation (m)		Minimum tool diameter (mm) when ...	
		... measured	... detected
Fixed system	0.225	0.20	0.10
	0.50	0.30	0.10
Separate system	1.00	0.40	0.20
	2.00	0.50	0.20
	3.00	0.60	0.30
	4.00	1.00	0.30
	5.00	1.00	0.30

For guidance purposes only



All dimensions are in mm (in).

### Fixed NC4

### Separate NC4

PRINCIPAL APPLICATION	High precision, high speed, non-contact broken tool measurement and tool detection on vertical and horizontal machining centres	
LASER TYPE	Visible red. Complies with 21 CFR 1040.10 and 1040.11 except for deviations pursuant to laser notice No. 50 dated July 26, 2001. The laser used is classified as a Class 2 product as defined by International standards IEC 60825-1:1993 + A1:1997 + A2:2001.	
LASER BEAM ALIGNMENT	Adjuster pack	Adjuster pack (optional on separate systems)
ELECTRICAL CONNECTION ARRANGEMENT	Hard-wired cable on end. Other options available on request	Hard-wired cable on underside of unit
SEALING	IPX8 with or without air	
MOUNTING	Single M10/M12 fixing	Fixing for M3 screws
COMPATIBLE INTERFACE	NCi-4	
REPEATABILITY OF TRIGGER POINTS	± 1.0 µm (2 σ) at 1 m separation (see performance table above)	
MINIMUM TOOL DIAMETER FOR SETTING	Ø0.2 mm (0.0008 in) or larger, depending on separation and set-up	Ø0.3 mm (0.01 in) or larger depending on separation and set-up
MINIMUM TOOL DIAMETER FOR BREAKAGE DETECTION	Ø0.1 mm (0.004 in) or larger (see performance table above)	
AIR PROTECTION SYSTEM	Supply pressure greater than 3 bar, air usage 8 litres / min. Supply must conform to ISO 8573-1 : Air quality class 5.7. Nylon piping included.	
POWER SUPPLY REQUIRED	120 mA @ 12 V, 70 mA @ 24 V	
OUTPUT SIGNAL WITH NCi-4	Voltage free SSR	
TEMPERATURE LIMIT	Operating +5° C to +50° C. Storage -10° C to +70° C	
SEPARATIONS AVAILABLE	300 mm system, providing a 225 mm operating gap. Others available upon request	0.5 m to 0.8 m, 0.8 m to 1.5 m 1.5 m to 2 m, 2 m to 3 m, 3 m to 5 m

\*See INTERFACES section for more details



## CNC lathe grinder and inspection probing systems

### Applications

Renishaw probes can be used on lathes and grinders for component setting and inspection applications.



### Component setting

The probe identifies the position of the workpiece, automatically updating work offsets, enabling parts to be manufactured right first time.

This can also be used for:

- part identification for FMS installations.
- component location and also misload detection to avoid scrap.
- excess material identification to bring the cutter to the component fast and safely.

### First-off inspection

Inspection of the first component in a batch on the machine tool to:

- reduce the time the machine is idle awaiting feedback from an off-line inspection device.
- correct any errors automatically.

### In-process inspection

Measure components following rough machining to:

- ensure critical final cuts are correct.
- highlight errors before they become faults.

### Post-process inspection

Inspection of the part once the machining is completed. This can be used to:

- provide information to certify that the component is within its specification.
- record part dimensions for statistical process control.

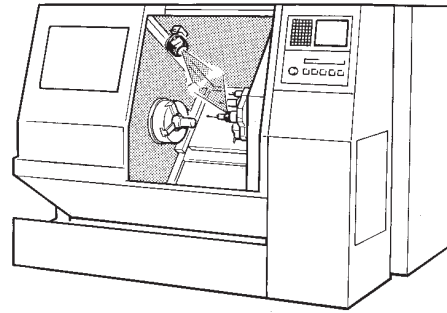
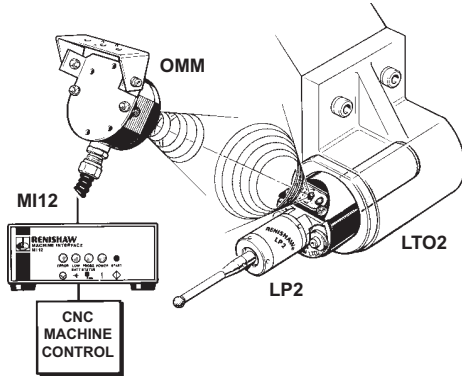
### Probe selection

On lathes, inspection probes require a remote transmission system. On grinders the probe is typically hard-wired to the CNC. (see section 2, Transmission selection).

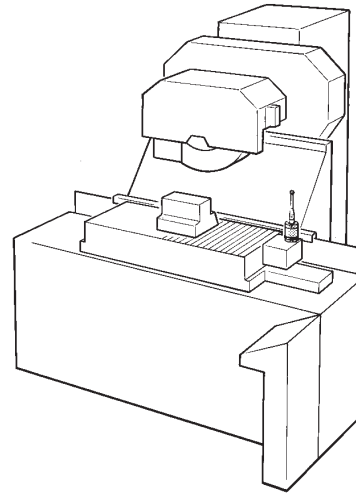
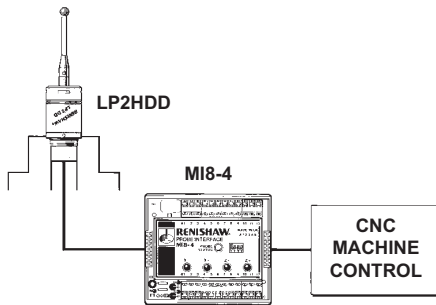
The next page shows some of the most common lathe and grinder inspection probe applications:

1. A small, horizontal lathe fitted with an **LP2** probe using the **LTO2** optical transmission.
2. A grinder fitted with a hard-wired **LP2H** probe, allowing the use of longer styli.
3. The **RMP60** probe has been designed for workpiece measurement and job set-up on medium to large horizontal, vertical and gantry machining centres, 5 axis machines, twin spindle machines and vertical turret lathes (VTL).

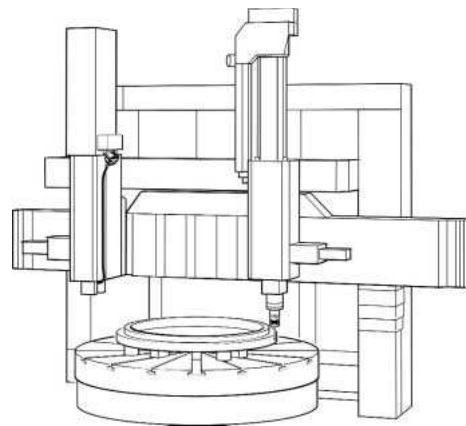
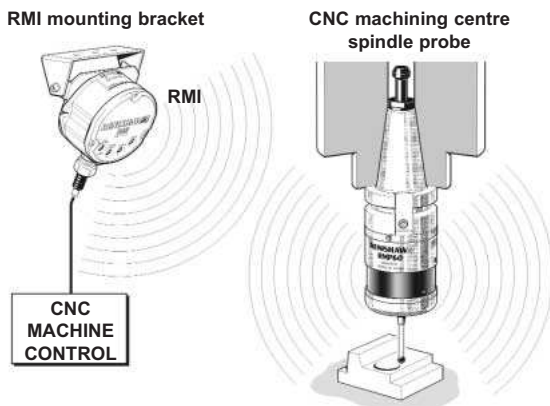
1. A **small horizontal lathe** fitted with an LP2 probe using the LTO2 optical transmission module. In this installation, signal transmissions are via an OMM and a separate MI12 interface.



2. A **tool grinder** fitted with a hard-wired high spring force LP2H probe. This allows the use of longer styli than the standard LP2 and has a double diaphragm for use in grinding environments.



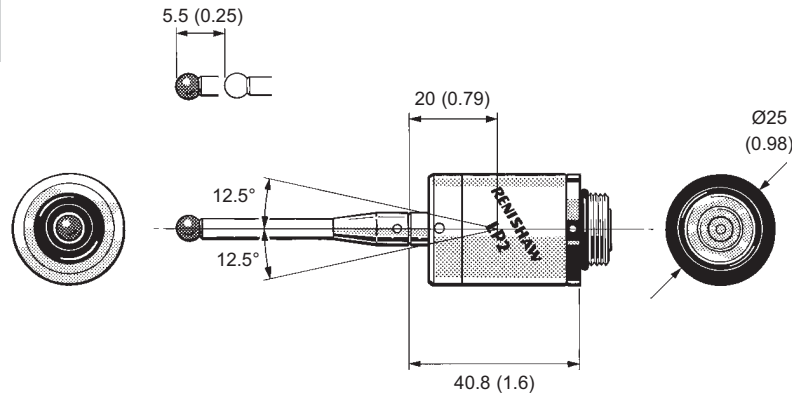
3. A **large vertical turret lathe** fitted with an RMP60 radio probe (refer to the CNC machining centre and milling machine inspection probing systems section for more details).



## LP2 / LP2H

The LP2 and LP2H are high performance, compact probes suitable for inspection and tool setting applications. The LP2H has a higher spring force, allowing the use of longer styli. It has greater resistance to machine vibration.

The LP2 and LP2H are suitable for attaching to the LTO2 family of optical transmission systems, as well as those using inductive transmission. They can also be hard-wired for grinder inspection applications.



All dimensions are in mm (in).

	LP2	LP2H
PRINCIPAL APPLICATION	Horizontal lathes	Horizontal lathes
PROBING DIRECTIONS	Omni-directional: ±X, ±Y, +Z	Omni-directional: ±X, ±Y, +Z
UNI-DIRECTIONAL REPEATABILITY MAX (2σ) AT STYLUS TIP†	1.0 μm (0.00004 in)	2.0 μm (0.00008 in)
WEIGHT	65 g (2.3 oz)	65 g (2.3 oz)
TRIGGER FORCE (factory setting)	Adjustable	Not adjustable
XY Plane - lowest force	0.50 N (50 gf) 1.76 ozf	2 N (200 gf) 7.05 ozf
XY Plane - highest force	0.90 N (90 gf) 3.17 ozf	4 N (400 gf) 14.1 ozf
+Z Direction	5.85 N (585 gf) 20.6 ozf	30 N (3000 gf) 6.6 lbf
STYLUS OVERTRAVEL		
XY Plane	±12.5°	±12.5°
+Z Direction	6.5 mm (0.25 in)	5.0 mm (0.20 in)
STANDARD STYLUS LENGTH	50 mm (1.97 in)	50 mm (1.97 in)
MAXIMUM STYLUS LENGTH	100 mm (3.94 in)	150 mm (5.91 in)
SEALING	IPX8	IPX8
MOUNTING	M16 thread for connection to LT family, extension bars and adaptors.	
COMPATIBLE INTERFACE*	OMI or OMM / MI12 if fitted with LTO2S / LTO2T / LTO3T / LTO2 MI8 / MI8-4 if hard-wired MI5 if fitted with inductive transmission	

¥ See INTERFACES section for more details.

‡ Test Conditions: Stylus Length: 35 mm 1.37 in  
Stylus Velocity: 480 mm/min 18.90 in/min  
Stylus Force: Factory settings

## FS1i and FS2i

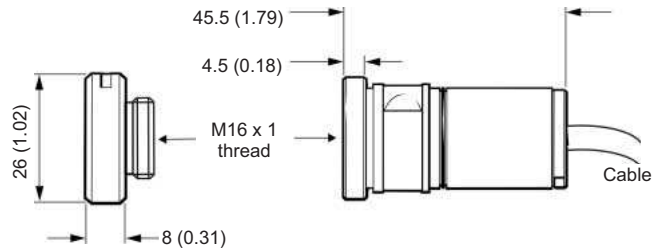
The FS1i and FS2i are female sockets, used for holding the LP2 or LP2H probes.

The **FS1i** can be radially adjusted by  $\pm 4^\circ$  for aligning the square stylus tip to the machine axes, where the **FS2i** is for fixed applications that do not require adjustment.

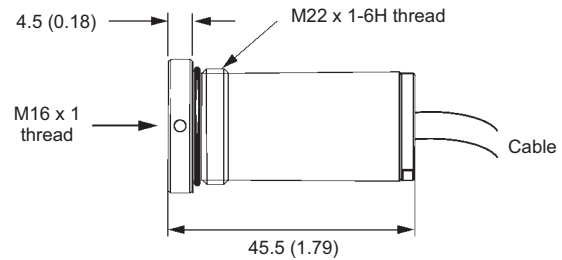
Powered from a 12 - 30 V supply, they contain an integral interface which converts the probe's signal into a voltage free solid state relay (SSR) output for transmission to the CNC machine control.

With the built in interface and compact size of  $\varnothing 25$  mm x 45.5 mm in length, these sockets eliminate the need for a separate interface within the control cabinet, making installation simple.

### FS1i adjustable female socket



### FS2i fixed female socket



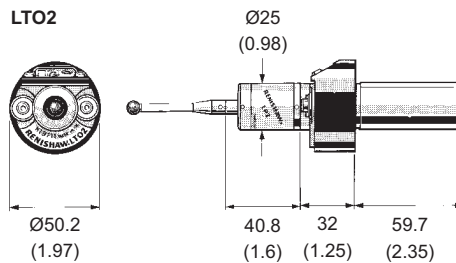
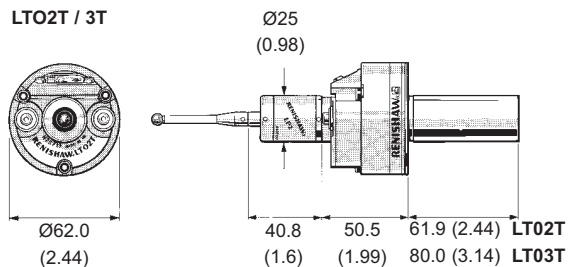
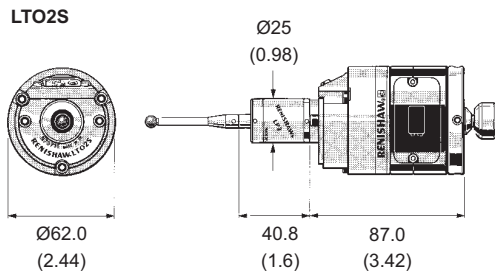
All dimensions are in mm (in).

	FS1i	FS2i
PRINCIPAL APPLICATION	<b>Adjustable</b> female socket with integral interface used for holding the LP2 and LP2H probes	<b>Fixed</b> female socket with integral interface used for holding the LP2 and LP2H probes
LENGTH	45.5mm (1.79 in)	45.5 mm (1.79 in)
DIAMETER	25 mm (0.98 in)	25 mm (0.98 in)
WEIGHT	70 g (2.4 oz)	70 g (2.4 oz)
STORAGE TEMPERATURE	-10° C to +70° C	-10° C to +70° C
OPERATING TEMPERATURE	+10° C to +40° C	+10° C to +40° C
IP RATING	IPX8	IPX8
CABLE	4 core screen cable with polyurethane sheath. Each core 7/0.2 insulated. $\varnothing 4.35$ mm (0.17 in) x 1.0 m (3 ft 3 in)	5 core screen cable with polyurethane sheath. Each core 7/0.2 insulated. $\varnothing 4.35$ mm (0.17 in) x 1.0 m (3 ft 3 in)
SUPPLY VOLTAGE	12 V to 30 V	12 V to 30 V
SUPPLY CURRENT	18 mA nominal, 25 mA max	18 mA nominal, 25 mA max.
MAX. OUTPUT CURRENT	50 mA	50 mA
OUTPUT TYPE	Voltage free SSR	Voltage free SSR
PROTECTION	Short circuit protected output <b>The interface must be powered from a suitably fused supply.</b>	Short circuit protected output. <b>The interface must be powered from a suitably fused supply</b>

**LTO2S / LTO2T / LTO3T / LTO2**  
optical transmissions

The LT family with optical transmission is ideal for turret mounting on all CNC lathes.

All LT units can be fitted with LP2 or LP2H probes.



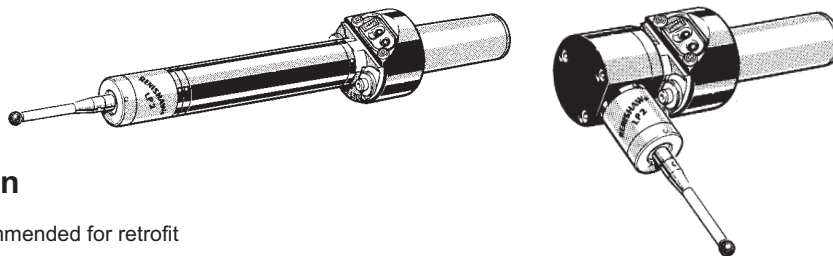
All dimensions are in mm (in).

	LTO2S	LTO2T	LTO3T	LTO2
TRANSMISSION TYPE†	Uni-directional infra-red optical transmission			
PRINCIPAL APPLICATION	Large/medium lathes	Medium lathes	Medium lathes	Small lathes
TURN ON/OFF METHOD	Optical on/optical off or optical on/timer off	Optical on/optical off or optical on/timer off	Optical on/optical off or optical on/timer off	Optical on/timer off
WEIGHT (including probe)	835 g	625 g	680 g	355 g
BATTERY LIFE	6LR61 (PP3 9V alkaline)	DL123A	DL123A (2 pieces)	DL123A
Stand-by	365 days	108 days	280 days	65 days
5% usage	80-98 days	42-45 days	110-114 days	35 days
Continuous life	110-140 hours	81-88 hours	183-225 hours	88 hours
SEALING	IPX8	IPX8	IPX8	IPX8
SHANKS	Various Ø25.4 (1 in)	Ø25 (0.98 in) Ø25.4 (1 in)	Ø25 (0.98 in)	Ø25 (0.98 in)
COMPATIBLE INTERFACE*	OMI or OMM/MI12	OMI or OMM/MI12	OMI or OMM/MI12	OMI or OMM/MI12

\*See INTERFACES section for more details

† See TRANSMISSION SYSTEMS section

Extension bars and adapters are also available for special applications.



**Inductive transmission**

Inductive transmission is not recommended for retrofit installations. Machine builders should contact their Renishaw supplier for further details or visit website [www.renishaw.com](http://www.renishaw.com).



## CNC lathe tool setting probing systems

### Applications

Renishaw probes can be used on lathes for tool setting and tool breakage detection applications.



### Tool setting

Tools are driven against the probe stylus with the tool either static or rotating:

- Static setting in X and Z directions for turning tools, part off tools etc.
- Rotating length and/or diameter setting in X and Z directions for powered tools such as drills, taps and slot drills.

### Tool breakage detection

Rapid checking of tool dimensions to ensure that tools are still intact after machining.

### Probe selection

Typically, tool setting probes cannot remain inside the machine frame of a lathe when not in use - they would obstruct the operation of the machine. However, Renishaw has developed a range of tool setting arms which allow's a probe to be placed near the tools only when it is needed. Renishaw's lathe tool setting systems allow manual and fully automatic operation. Manual arms can be removed by hand, whilst automatic arms can be actuated by program commands.

Whether manual or automatic, all Renishaw tool setting arms provide a highly repeatable location for the probe. Manual systems are most suitable where tool set-ups are relatively infrequent. A fully automatic system is ideal where batch changeovers are frequent, or where in-process tool breakage detection is required to support unmanned operation. The next page shows some of the most common tool setting probe applications on lathes:

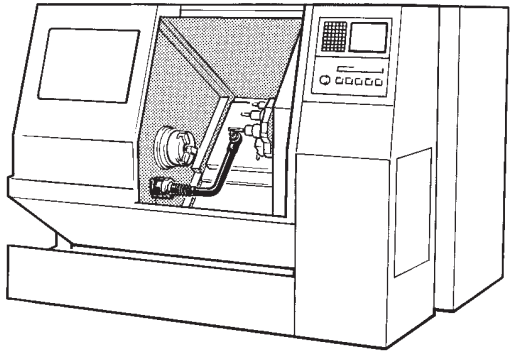
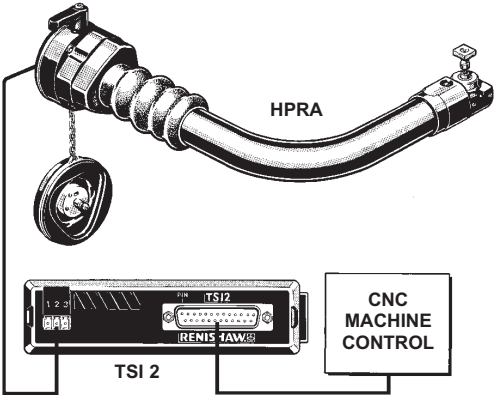
1. A typical horizontal lathe fitted with an **HPRA** manual tool setting arm.
2. The **HPPA** shown in a horizontal lathe.
3. The same lathe fitted with a **HPMA** automatic tool setting arm.

Renishaw tool setting probes can also be purchased separately for use in special applications.

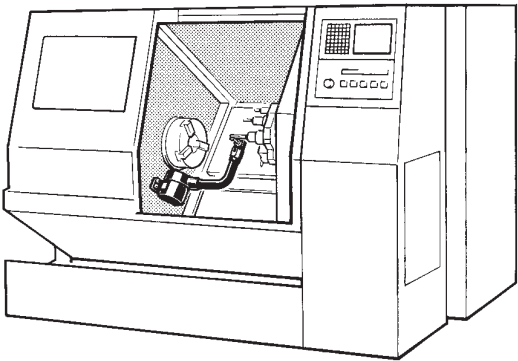
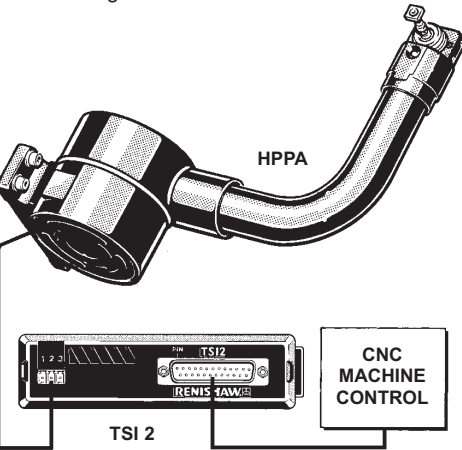
The Renishaw range includes:

- **RP3** – a compact 5 axis tool setting probe ideal for arm applications.
- **LP2** – a high specification probe for specialist applications.

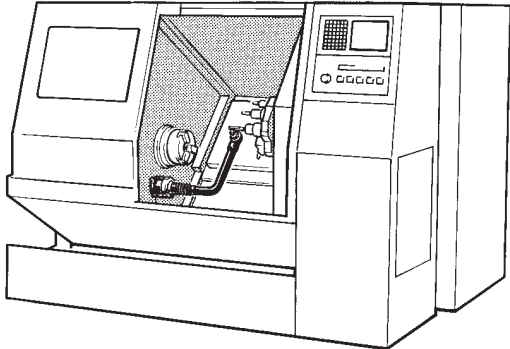
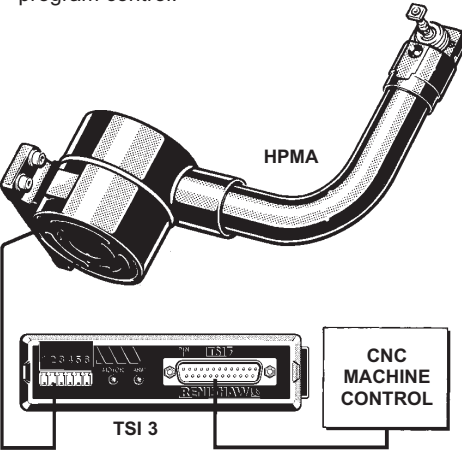
1. A **horizontal lathe** fitted with an HPRA manual tool setting system. The HPRA is locked to a permanent base when in use, and can be stored on a stand outside the machine tool when not required.



2. A **horizontal lathe** fitted with the HPPA manual operated 'pull down, push up' system, which is permanently located within the turning centre.



3. A **horizontal lathe** fitted with the HPMA automatic tool setting system. The HPMA remains inside the machine tool all the time, manoeuvring the tool setting probe into position when needed – under program control.

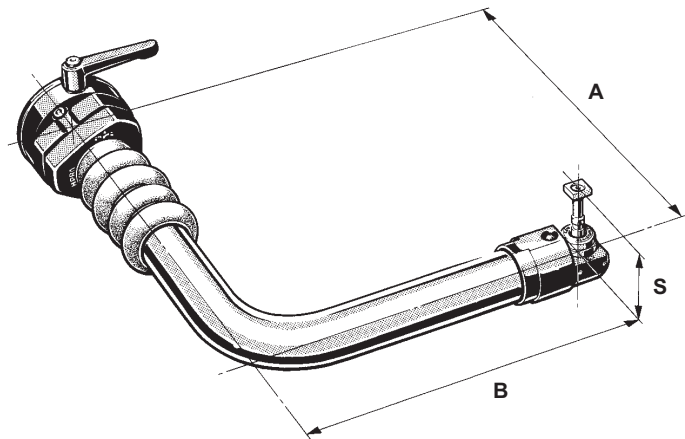


**HPRA**  
High precision removable arm

The HPRA is a 'plug-in' arm which is manually located inside the machine for tool setting, and then removed once the process is complete.

The arm is locked into a repeatable kinematic location on a mounting base during operation, enabling the probe stylus to be re-located to within 5 µm (2σ).

When not in use the HPRA is stored on a stand located on or near the machine.



All dimensions are in mm (in).

**HPRA**

PRINCIPAL APPLICATION	Tool setting on two and three axis lathes	
TYPICAL POSITIONAL REPEATABILITY MAX (2σ) AT STYLUS TIP‡	5.0 µm 2σ	0.0002 in (Arms for machines with 6 in to 15 in chucks)
	8.0 µm 2σ	0.0003 in (Arms for machines with 18 in and 24 in chucks)
ARM DIMENSIONS	<b>Maximum</b>	
A	580 mm (22.85 in)	
B	450 mm (17.73 in)	
S (50 mm tooling)	71 mm (2.80 in)	
ARM DIMENSIONS	<b>Minimum</b>	
A	250 mm (9.84 in)	
B	211 mm (8.31 in)	
S (16 mm tooling)	35.7 mm (1.41 in)	
BASE DIAMETER	85 mm (3.35 in)	
SEALING	IPX8	
PROBE	RP3	
COMPATIBLE INTERFACE*	TSI 2	

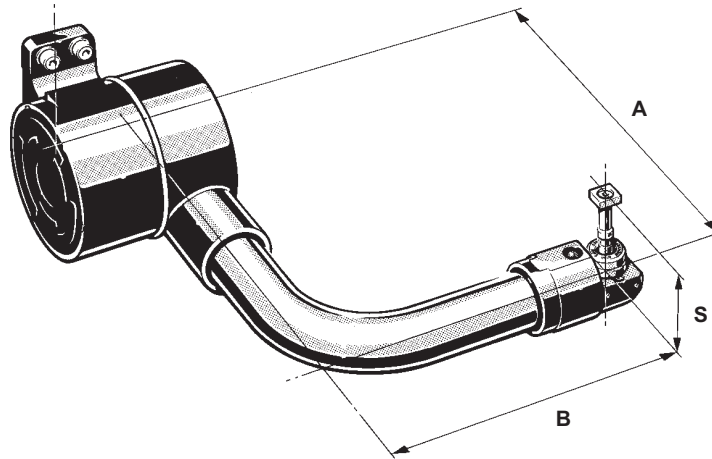
\* See INTERFACES section for more details

‡ Test conditions: stylus length: 22 mm 0.87 in  
stylus velocity: 36 mm/min 1.42 in/min  
stylus force: factory settings

**HPPA**  
High precision pulldown arm

The HPPA is a simple, manually operated 'pull down, push-up' system, which is permanently located within the turning centre, and readily available for tool setting operations.

An innovative patented rotary device automatically locks the arm into a kinematic location, with no additional adjustment or locking device required. This enables the probe's stylus to be re-located to within 5 µm (2σ).



All dimensions are in mm (in).

**HPPA**

PRINCIPAL APPLICATION	Tool setting on two and three axis lathes
TYPICAL POSITIONAL REPEATABILITY MAX (2σ) AT STYLUS TIP†	5.0 µm 2σ x/z 0.0002 in (Arms for machines with 6 in to 15 in chucks) 8.0 µm 2σ x/z 0.0003 in (Arms for machines with 18 in and 24 in chucks)
ARM DIMENSIONS	<b>Maximum</b>
A	555 mm (21.87 in)
B	458.2 mm (18.04 in)
S (50 mm tooling)	71 mm (2.80 in)
ARM DIMENSIONS	<b>Minimum</b>
A	250 mm (9.84 in)
B	219.2 mm (8.63 in)
S (16 mm tooling)	35.7 mm (1.41 in)
BASE DIAMETER	120 mm (4.72 in)
SEALING	IPX8 (static)
PROBE	RP3
COMPATIBLE INTERFACE*	TSI 2

\* See INTERFACES section for more details

† Test conditions: stylus length: 22 mm 0.87 in  
stylus velocity: 36 mm/min 1.42 in/min  
stylus force: factory settings

## Machine Interface Units

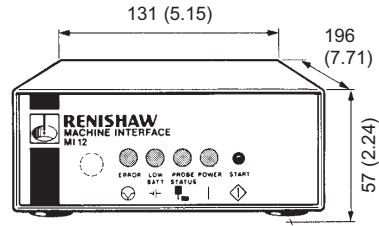
### MI12/MI12E/MI12-B (Optical transmission)

The MI12 and MI12B interfaces process signals between one or two OMMs and the CNC machine control.

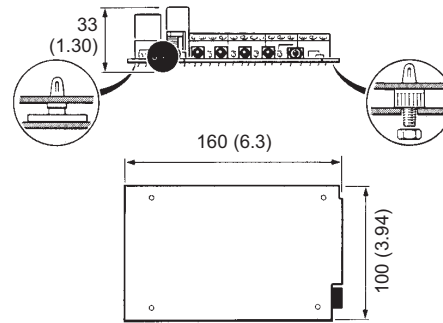
The standard MI12 unit is contained within a free standing enclosure with an optional panel mounting kit also available. The MI12-B is a board-only version for mounting within the machine cabinet.

The MI12E interface forms part of the high power optical transmission system. It processes signals between one or two OMMEs and the CNC machine's control. For optimum system performance, the MI12E should only be used with OMME(s) and MP10E (or MP700E).

MI12 and MI12E



MI12-B



All dimensions are in mm (in).

#### MI12 / MI12-B / MI12E

PRINCIPAL APPLICATION	Optical transmission probing systems on machining centres and lathes	
MOUNTING	Free standing enclosure (optional panel mount available) The MI12-B has self-adhesive feet or M4 support studs	
SYSTEM STATUS	Audible indicator	'Beeper'
	Error LED	Illuminated when beam obstructed, probe out of range, probe off
	Low battery LED	Indicates probe batteries should be replaced
	Probe status LED	Illuminated when probe is seated, off when stylus deflected
	Power LED	Illuminated when power is on
	Start button	Manual start push button on front of interface
MACHINE START OPTIONS	1. Machine start	OMM / OMME sends start signal when commanded by the machine control
	2. Auto start	OMM / OMME sends start signal once every second when the probe is not transmitting
OUTPUTS	Four solid state relay (SSR) outputs 1. Probe status (or complement) 2. Probe skip (or complement) 3. Probe error (or complement) 4. Low battery	
OUTPUT SIGNAL FORMAT	Output signals must be compatible with machine control input	
	Maximum current	±50 mA
	Maximum voltage	±50 V peak
OTHER I/O	Remote audible indicator or lamp (not supplied by Renishaw)	
	Maximum current	100 mA
	Maximum voltage	+50 V DC
	Output duration	44 ms
POWER SUPPLY	The interface can draw its supply from the CNC +15 to + 30 V DC and presents a load of up to 400mA Alternatively, the Renishaw PSU3 power supply unit can be used	



## Machine Interface Units

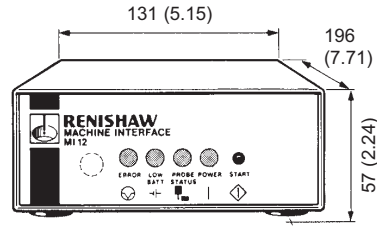
### MI12/MI12E/MI12-B (Optical transmission)

The MI12 and MI12B interfaces process signals between one or two OMMs and the CNC machine control.

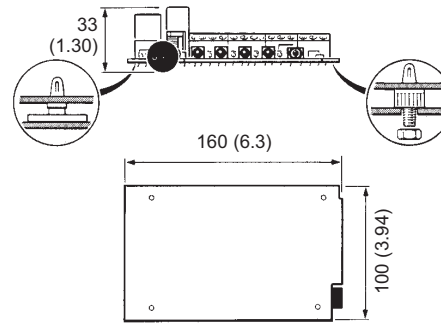
The standard MI12 unit is contained within a free standing enclosure with an optional panel mounting kit also available. The MI12-B is a board-only version for mounting within the machine cabinet.

The MI12E interface forms part of the high power optical transmission system. It processes signals between one or two OMMEs and the CNC machine's control. For optimum system performance, the MI12E should only be used with OMME(s) and MP10E (or MP700E).

MI12 and MI12E



MI12-B



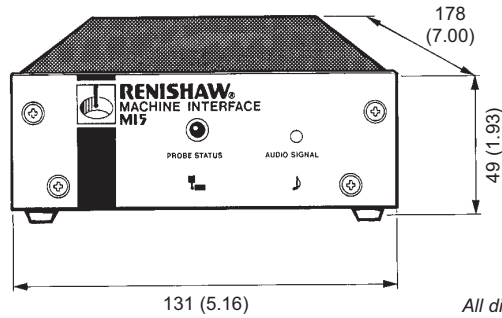
All dimensions are in mm (in).

#### MI12 / MI12-B / MI12E

PRINCIPAL APPLICATION	Optical transmission probing systems on machining centres and lathes	
MOUNTING	Free standing enclosure (optional panel mount available) The MI12-B has self-adhesive feet or M4 support studs	
SYSTEM STATUS	Audible indicator	'Beeper'
	Error LED	Illuminated when beam obstructed, probe out of range, probe off
	Low battery LED	Indicates probe batteries should be replaced
	Probe status LED	Illuminated when probe is seated, off when stylus deflected
	Power LED	Illuminated when power is on
	Start button	Manual start push button on front of interface
MACHINE START OPTIONS	1. Machine start	OMM / OMME sends start signal when commanded by the machine control
	2. Auto start	OMM / OMME sends start signal once every second when the probe is not transmitting
OUTPUTS	Four solid state relay (SSR) outputs 1. Probe status (or complement) 2. Probe skip (or complement) 3. Probe error (or complement) 4. Low battery	
OUTPUT SIGNAL FORMAT	Output signals must be compatible with machine control input	
	Maximum current	±50 mA
	Maximum voltage	±50 V peak
OTHER I/O	Remote audible indicator or lamp (not supplied by Renishaw)	
	Maximum current	100 mA
	Maximum voltage	+50 V DC
	Output duration	44 ms
POWER SUPPLY	The interface can draw its supply from the CNC +15 to + 30 V DC and presents a load of up to 400mA Alternatively, the Renishaw PSU3 power supply unit can be used	

**MI5**  
**(Inductive transmission)**

The MI5 interface processes signals from Renishaw inductive probes and converts the signals into voltage free solid state relay (SSR) output, for transmission to the machine's controller.



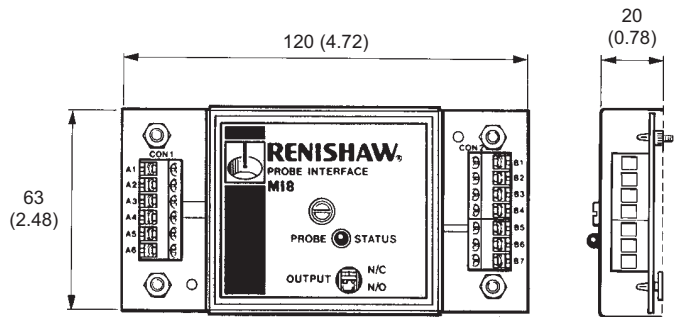
All dimensions are in mm (in).

**MI5**

PRINCIPAL APPLICATION	Inductive probing systems on machining centres and lathes	
MOUNTING	Free standing enclosure	
SYSTEM STATUS	Audible indicator Probe Status LED	'Beeper' On when probe is seated, off when stylus deflected or power is off
OUTPUT	1. Probe Status (or complement) 2. Probe Skip (or complement)	
OUTPUT SIGNAL FORMAT	Solid state relay (SSR) Maximum current 40 mA peak Maximum voltage ±50 V peak	
POWER SUPPLY	The MI5 can draw its supply from the CNC +18 to + 30V DC The MI5 presents a load of up to 200 mA Alternatively, the Renishaw PSU3 power supply unit can be used	

**MI8**  
**(Hard-wired transmission)**

The MI8 interface processes signals from Renishaw hard-wired probes and converts the signals into a voltage-free solid-state relay (SSR) output, for connection to the machine's controller.



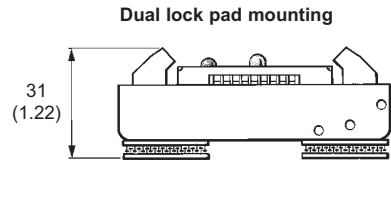
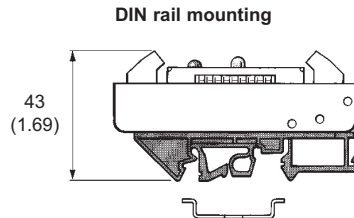
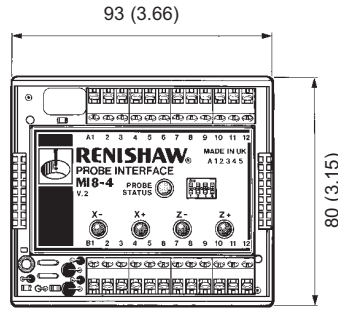
**MI8**

PRINCIPAL APPLICATION	Hard-wired probing systems on machining centres and lathes	
MOUNTING	Self adhesive feet, M4 studded support or DIN rail mounting	
SYSTEM STATUS	Probe status LED	On when probe seated, off when stylus deflected or power is off
OUTPUT	1. Probe Status/Status Bar – configurable	
OUTPUT SIGNAL FORMAT	Solid state relay (SSR) Maximum current 50 mA peak Maximum voltage ±50 V peak	
OTHER I/O	Outputs are available for a remote probe status LED (not supplied by Renishaw). Nominal current is 10 mA	
POWER SUPPLY	The MI8 can draw its supply from the CNC +15 to + 30 V DC The MI8 presents a load of up to 50 mA Alternatively, the Renishaw PSU3 power supply unit can be used	

**MI8-4**  
**(Hard wired transmission)**

The MI8-4 interface processes the probe signal from a hard-wired probe and converts it to the correct format for connection to a controller's probe input.

The MI8-4 can also be connected to the 4 wire Fanuc automatic measurement input (XAE, ZAE). Four signals are required from the control to determine which of the four outputs should generate the probe's signal.



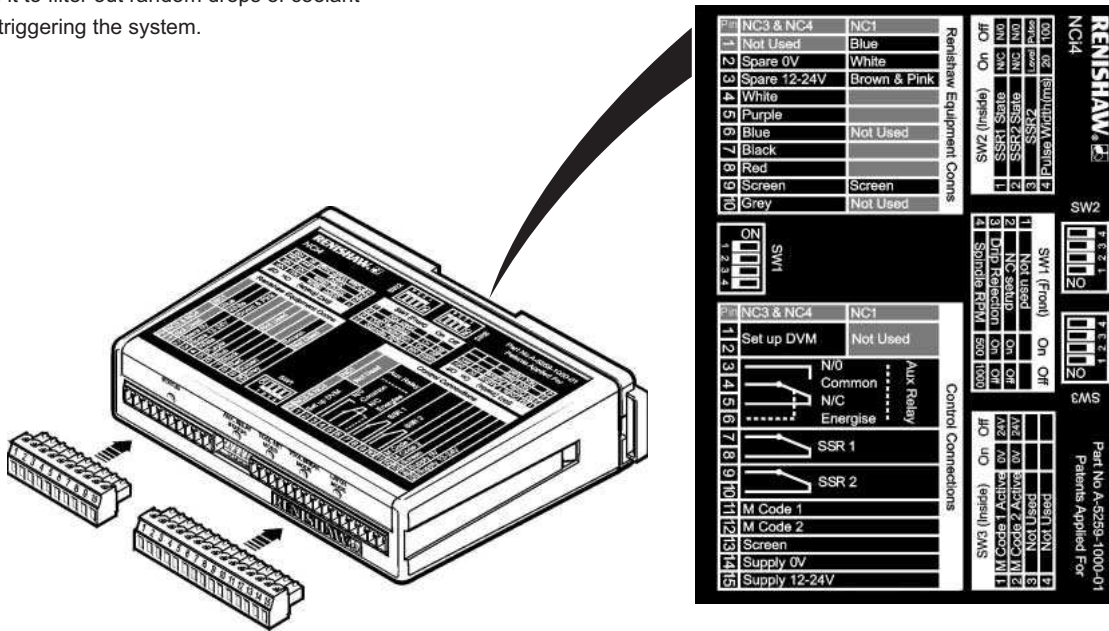
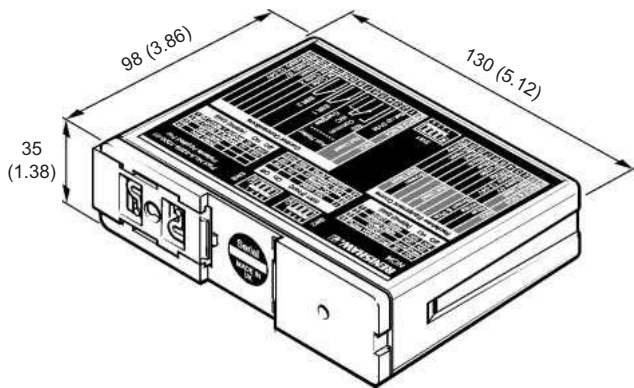
**MI8-4**

PRINCIPAL APPLICATION	Hard wired probing systems on machining centres and lathes	
MOUNTING	Self adhesive dual locked fixing or DIN rail mounting	
SYSTEM STATUS	Probe status LED	Green when probe is seated, red when stylus deflected off when power is off
	4 Diagnostic LEDs	Illuminated to indicate direction of machine movement (for use with 4 wire output option)
STANDARD OUTPUT	1. Probe status (or complement)	
STANDARD OUTPUT SIGNAL FORMAT	Probe status output is an isolated totem-pole output which requires a three wire connection: signal, power and ground	
TTL COMPATIBILITY	Probe status output is TTL compatible with a 5 V ± 5% supply voltage. If this supply voltage is not available then another voltage in the 4.75 V to 30 V range can be used	
	V out high	2.5 V min at 2.5 mA
	V out low	0.4 V max at 10 mA
FANUC '4 WIRE' OUTPUTS	1. X- output (or complement) 2. X+ output (or complement) 3. Z- output (or complement) 4. Z+ output (or complement)	
'4 WIRE' OUTPUT FORMAT	Four wire outputs are totem-pole outputs supplied by the +15 V to +30 V power supply to the MI8-4 Four 'machine axis moving' inputs to the MI8-4 are open collector transistor (OCT), totem-pole and relay compatible	
OTHER I/O	An inspection probe system output can be connected to the MI8-4 and then routed to the machine control. The selection of probe is controlled by a machine control input to the MI8-4 (M code)	
POWER SUPPLY	The MI8-4 can draw its supply from the CNC +15 to +30 V DC. A voltage of +16.5 to +28.5 V with 3 V peak ripple is also acceptable The MI8-4 presents a load of up to 80 mA (each XAE, ZAE output connection will add to the supply current)	

**NCi-4**  
(Interface for NC products)

The NCi-4 interface is used with the NC1, NC3 and NC4 non-contact tool setting systems, processing their signals and converting them into a voltage-free solid state relay (SSR) output, for transmission to the CNC machine control.

The NCi-4 features a drip rejection mode allowing it to filter out random drops of coolant without triggering the system.



**NCi-4**

<b>PRINCIPAL APPLICATION</b>	The NCi-4 processes signals from the NC1, NC3 or NC4 and converts them into a voltage free solid state (SSR) output, which is transmitted to the CNC machine control.
<b>DIMENSIONS</b>	Compact size 130 mm (5.12 in) x 98 mm (3.86 in) x 35 mm (1.38 in)
<b>SUPPLY VOLTAGE</b>	11V to 30V dc
<b>SUPPLY CURRENT - NC3 or NC4 CONNECTED</b>	120 mA @ 12V, 70 mA @ 24V
<b>SUPPLY CURRENT - NC1 CONNECTED</b>	300 mA @ 12V, 130 mA @ 24V
<b>OUTPUT SIGNAL</b>	Two voltage free solid state relay (SSR) outputs configurable normally open or normally closed, one of which can be configured pulsed or level.
<b>AUXILIARY RELAY</b>	Auxiliary relay for skip sharing with a spindle probe system or controlling the transmitter separately from the receiver
<b>TEMPERATURE OPERATING</b>	+ 5 C to + 50 C
<b>TEMPERATURE STORAGE</b>	-10 C to + 70 C
<b>POWER SUPPLY</b>	12 V to 30 V
<b>MOUNTING</b>	DIN rail. Alternative mounting using screws
<b>INPUT/OUTPUT PROTECTION</b>	SSR outputs protected by 50mA resettable fuses. Aux relay output protected by a 200mA resettable fuse
<b>DIAGNOSTIC LED's</b>	Beam status, latch mode, high-speed tool breakage detection mode, auxiliary relay, tool setting mode
<b>MODES OF OPERATION</b>	High speed tool breakage detection mode. Normal measurement mode. Latch mode for profile checking and cutting edge checking. Drip rejection mode - rejects random drops of coolant falling through the beam.

**TSI2, TSI3, TSI2-C and TSI3-C  
(for tool setting arms)**

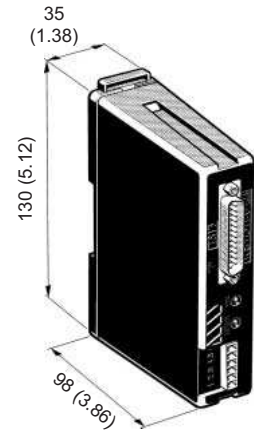
The TSI interfaces process signals between the HPRA, HPPA or HPMA toolsetting arms and the machine's control.

These units are DIN rail-mounted and feature an 'easy fit' location mechanism. The interfaces are designed to be used with all standard +24 V dc operated controllers i.e. Fanuc, Siemens etc. TSI2 suits the HPRA and HPPA, whilst TSI3 is for the motorised HPMA.

For controllers that do not operate from standard +24 V dc, power supplies the TSI2-C and TSI3-C should be used instead. These feature configurable Solid State Relay (SSR) outputs that are easily integrated into all non +24 V controllers.



TSI2/TSI2-C



TSI3/TSI3-C

	TSI 2	TSI 3
PRINCIPAL APPLICATION	Hard-wired tool setting probe applications with HPRA and HPPA	Hard-wired probe applications with HPMA
MOUNTING	DIN rail mounting	DIN rail mounting
STANDARD OUTPUTS	1. Probe status (no complement) 2. Position confirm signals (machine ready and arm ready)	1. Probe status (no complement) 2. Position confirm signals (machine ready and arm ready)
STANDARD OUTPUT SIGNAL FORMAT	1. Unipolar active high probe status outputs (non configurable) 2. Unipolar active high confirm outputs for machine ready and arm ready positions (non configurable)	1. Unipolar active high probe status outputs (non configurable) 2. Unipolar active high confirm outputs for machine ready and arm ready positions (non configurable)
TTL COMPATIBILITY	Not compatible	Not compatible
STANDARD INPUTS	1. Inhibit 2. Probe Select inputs	1. Inhibit, Arm Ready command, Machine Ready command 2. Probe Select inputs
STANDARD INPUT SIGNAL FORMAT	1. Internally pulled down (2k4) ACTIVE HIGH 2. Internally pulled down (2k4) ACTIVE HIGH	1. Internally pulled down (2k4) ACTIVE HIGH 2. Internally pulled down (2k4) ACTIVE HIGH
PROBE VIBRATION FILTER	A trigger delay circuit (6.5 ms) can be activated by reversing the probe connections to the TSI2 (PL2-1 and PL2-3)	A trigger delay circuit (6.5 ms) can be activated by reversing the probe connections to the TS1 3 (PL2-1 and PL2-3)
POWER SUPPLY	18 V – 30 V DC, I <sub>max</sub> = 50 mA not including output loading. Fuse protected at 250 mA (FF).	<b>Interface voltage supply (1, 13, 25)</b> 18 V-30 V DC, I <sub>max</sub> = 100 mA not including output loading. <b>Motor voltage supply (10, 22, 11, 23)</b> 24 V DC + 20% -10%, I <sub>max</sub> + 2.5 A for 4 s (worst case stall). Overcurrent and reverse connection protected. Self-resettable

## Taper shanks for machine tool probes

### Shanks for RMP60 (when not used in shank switch configuration)

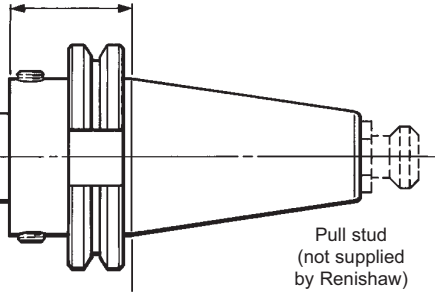
- MP10 – MP10E – MP12 – MP18 (non-shank switch version)
- MP700 – MP700E probes

- Please quote the part number when ordering equipment
- Shanks are supplied in a natural finish
- Dimensions mm (in)
- If you cannot find the shank you require, please contact your local Renishaw office for further details

### Taper shanks

Shank type	Part no.	Taper	Gauge length A
<b>DIN 69871 A</b>	M-2045-0064	30	35.25 (1.388)
	M-2045-0065	40	35.25 (1.388)
	M-2045-0067	50	35.25 (1.388)
<b>BT - 1982</b>	M-2045-0077	30	27.5 (1.083)
	M-2045-0027	40	32.0 (1.260)
	M-2045-0073	50	38.0 (1.496)
<b>ANSI CAT B5.50-1985</b> (Imperial pull stud thread)	M-2045-0137	40	35.25 (1.388)
	M-2045-0139	50	35.25 (1.388)
<b>ANSI CAT B5.50-1985</b> (Metric pull stud thread)	M-2045-0208	40	40.00 (1.575)
	M-2045-0238	50	35.25 (1.388)
<b>DIN 2080</b> (Manual tool change)	M-2045-0132	30	20.0 (0.787)
	M-2045-0024	40	13.6 (0.535)

Gauge length A

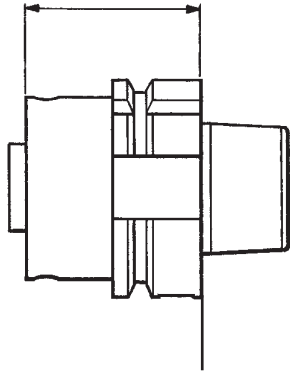


Gauge line

### HSK shanks

Shank type	Part no.	HSK	Gauge length A
<b>DIN 69893 HSK Form A</b>	M-2045-0232	A32	46 (1.811)
	M-2045-0186	A40	47 (1.850)
	M-2045-0187	A50	50 (1.969)
	M-2045-0188	A63	53 (2.087)
	M-2045-0189	A80	50 (1.969)
	M-2045-0190	A100	61 (2.402)
<b>DIN 69893 HSK Form E</b>	M-2045-0204	E40	38 (1.496)
<b>DIN 69893 HSK Form F</b>	M-2045-0287	F3	53 (2.087)
<b>SANDVIK CAPTO</b>	M-2045-0346	C5	32 (1.259)
	M-2045-0310	C6	42 (1.654)
	M-2045-0311	C8	50 (1.969)
<b>KENNAMETAL KM</b>	M-2045-0335	KM63	25.6 (1.07)
	M-2045-0344	KM63Y	30.0 (1.181)

Gauge length A



Gauge line



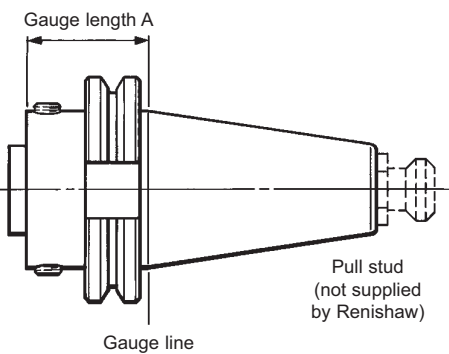
## Taper shanks for machine tool probes

### Shanks for RMP60 (when not used in shank switch configuration)

- MP10 – MP10E – MP12 – MP18 (non-shank switch version)
- MP700 – MP700E probes

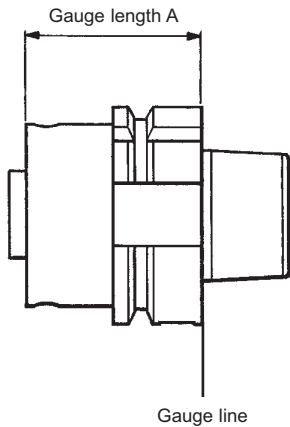
- Please quote the part number when ordering equipment
- Shanks are supplied in a natural finish
- Dimensions mm (in)
- If you cannot find the shank you require, please contact your local Renishaw office for further details

## Taper shanks



Shank type	Part no.	Taper	Gauge length A
<b>DIN 69871 A</b>	M-2045-0064	30	35.25 (1.388)
	M-2045-0065	40	35.25 (1.388)
	M-2045-0067	50	35.25 (1.388)
<b>BT - 1982</b>	M-2045-0077	30	27.5 (1.083)
	M-2045-0027	40	32.0 (1.260)
	M-2045-0073	50	38.0 (1.496)
<b>ANSI CAT B5.50-1985</b> (Imperial pull stud thread)	M-2045-0137	40	35.25 (1.388)
	M-2045-0139	50	35.25 (1.388)
<b>ANSI CAT B5.50-1985</b> (Metric pull stud thread)	M-2045-0208	40	40.00 (1.575)
	M-2045-0238	50	35.25 (1.388)
<b>DIN 2080</b> (Manual tool change)	M-2045-0132	30	20.0 (0.787)
	M-2045-0024	40	13.6 (0.535)

## HSK shanks



Shank type	Part no.	HSK	Gauge length A
<b>DIN 69893 HSK Form A</b>	M-2045-0232	A32	46 (1.811)
	M-2045-0186	A40	47 (1.850)
	M-2045-0187	A50	50 (1.969)
	M-2045-0188	A63	53 (2.087)
	M-2045-0189	A80	50 (1.969)
	M-2045-0190	A100	61 (2.402)
<b>DIN 69893 HSK Form E</b>	M-2045-0204	E40	38 (1.496)
<b>DIN 69893 HSK Form F</b>	M-2045-0287	F3	53 (2.087)
<b>SANDVIK CAPTO</b>	M-2045-0346	C5	32 (1.259)
	M-2045-0310	C6	42 (1.654)
	M-2045-0311	C8	50 (1.969)
<b>KENNAMETAL KM</b>	M-2045-0335	KM63	25.6 (1.07)
	M-2045-0344	KM63Y	30.0 (1.181)

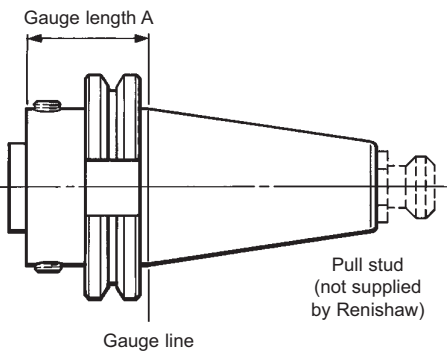
## Taper shanks for machine tool probes

### Shanks for RMP60 (when not used in shank switch configuration)

- MP10 – MP10E – MP12 – MP18 (non-shank switch version)
- MP700 – MP700E probes

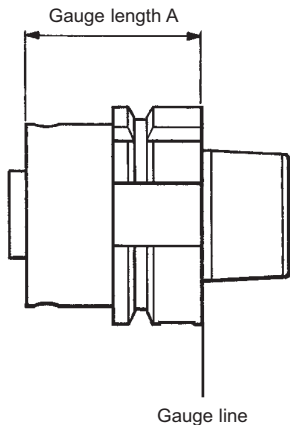
- Please quote the part number when ordering equipment
- Shanks are supplied in a natural finish
- Dimensions mm (in)
- If you cannot find the shank you require, please contact your local Renishaw office for further details

## Taper shanks



Shank type	Part no.	Taper	Gauge length A
<b>DIN 69871 A</b>	M-2045-0064	30	35.25 (1.388)
	M-2045-0065	40	35.25 (1.388)
	M-2045-0067	50	35.25 (1.388)
<b>BT - 1982</b>	M-2045-0077	30	27.5 (1.083)
	M-2045-0027	40	32.0 (1.260)
	M-2045-0073	50	38.0 (1.496)
<b>ANSI CAT B5.50-1985</b> (Imperial pull stud thread)	M-2045-0137	40	35.25 (1.388)
	M-2045-0139	50	35.25 (1.388)
<b>ANSI CAT B5.50-1985</b> (Metric pull stud thread)	M-2045-0208	40	40.00 (1.575)
	M-2045-0238	50	35.25 (1.388)
<b>DIN 2080</b> (Manual tool change)	M-2045-0132	30	20.0 (0.787)
	M-2045-0024	40	13.6 (0.535)

## HSK shanks

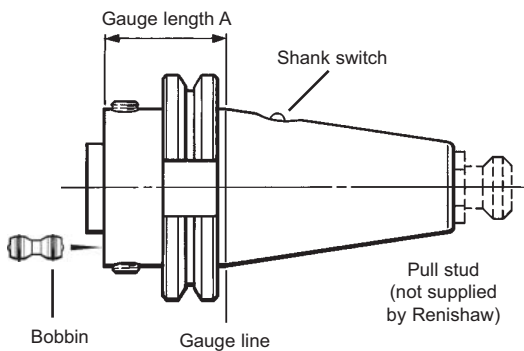


Shank type	Part no.	HSK	Gauge length A
<b>DIN 69893 HSK Form A</b>	M-2045-0232	A32	46 (1.811)
	M-2045-0186	A40	47 (1.850)
	M-2045-0187	A50	50 (1.969)
	M-2045-0188	A63	53 (2.087)
	M-2045-0189	A80	50 (1.969)
	M-2045-0190	A100	61 (2.402)
<b>DIN 69893 HSK Form E</b>	M-2045-0204	E40	38 (1.496)
<b>DIN 69893 HSK Form F</b>	M-2045-0287	F3	53 (2.087)
<b>SANDVIK CAPTO</b>	M-2045-0346	C5	32 (1.259)
	M-2045-0310	C6	42 (1.654)
	M-2045-0311	C8	50 (1.969)
<b>KENAMETAL KM</b>	M-2045-0335	KM63	25.6 (1.07)
	M-2045-0344	KM63Y	30.0 (1.181)

## Shanks for RMP60 probes when used in shank switch configuration

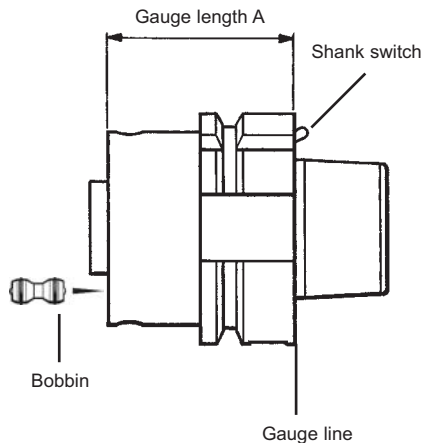
- Please quote the part number when ordering equipment
- Shanks are supplied in a natural finish
- Bobbin supplied with shank
- Dimensions mm (in)
- If you cannot find the shank you require, please contact your local Renishaw office for further details

### Taper shanks



Shank type	Part no.	Taper	Gauge length A
DIN 69871 A	M-4038-0231	30	65.00 (2.559)
	M-4038-0053	40	35.25 (1.388)
	M-4038-0232	50	41.00 (1.614)
BT - 1982	M-4038-0233	30	65.00 (2.559)
	M-4038-0234	40	35.25 (1.388)
	M-4038-0235	50	41.00 (1.614)
ANSI CAT B5.50-1985 (Imperial pull stud thread)	M-4038-0236	30	65.00 (2.559)
	M-4038-0237	40	35.25 (1.388)
	M-4038-0238	50	35.25 (1.388)
ANSI CAT B5.50-1985 (Metric pull stud thread)	M-4038-0239	40	35.25 (1.388)
	M-4038-0240	50	35.25 (1.388)

### HSK shanks



Shank type	Part no.	HSK	Gauge length A
DIN 69893 HSK Form A	A-4038-0070	A40	65.00 (2.559)
	A-4038-0050	A50	62.00 (2.441)
	A-4038-0063	A63	50.00 (1.969)
	A-4038-0241	A80	42.50 (1.673)
	A-4038-0242	A100	45.50 (1.791)
	DIN 69893 HSK Form E	M-4038-0243	E40
M-4038-0244		E50	62.00 (2.441)
M-4038-0245		E63	50.00 (1.969)

### Bobbin for shank switch configuration



Part no.

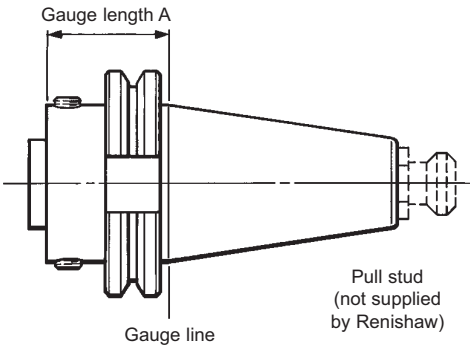
A-4038-0303

## Shanks for OMP40 probes

- Please quote the part number when ordering equipment
- Shanks are supplied in a natural finish
- Dimensions mm (in)
- If you cannot find the shank you require, please contact your local Renishaw office for further details

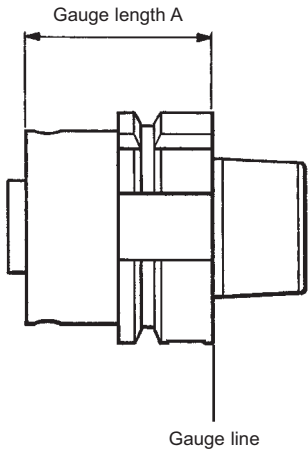
## Taper shanks

Shank type	Part no.	Taper	Gauge length A
<b>DIN 69871 A</b>	M-4071-0048	30	35.25 (1.388)
	M-4071-0069	40	41.60 (1.638)
	M-4071-0070	50	50.00 (1.969)
<b>BT - 1982</b>	M-4071-0049	30	27 (1.063)
	M-4071-0057	40	32 (1.260)
	M-4071-0071	50	50 (1.696)
<b>ANSI CAT B5.50-1985</b> (Imperial pull stud thread)	M-4071-0050	30	35.3 (1.39)
	M-4071-0058	40	35.3 (1.39)
	M-4071-0072	50	35.3 (1.39)
<b>ANSI CAT B5.50-1985</b> (Metric pull stud thread)	M-4071-0073	40	35 (1.378)
	M-4071-0064	50	35 (1.378)

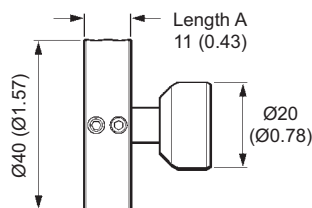


## HSK shanks

Shank type	Part no.	HSK	Gauge length A
<b>DIN 69893 HSK Form A</b>	M-4071-0045	A32	35.00 (1.378)
	M-4071-0046	A40	35.25 (1.388)
	M-4071-0047	A50	42.25 (1.663)
	M-4071-0029	A63	42.00 (1.654)
	M-4071-0075	A80	42.00 (1.654)
	M-4071-0076	A100	45.00 (1.772)
<b>DIN 69893 HSK Form C</b>	M-4071-0085	C40	35.25 (1.388)
<b>DIN 69893 HSK Form E</b>	M-4071-0044	E25	21.25 (1.837)
	M-4071-0055	E32	35.00 (1.378)
	M-4071-0054	E40	35.25 (1.388)
	M-4071-0077	E50	42.00 (1.654)
M-4071-0078	E63	42.00 (1.654)	
<b>DIN 69893 HSK Form F</b>	M-4071-0079	F63	42.00 (1.654)
<b>SANDVIK CAPTO</b>	M-4071-0066	C5	45 (1.772)
	M-4071-0067	C6	45 (0.772)
<b>KENNAMETAL KM</b>	M-4071-0065	KM63	30 (1.181)
	M-4071-0074	KM63Y	30 (1.181)



## Shanks adapter to fit OMP40 onto MP10 – MP10E – MP11 – MP12 – MP18 (non-shank switch version) – MP700 – MP700E type shanks



Part No.	Length A
A-4071-0031	11 mm (0.43)

## Accuracy at the point of contact

As industry has developed its requirement for increasingly diverse and complex manufactured parts, inspection systems have had to work hard to keep up. The use of CMMs with probing systems and in-process inspection on machine tools are two of the solutions offered by Renishaw to help you maximise your productivity and maintain the highest possible standards of quality.

Successful gauging depends very much on the ability of the probe's stylus to access a feature and then maintain accuracy at the point of contact. At Renishaw we have used our expertise in probe and stylus design to develop a comprehensive range of CMM and machine tool styli to offer you the greatest possible precision.

Please refer to the styli and accessories technical specification (document H-1000-3200) for more details.

### Stylus types

Renishaw's stylus range covers several different types for different applications:

#### Ruby ball styli

This is the standard stylus for most inspection applications. A hard, highly spherical tip ensures long life with excellent accuracy.



Ruby balls are available mounted to stems made from a variety of materials including non-magnetic stainless steel, ceramic and a specialised carbon fibre material, Renishaw GF.

#### Disc styli

These 'thin sections' of a large sphere are used to probe undercuts and grooves.



A simple disc requires datuming on only one diameter (usually a ring gauge), but limits effective probing to only the X and Y directions.

#### Tool setting styli

Typically fitted with a square tip, tool setting styli can have threaded or plain shaft attachments.



The stylus tip faces are ground to ensure high squareness and parallelism.

Note that the TS27R tool setting probe for machining centres can also be fitted with a tungsten carbide disc stylus.

## Stylus accessories

### Stylus extensions

Stylus extensions give greater reach and allow access to deep features without risk of damage to the probe.



### Crash protection

Renishaw's stylus crash protection devices are designed to break, and protect the probe from damage.



### Stylus crank

A crank can allow access to features that are otherwise difficult to reach, and are often used in lathe inspection applications.



## Stylus selection tips

Your choice of stylus can have an impact on measurement results. A stylus should be as stiff as possible, so consider the following points:

1. **Use the shortest stylus** that allows access to all the features that you want to probe.
2. **Use the largest ball diameter** that allows the stylus to enter the smallest internal features. This keeps the stem diameter as large as possible.
3. **Minimise the number of joints** in the stylus assembly.

Regular stylus datuming will ensure that you achieve the best measurement accuracy.

## Software

Renishaw has developed probing software for all probing applications on a broad range of machine tool controllers. Refer to the Probe software for machine tools data sheet (document H-2000-2289) for further details.

### Probing packages available

#### EasyProbe

EasyProbe software for machining centres provides simple and fast job setup and measuring routines, for operators with minimal programming skill.

#### Inspection software for machining centres

Basic inspection / job setup software with the ability to set work offsets, update tool offsets and print inspection results (where this control option is available). Suitable for use by an operator or part programmer.

#### Additional software for machining centres

Several packages to enhance and extend the capabilities of the standard inspection software. Includes vector measuring and angle measure, plus a 5 axis option.

#### Inspection plus software for machining centres

A totally integrated package of software that includes vector and angle measure options, print options (where this control option is available) and an extended range of cycles. Includes SPC cycle, 1 or 2 touch probing option, tool offset compensation by percentage of error and output data stored in an accessible variable stack.

#### Rotating tool software for machining centres

Uses the industry standard TS27R probe, which suits the majority of applications.

#### Non-contact tool setting software for machining centres

Preferred for applications using delicate tools, and other applications where the probe must not obstruct the machine's working envelope.

For further software information please refer to Renishaw part number H-2000-2289.

	Fanuc 0 - 18/21M	Fanuc 0T - 21T	Mazatrol (Mazak)	Mitsubishi Meldas	Yasnac	Fadal	Okuma OSP/U	Haas	Siemens 800 series	Siemens 840D/810D	Selca	GE2000	Toshiba Tosnuc	Allen Bradley 8600	Heidenhain	Num	Traub	Hitachi-Seicos	OSAI series 10
<b>Machining centres</b>																			
Inspection	•		•	•	•	•	•	•	•		•	•	•	•	•				•
Inspection Plus	•		•	•	•		•	•		•						•		•	
Inspection Plus for MP700	•		•	•	•			•		•								•	
Tool setting (contact)	•		•	•	•	•		•	•	•	•	•				•			
EasyProbe	•			•	•				•	•									
Tool setting (non-contact)	•		•	•	•		•	•		•					•			•	•
<b>Lathes</b>																			
Inspection		•	•	•	•			•	•	•							•	•	
Tool setting		•						•	•	•							•		
3 axis tool setting		•																	

## Productivity+ GibbsCAM plug-in

Introducing a new simplified approach to producing touch probing routines on machine tools, allowing process control and inspection to be programmed at the same time as toolpath generation.

Machine tool probing for process control and inspection becomes a natural part of the engineering process, using the probe just like any other tool in the magazine.

For more information on this software, please visit [www.renishaw.com](http://www.renishaw.com) or refer to the Productivity+ brochure H-2000-3331 (English) for further information.

The Productivity+ GibbsCAM plug-in will be available summer 2004 for GibbsCAM 2004.



## Custom design service

### Total product service

- Design and manufacturing solutions based on Renishaw's knowledge and experience in product applications worldwide.
- Easy integration of Renishaw's probing products onto your machine.
- Best application of standard and custom products on customers' machines.
- Cost and delivery times minimised as standard parts are used where possible.

### A team approach

The Styli and Custom Products Division is based at New Mills, Wotton-under-Edge, Gloucestershire, UK. It comprises a team that encompasses design, engineering, production and marketing, to ensure a comprehensive and efficient service.

Many years of experience in satisfying specific customer requirements exist within the group, which is backed by Renishaw's worldwide experience in probing related technology and applications.

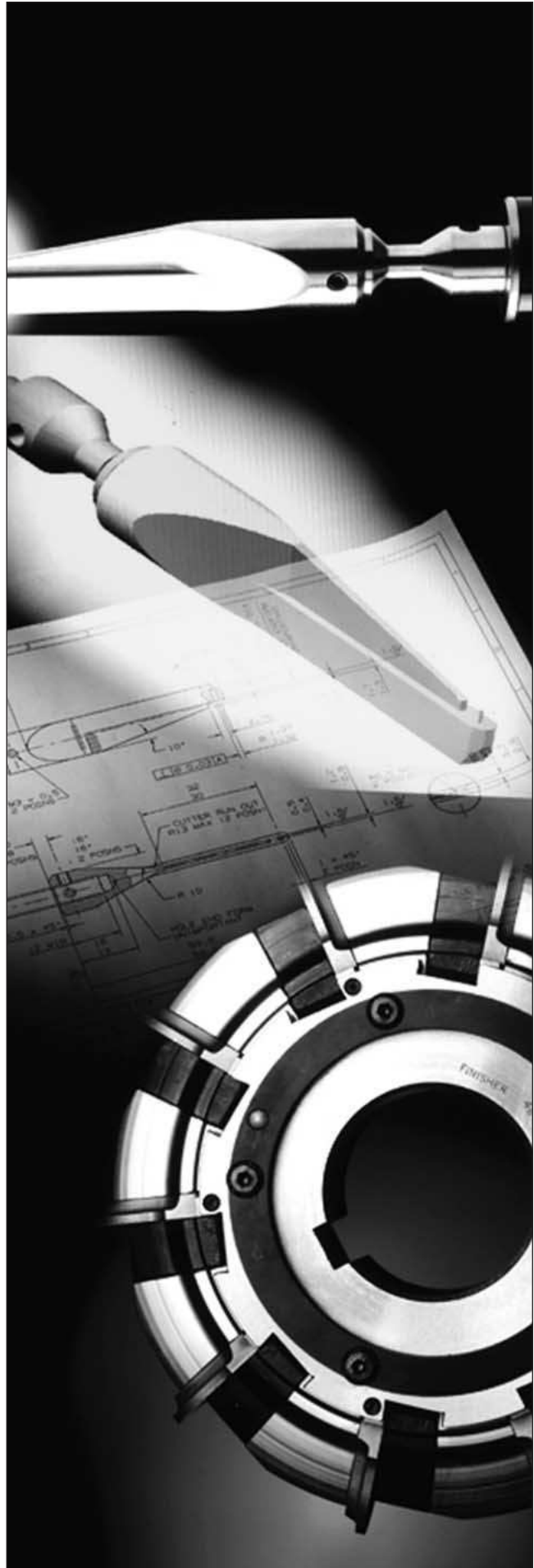
The group works with Renishaw's customer support service, our distributors and ultimately our customer to ensure the most effective solution is found.

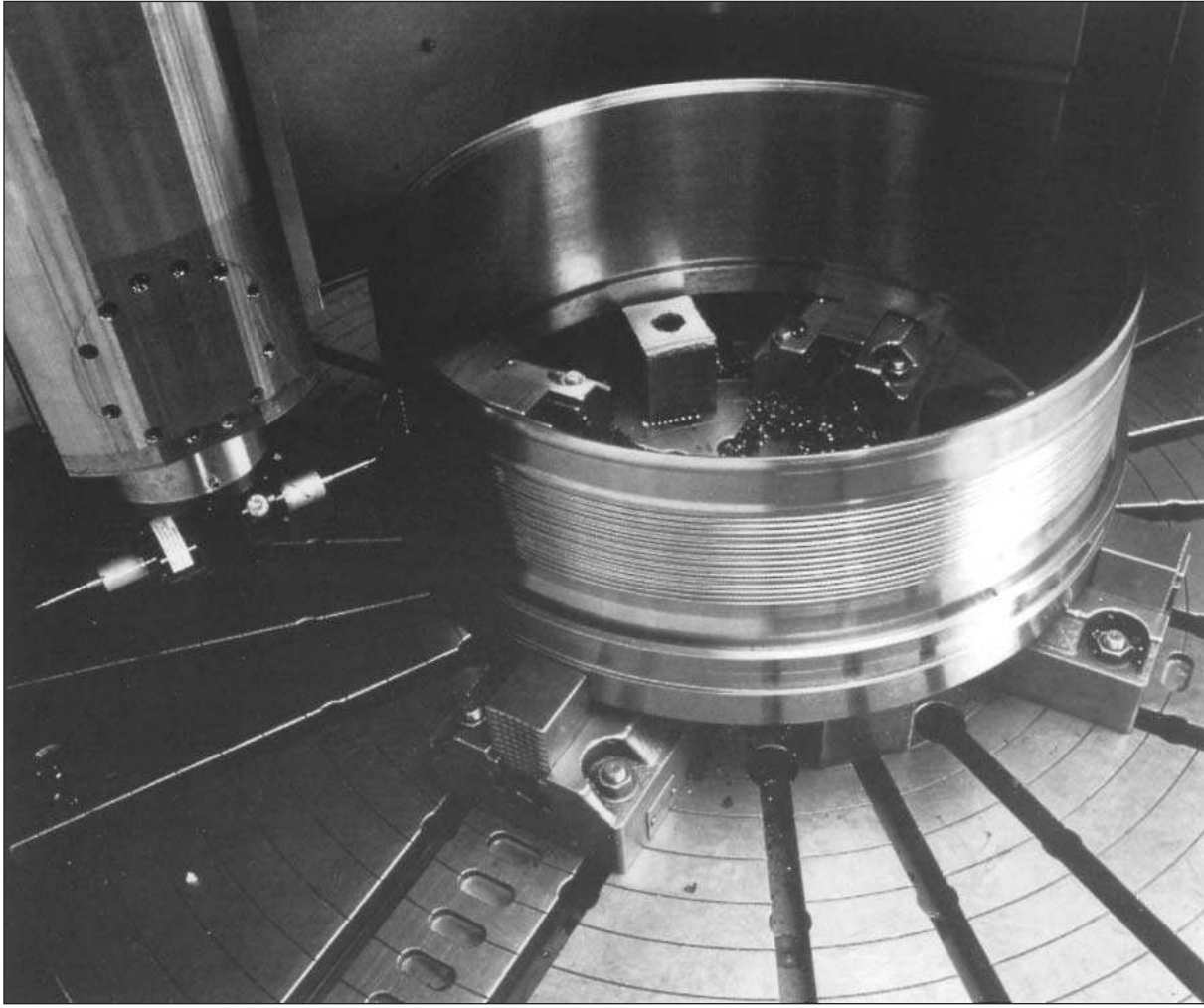
### Access to Renishaw's custom design service

If your specialised needs cannot be met from the standard range of products, we will be pleased to make recommendations to your regular Renishaw supplier.

To help identify your particular needs, your supplier will assist you in completing a questionnaire. He will need full details of the specific application for which the system will be used, together with any environmental constraints. The make and model of the host machine tool must be specified, as should the required total accuracy of the probing system.

The required timescale is also important. The initial quantity and forecast of future requirements will naturally affect the final price quotation.





## Renishaw applies innovation to provide solutions to your problems

Renishaw is an established world leader in metrology, providing high performance, cost-effective solutions for measurement and increased productivity. A worldwide network of subsidiary companies and distributors provides exceptional service and support for its customers.

Renishaw designs, develops and manufactures products which conform to ISO 9001 standards.

Renishaw provides innovative solutions using the following products:

- Probe systems for inspection on CMMs (co-ordinate measuring machines).
- Systems for job set-up, tool setting and inspection on machine tools.
- Scanning and digitising systems.
- Laser and automated ballbar systems for performance measurement and calibration of machines.
- Encoder systems for high accuracy position feedback.
- Spectroscopy systems for non-destructive material analysis in laboratory and process environments.
- Styli for inspection and tool setting probes.
- Customised solutions for your applications.

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