Installation guide
H-5450-8400-04-A

RENISHAW
apply innovation™

TRS2 non-contact broken tool detection system

Renishaw part no: H-5450-8400-04-A

First issued: 08.2007

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Contents

Before you begin

Before you begin

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Warranty

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

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

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

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

Changes to equipment

Renishaw reserves the right to change equipment specifications without notice.

CNC machines

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

Patents

Features of TRS2 non-contact broken tool detection system (and features of similar products) are the subject of one or more of the following patents and/or patent applications:

EP 1144944
EP 1562020
EP 1799398
EP 2114617
CN 100569442
CN 1202403
CN 101573210
CN 1660541
JP 4695808
JP 4764427
JP 5677745
SG 130252
TW I415708
TW NI-178572
US 6635894
US 6878953
US 7053392
US 7732797
US 8537359
WO 2006/027577

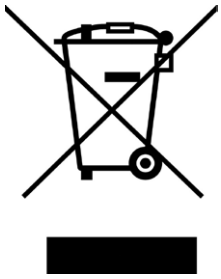
EC declaration of conformity

CE

Renishaw plc declares that the TRS2 complies with the applicable standards and regulations.

Contact Renishaw plc or visit **www.renishaw.com/trs2** for the full EC declaration of conformity.

WEEE directive



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

FCC information to user (USA only)

47 CFR Section 15.19

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

1. This device may not cause harmful interference, and
2. This device must accept any interference received, including interference that may cause undesired operation.

47 CFR Section 15.21

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

47 CFR Section 15.105

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

Safety, warnings and cautions

Information to the user

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

Information to the machine supplier/ installer

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

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

Warnings

Use of controls or adjustments or performance of procedures other than those specified within this publication may result in hazardous radiation exposure.

Switch off the power supply before carrying out maintenance on the TRS2 system.

When using the TRS2, basic safety precautions must always be followed to reduce the risk of fire, electric shock and personal injury, including the following:

- Read all instructions before operating this product.
- The device must only be installed and used by competent, trained personnel.
- Use eye protection to protect against mechanical hazards, coolant and swarf.
- Avoid inhalation of coolant vapour from the machine tool.
- Do not block the air exiting from the transmitter aperture.
- Prevent direct exposure of the eyes to the laser beam.

  Ensure that the beam is not reflected into the eyes via any reflective surface.
- Prevent the beam from straying outside of the immediate work area. A beam terminator is supplied with the TRS2, which may be fixed to the outside of the machine window for this purpose.

Caution – Laser safety

The laser used in the Renishaw TRS2 non-contact broken tool detection system emits visible red light at a wavelength of 670 nm and has a power output of less than 1 mW. The laser is driven by a continuous pulse train running at a frequency of 125 kHz. The pulse duration is 2 µs and each pulse has a maximum energy of 7.2×10^{-9} J.

The laser used is classified as a Class 2 product as defined by BS EN 60825-1:2014 (IEC 60825-1:2014).

The product complies with 21CFR 1040.10 and 1040.11 except for deviations pursuant to Laser notice no. 50 dated June 24, 2007.

The standard BS EN 60825-1:2014 (IEC 60825-1:2014) directs to attach a laser warning label and explanatory label.

A warning label and explanatory label are permanently fixed to one side of the housing, for more information, see TRS2 dimensions and laser warning labels on page 2.3 of Chapter 2, "TRS2 basics". An adhesive warning label is provided for attachment outside the machine.

CAUTION: This equipment is rated to IK06 as defined by BS EN 62262:2002.

Equipment operation

If this equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

TRS2 basics

General

Introduction

This guide describes how to install and maintain the Renishaw TRS2 non-contact broken tool detection system.

The TRS2 is a laser-based non-contact broken tool detection system that is designed specifically for solid centred tools; for example, drills and taps. A tool that is rotating at a speed of 5000 r/min, 1000 r/min or 200 r/min is moved into the laser beam. The output of the TRS2 is activated and the output changes when the tool is detected by the receiver.

Three versions of the TRS2 are available. Two are referred to as TRS2 units and one as a TRS2-S unit. One TRS2 version is fitted with an electrical connector on the underside. Electrical connections to and from the machine's controller are made via this connector. This facilitates the quick and easy removal of the TRS2 from its mounting location and its replacement with a similar TRS2 unit. The other TRS2 version and the TRS2-S unit are not fitted with an electrical connector. Electrical connections to and from the machine's controller are wired directly to the TRS2 or TRS2-S.

Both versions of the TRS2 can be adjusted to detect a broken tool over the range 300.0 mm (11.81 in) to 2.0 m (78.74 in). The TRS2-S unit has its range preset to 350.0 mm (13.78 in). This cannot be adjusted.

For reliable detection of a tool with through-tool coolant, it should be noted that the flow of coolant must be stopped before checking the tool. For all tools, the flow of coolant off the surface of the tool must be stopped before reliable detection can be carried out.

NOTE: That removing the TRS2 side panel or tampering with the side panel retaining screw may invalidate the warranty.

Software routines

Examples of programs for high-speed broken tool detection of solid tools are available for a wide range of machine controller types. A TRS2 software package is available for download from www.renishaw.com/trs2

Probe status LED

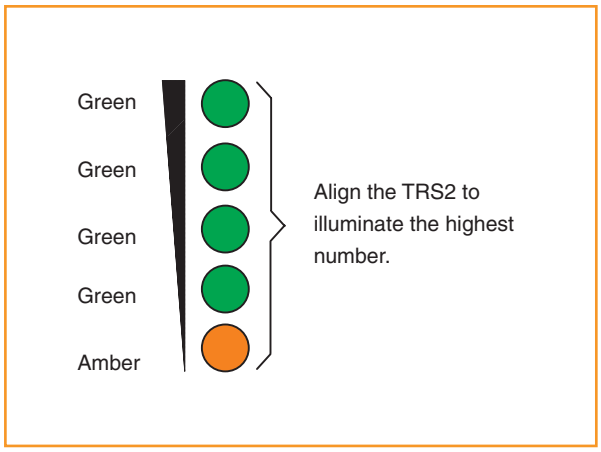
The status LED on the front of the TRS2 unit indicates the status of the probe to the user.

LED colour	Status
Not lit	Power off
Red	Broken tool or no tool
Green	Good tool detected

CAUTION: The tool must be rotating at a speed of 5000 r/min, 1000 r/min or 200 r/min, at the checking point in the laser beam, for it to be detected.

Bar graph display

The bar graph display on the front of the TRS2 unit indicates the level of light falling on the receiver. The minimum requirement for effective tool detection is that the amber LED and at least one green LED must be illuminated.



TRS2 typical performance

Typically, the TRS2 can detect a solid centred tool that has a diameter of 0.2 mm (0.008 in) or greater at a range of 300.0 mm (11.81 in). The level of the signal reflected from a tool that is received by the TRS2 is dependent on the colour, geometry and surface finish of the tool, the machine environment, and the installation.

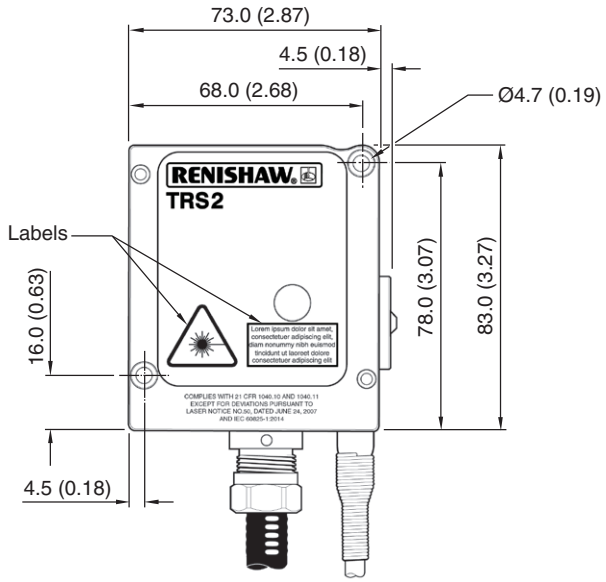
NOTE: For a tool to be detected, sufficient light must be reflected back to the TRS2 system. Before running the broken tool cycle, ensure that every tool to be used can be detected by the TRS2 system as this varies with range, colour and surface finish of the tool, and installation and set-up.

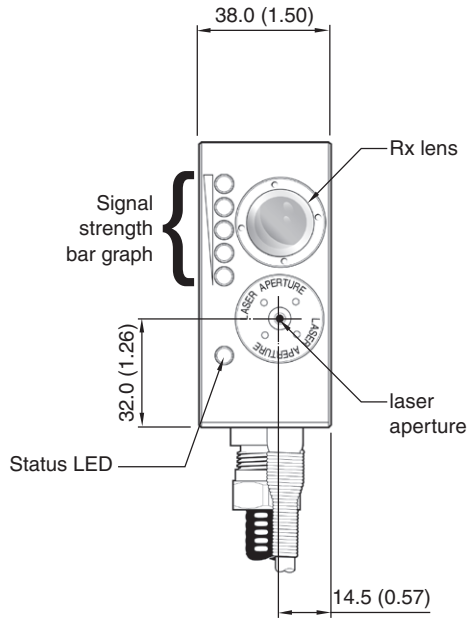
The TRS2 can detect a tool at a distance of between 300.0 mm (11.81 in) and 2.0 m (78.74 in), although it is optimised for use at 1.0 m (39.30 in) and less. Typically, it can detect a tool of Ø2.0 mm (0.08 in) or larger at a range of up to 1.0 m (39.30 in). If the range is greater than 1.0 m (39.30 in) or if the tool is smaller than Ø2.0 mm (0.08 in), there are restrictions on tool detection dependent on the following points:

- Colour of the tool.
- Geometry and surface finish of the tool.
- Range.
- Machine environment.
- Installation.

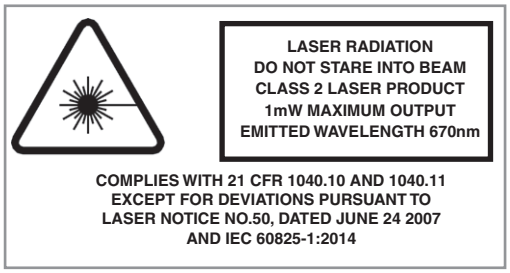
IMPORTANT: Remember that excess coolant must always be cleared from the tool before detection is carried out.

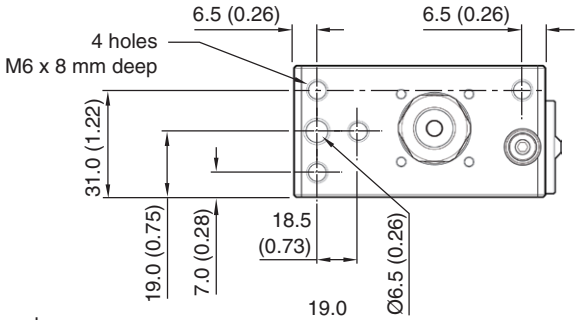
TRS2 dimensions and laser warning labels: TRS2 and TRS2-S

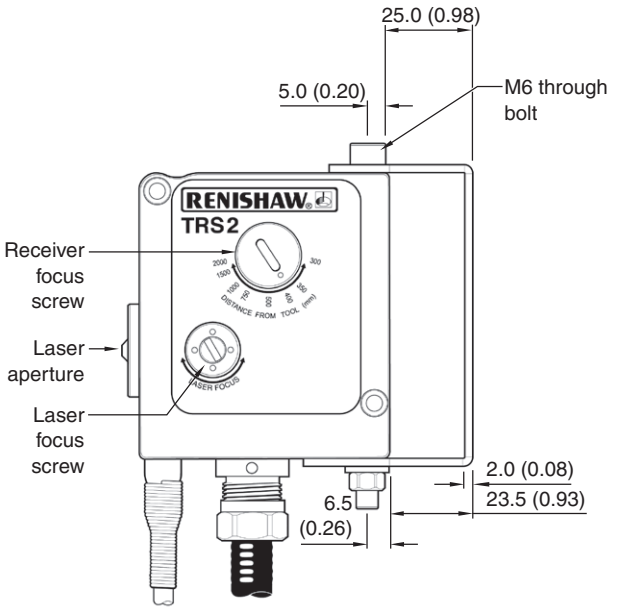


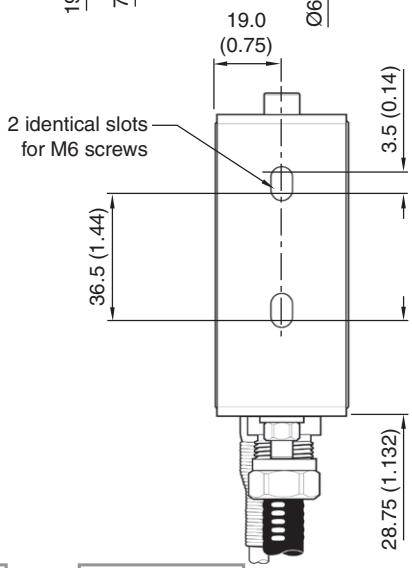


Warning label **Explanatory label**



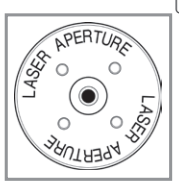






Laser focus screw (not available on TRS2-S)

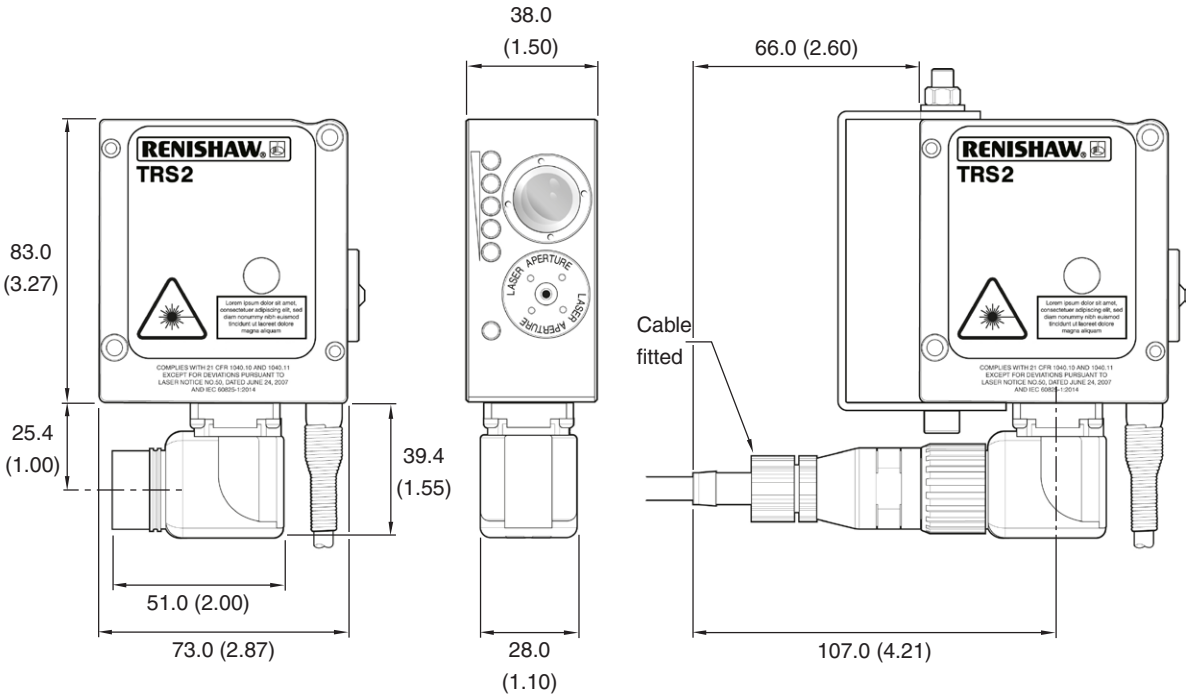
Receiver focus screw (not available on TRS2-S)



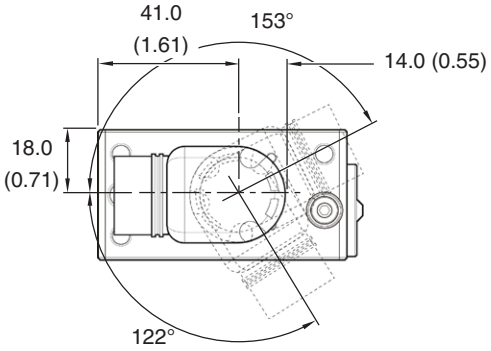
Laser aperture

Dimensions in mm (in)

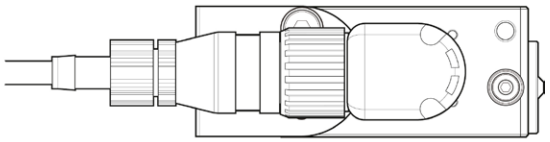
TRS2 dimensions with cable connector



TRS2 without mounting bracket



TRS2 with mounting bracket



Dimensions in mm (in)

TRS2 specification

Principal application		High-speed non-contact tool breakage detection of solid tools on all sizes of vertical and horizontal machining centres, all gantry machining centres and multi-tasking machines.	
Dimensions		Height Width Depth	83.0 mm (3.27 in) 38.0 mm (1.50 in) 73.0 mm (2.87 in)
Weight		750.0 g (1.65 lb), including 10.0 m (32.80 ft) of cable	
Transmission type		Hard-wired transmission	
Compatible interface		N/A (integrated interface)	
Tool breakage detection		Ø0.2 mm (0.008 in) *(see notes 1 and 2)*	
Detection range		TRS2 adjustable between 300.0 mm (11.81 in) and 2.0 m (78.74 in). Factory set to 350.0 mm (13.80 in). TRS2-S fixed at 350.0 mm (13.80 in).	
Supply voltage		11 Vdc to 30 Vdc	
Supply current		65 mA @ 12 Vdc, 42 mA @ 24 Vdc	
Output signal (from interface unit)		Status output. Voltage-free solid-state relay (SSR) output, configurable normally open or normally closed.	
Input/output protection		Supply/output protected by resettable fuses	
Electrical connection arrangement		Cable on the underside of the unit	
Cable (to machine control)	Specification	Ø4.85 mm (0.19 in), 5-core screened cable, each core 18 × 0.1 mm insulated.	
	Length	5.0 m (16.40 ft),10.0 m (32.80 ft)	
	Electrical Connection	Cable on the underside of the unit.	
Pneumatic supply		Ø4.0 mm (0.16 in) air pipe (for more information, see the graph of recommended air pressures on page 3.3 of Chapter 3, “System installation”. The air supply to the TRS2 must conform to BS ISO 8573-1: 2010 Class 1.7.2.	
Laser type		Class 2 laser product	
Laser beam alignment		The unit is supplied with an adjustable mounting bracket.	
Mounting		Mounting bracket provided, with M6 (2 off) clearance slots. Alternative fixing arrangements are available.	
Environment	IP rating	IPX8 BS EN 60529:1992+A2:2013 (IEC 60529:1989+A1:1999+A2:2013) with air on	
	IK rating	IK06 BS EN 62262:2002 [for glass window]	
	Storage temperature	–25 °C to +70 °C (–13 °F to +158 °F)	
	Operating temperature	+5 °C to +55 °C (+41 °F to +131 °F)	

Note 1 Each TRS2 unit is tested with a Ø0.5 mm (0.02 in), blue finish, HSS jobber drill (Farnell part no. 203778) at a range of 350 mm (13.8 in). Test conditions: dry tool, spinning at 5000 r/min, which must be detected by the TRS2 within 1 second.

Note 2 Depending on range, tool surface finish, machine environment and installation.

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System installation

Mounting the TRS2

Introduction

The mounting surface must be sufficiently rigid so the TRS2 laser beam cannot move due to vibration or flexing of the surface. If the laser beam moves, tools, particularly those of small diameter, may not then be detected.

NOTES:

Where practicable, the TRS2 system must be mounted so that the laser beam does not shine out of the machine. Where this is not possible, open paths must be located above or below eye level.

A beam terminator, which is supplied with the TRS2, may be fixed to the outside of the machine window.

The TRS2 must be mounted, either on its side or upright, as close as possible to the tools to be detected, so the beam is at 90 degrees to the end of the tool. For optimum performance it must be installed perpendicular to the tool axis (for instructions describing how to set the range, see “Range setting” on page 3.7). Performance is affected if perpendicularity is not achieved, and this effect increases with separation.

Guidelines

When installing the TRS2, keep the following points in mind:

- The tool must be able to move in the Z axis relative to the TRS2 system, so that tools of different lengths can be checked;
- the closer the TRS2 is to the tool, the greater the reflected light level, so small diameter tools or those with a dark finish are more easily detected;
- consider fitting an air blast system to clear coolant from the tool. It is recommended that an air blast system is used if the tool is to be detected at a speed of 200 r/min or 1000 r/min;
- to maximise service life, mount the TRS2 unit so that it will not be directly subjected to bombardment by swarf and that swarf contamination will be at a minimum;
- install the TRS2 so that the laser beam cannot strike a reflective surface inside the machine which will reflect the beam into the receiver lens. If any of the bar graph LEDs are lit when no tool is in the beam, this indicates a potential problem;

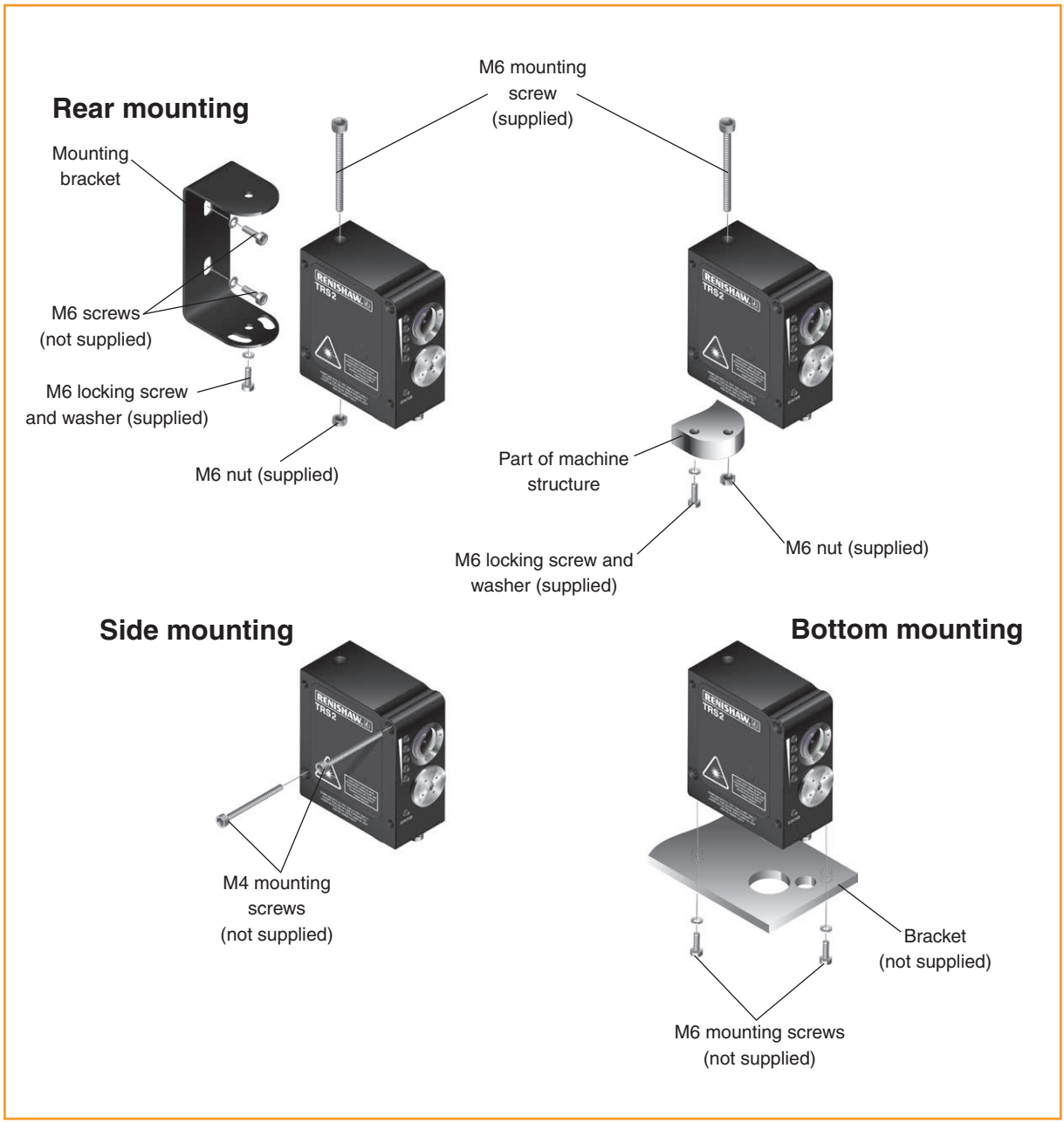
  to prevent this, either move the TRS2 so this does not happen or place a nonreflective object, such as black nonreflective tape, in the beam path. A beam terminator is supplied with the TRS2 for this purpose.

Mounting the TRS2 unit

1. Mount the TRS2 unit on a rigid part of the machine (see the figure below for possible mounting configurations).
2. Tighten the mounting screws as follows:

   For M6 mounting screws, tighten to 14.0 Nm (10.30 lbf. ft) using a 10 mm AF spanner and a 5 mm AF hex driver.

   For M4 mounting screws, tighten to 4.0 Nm (2.90 lbf. ft) using a 3 mm AF hex driver.
3. When the TRS2 unit is rear mounted, fit the M6 locking screw and washer (as shown in the figure below) and tighten to 14.0 Nm (10.30 lbf. ft) using a 5 mm AF hex driver.
4. Fit the cable conduit and air pipe spring conduit to the unit (for instructions describing how to fit the cable conduit and air pipe spring conduit to the unit, see “Connecting and purging the air supply” on page 3.4).
5. Connect the cable to the machine controller (for instructions on connecting cables, see “Electrical connections” on page 3.6).



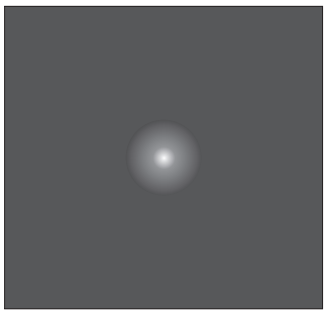
Air supply

The TRS2 uses a clean air supply to protect the laser transmitter from the machine's environment. It is recommended that the air supply is switched on at all times to prevent contamination of the laser aperture. If it is necessary to switch off the air supply, ensure that the coolant supply is switched off first.

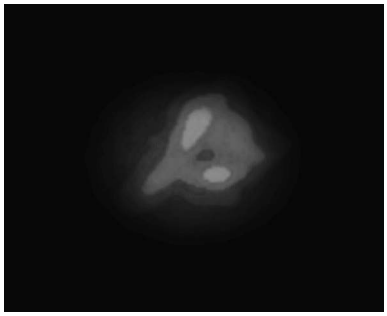
The air supply to the TRS2 system must conform to BS ISO 8573-1: 2010 air quality of class 1.7.2 and be moisture-free. If the air quality cannot be guaranteed, an optional air filtration system is available from Renishaw (see Chapter 6, "Parts list").

Also refer to the graph on this page which helps you select the recommended air pressure for the length of installed air pipe.

Failure of the air supply may cause the TRS2 system to become contaminated. Contamination is indicated if the laser spot is dispersed instead of being sharp when shone on to a piece of white paper (refer to the two diagrams below). If contamination is suspected, carry out the cleaning procedure (for more information, see Chapter 4, "Cleaning the system" on page 4.2).



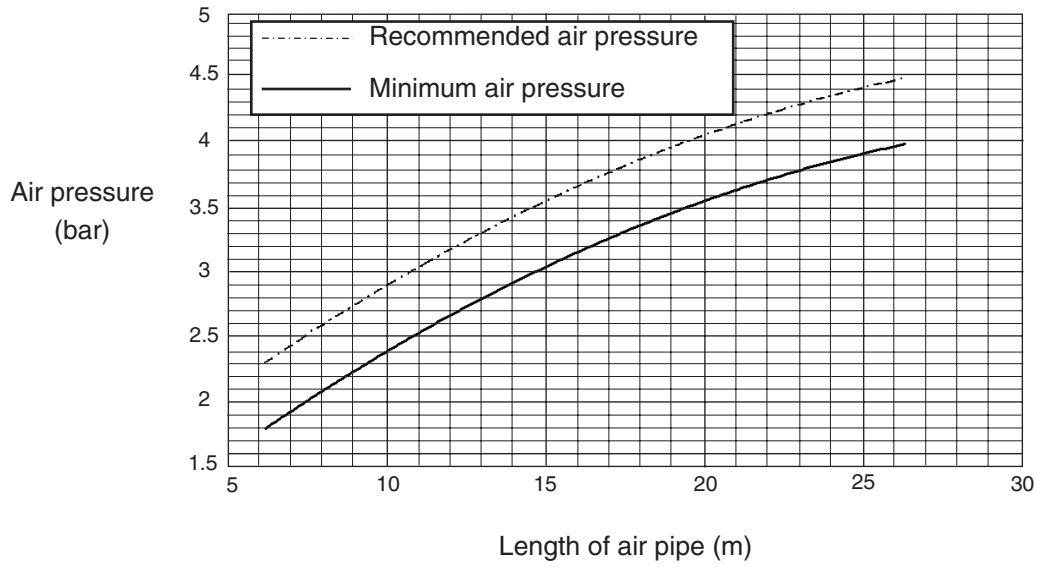
Good spot



Dispersed spot

Air pressure

The graph shown below shows the recommended air pressure against the length of air pipe.



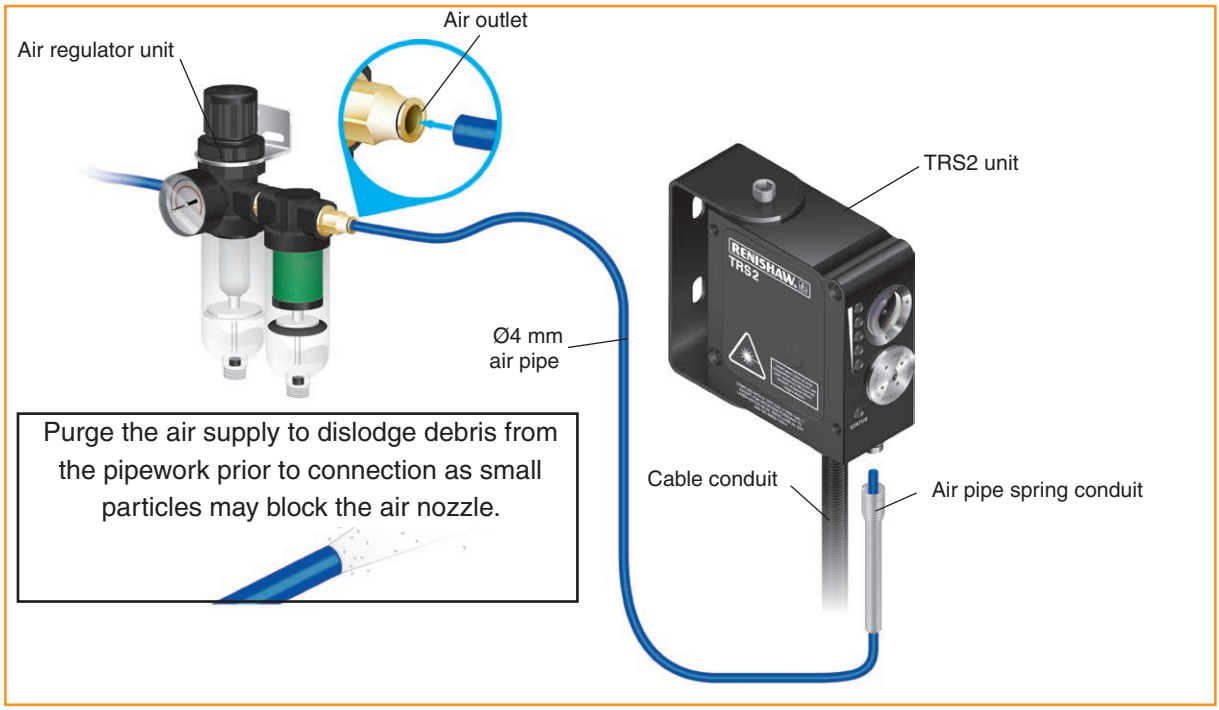
Connecting and purging the air supply

CAUTIONS:

Do not connect the TRS2 system to an oiled air supply. Purge all piping prior to connection.

Safety glasses must be worn.

1. Locate a source of clean air that conforms to BS ISO 8573-1: 2010: Air quality of class 5.9.4.
2. Connect a suitable pipe to the air supply.
3. Before connecting the pipe to the inlet of the air regulator unit, briefly switch on the air supply to clear out all debris from the pipe.
4. Connect one end of the Ø4.0 mm air pipe into the air regulator unit.
5. Cut the Ø4.0 mm pipe to length, ensuring that the length of the pipe is as short as possible to minimise the drop in air pressure. Make a note of the length of the installed pipe.
6. Temporarily tape over the free end of the pipe to ensure that no coolant or debris is able to enter it.
7. Push the free end of the air supply pipe through the air pipe spring conduit.
8. Remove the tape from the end of the air pipe. Before connecting the pipe to the inlet of the TRS2 unit, briefly switch on the air supply to clear out any debris from the pipe.
9. Connect the free end of the pipe to the TRS2 unit.
10. Push the air pipe spring conduit over the air fitting on the TRS2 unit.
11. Switch on the air supply and set the pressure (for instructions describing how to set the correct air pressure, see “Air pressure” on page 3.3).

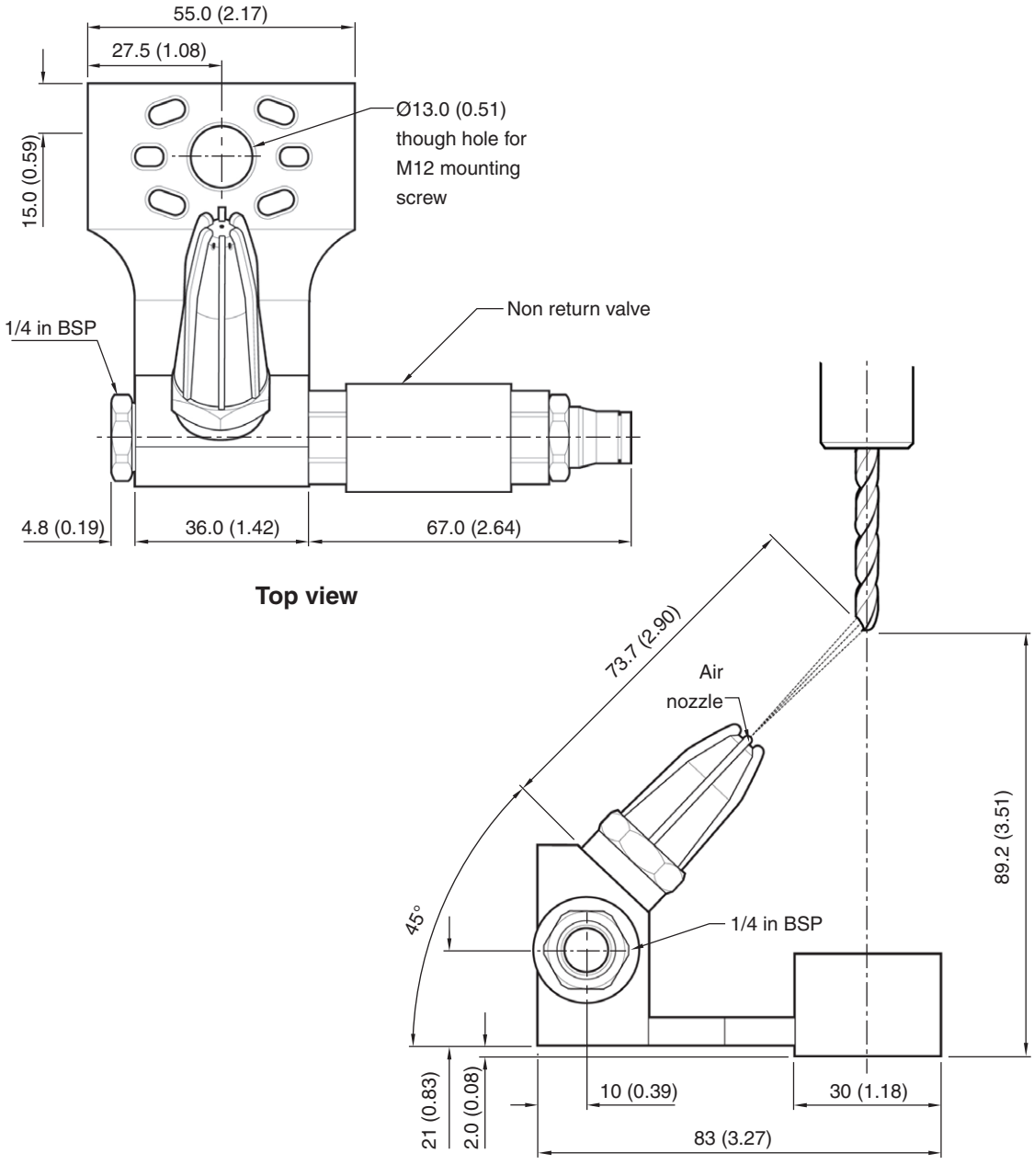


CAUTION: The air supply must be permanently switched on otherwise coolant may enter the TRS2.

Air blast kit

The air blast kit is an optional device that can be used just prior to the broken tool detection cycle to clean coolant and swarf from a tool. When checking a tool that is rotating at either 200 r/min or 1000 r/min, it is recommended that the air blast unit is used for optimum performance.

- Mount the air blast unit on a rigid surface;
- use an air feed controlled with a solenoid valve and M-code;
- **DO NOT** take the air feed controlled from the TRS2 air filter kit, use a separate supply;
- set the air pressure to 4 bar;
- position the tool as shown in the figure below.
- switch on the air supply for 1 second while the tool is spinning.



Dimensions in mm (in)

NOTE: That the non-return valve can be fitted on either side of the air nozzle assembly.

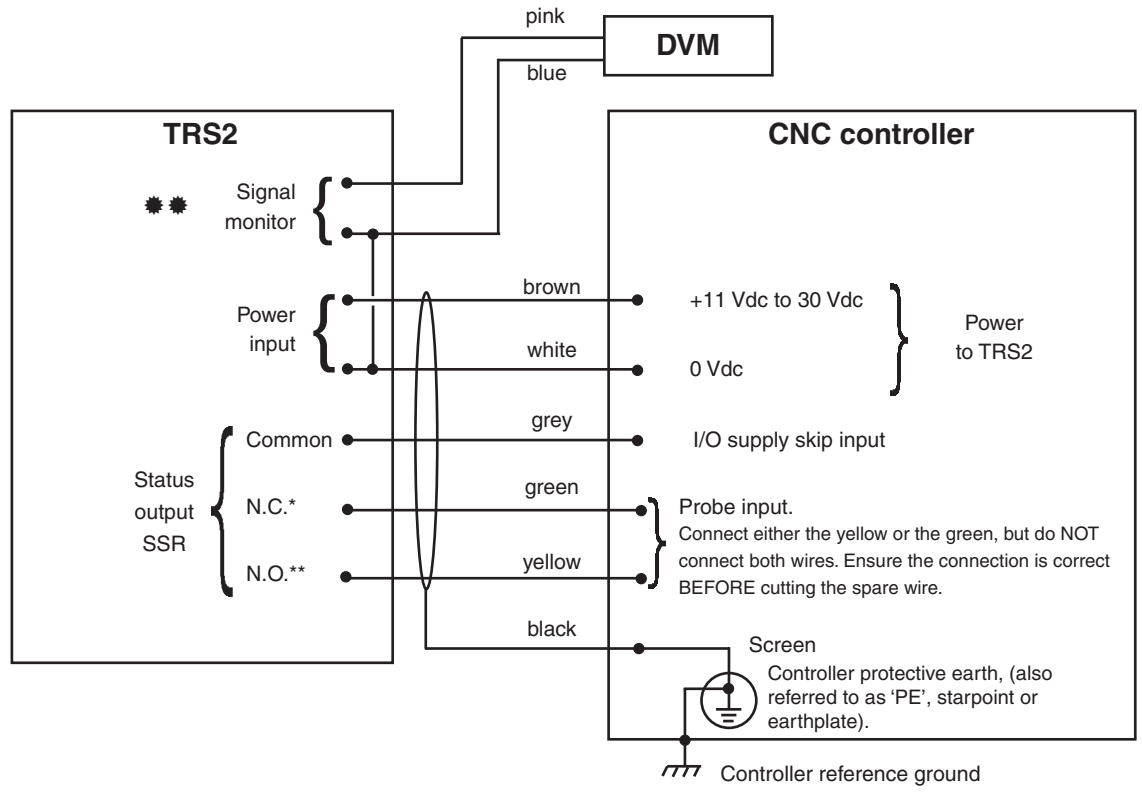
Electrical connections

Power supply

The TRS2 can draw its power from the CNC machine's 12 V to 24 V nominal dc supply. Its input voltage range is 11 Vdc to 30 Vdc maximum and it presents a typical load of up to 65 mA at 12 Vdc and up to 43 mA at 24 Vdc.

The SSR output is protected by a 50 mA resettable fuse. To reset the fuse, remove the power and rectify the fault.

CAUTION: When the SSR output is connected as normally-open (N.O.), the TRS2 will remain in a non-triggered state if the power supply is interrupted or if the TRS2 is damaged.



Status	SSR contact	
	*Normally-closed (N.C.)	**Normally-open (N.O.)
Tool detected	Open	Closed
Tool not detected	Closed	Open

✸✸ denotes that the signal monitor output is available only with the version of the TRS2 that is fitted with a connector. This is recommended for use when the bar graph cannot be seen.

IMPORTANT NOTE: The above is an example connection diagram. For controller-specific connection figures, see **www.renishaw.com/trs2**.

Setting up the TRS2 system

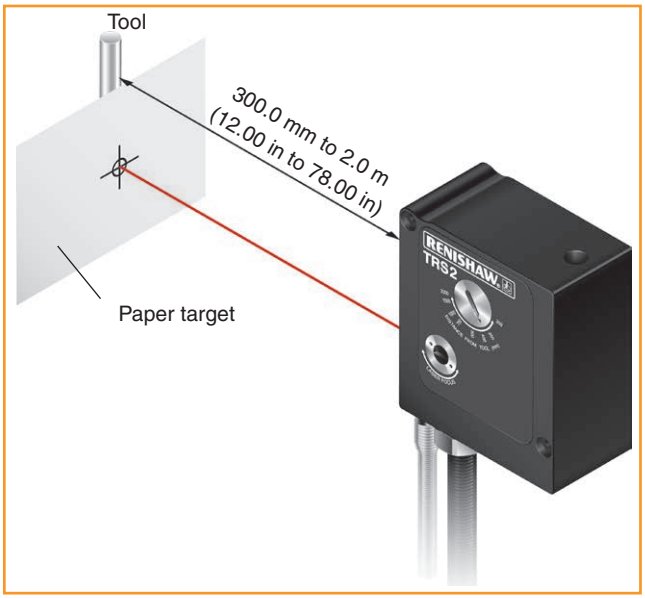
Preparation

To set the operating range of the TRS2 you will need to change the settings of the receiver focus screw and laser focus screw. If these screws cannot be accessed when the TRS2 unit is mounted in the machine, range setting can be performed off the machine.

To determine the checking position of the TRS2 system you will need to use a reference tool. The length of this tool must be known. The diameter must be the same as the smallest diameter tool that will be checked, as this will provide the weakest reflected light signal.

Range setting

The procedure described here is not applicable to the TRS2-S unit. The operating range of the TRS2-S is preset to 350.0 mm (13.78 in) and cannot be adjusted.

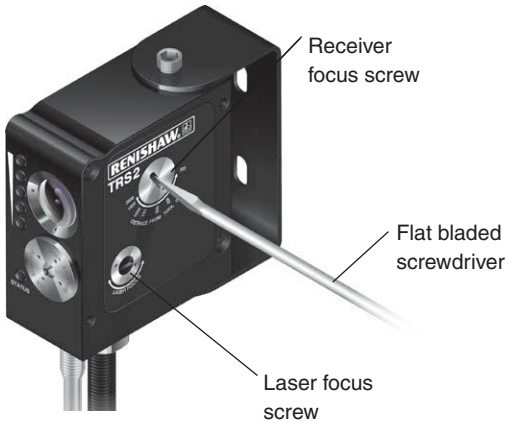


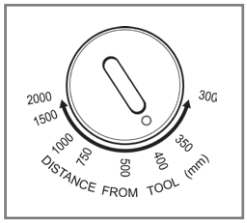
1. Position the reference tool at the point at which tool checking will be performed.
2. Remove one of the targets from the back of this guide. Using either blu tack or adhesive tape, attach it to the tool as shown in the figure above
3. Measure the distance between the tool and the front face of the TRS2 (this must be between 300.0 mm [11.81 in] and 2.0 m [78.74 in]).

continued on next page

4. Using either a flat-bladed screwdriver or coin, adjust the receiver focus screw until the pointer is opposite the required distance measured during step 3 (see the figure below).

7. Hold the laser focus screw in position with the flat-bladed screwdriver then, using the pin spanner, tighten the locking ring to 2 Nm (1.48 lbf.ft), taking care that the laser focus screw does not move.





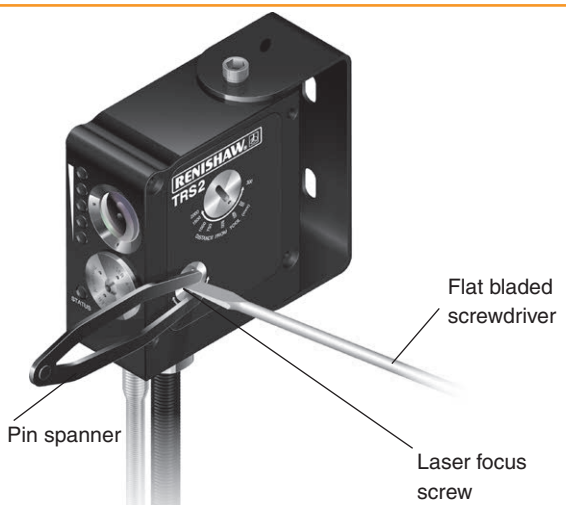
Receiver focus screw
(not available on TRS2-S)

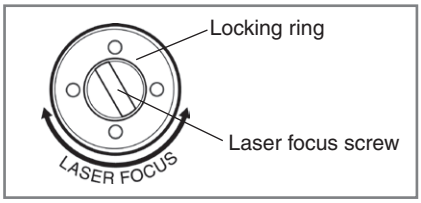
5. Using a pin spanner (see the figure below), loosen the locking ring of the laser focus screw by 1 to 2 turns (turning counter-clockwise) until it is fully slackened.

NOTE: The locking ring cannot fall out.

6. Using a flat-bladed screwdriver, adjust the laser focus screw until the size of the laser spot shining on the paper target is minimised. Take care when adjusting the focus screw that the locking ring does not accidentally become tightened again due to friction between it and the focus screw.

8. Finally, remove the paper target from the tool.





Laser focus screw
(not available on TRS2-S)

Spindle speed selection

For a tool to be detected by the TRS2 system, it must be rotating at a fixed speed of 5000 r/min, 1000 r/min or 200 r/min. The required spindle speed must be selected in the macro software.

- 5000 r/min. This is the default speed and gives the shortest detection time. It is recommended that this speed is used whenever possible. However, when selecting this speed you must ensure that it does not exceed the maximum speed indicated by the manufacturer.
- 1000 r/min. Select this speed when 5000 r/min is not suitable. Before detecting a tool at this speed, the tool must be cleaned, either by using a compressed air blast or by spinning the tool at a greater speed. Optionally, you can use an air blast kit that is available from Renishaw plc (for more information, see the "Air blast kit" on page 3.5 and Chapter 6 "Parts list").
- 200 r/min. This speed is reserved for use with gun drills. The detection time is likely to be significantly longer than at the two other speeds. Before detecting a tool at this speed, it is recommended that the tool is cleaned using a compressed air blast.

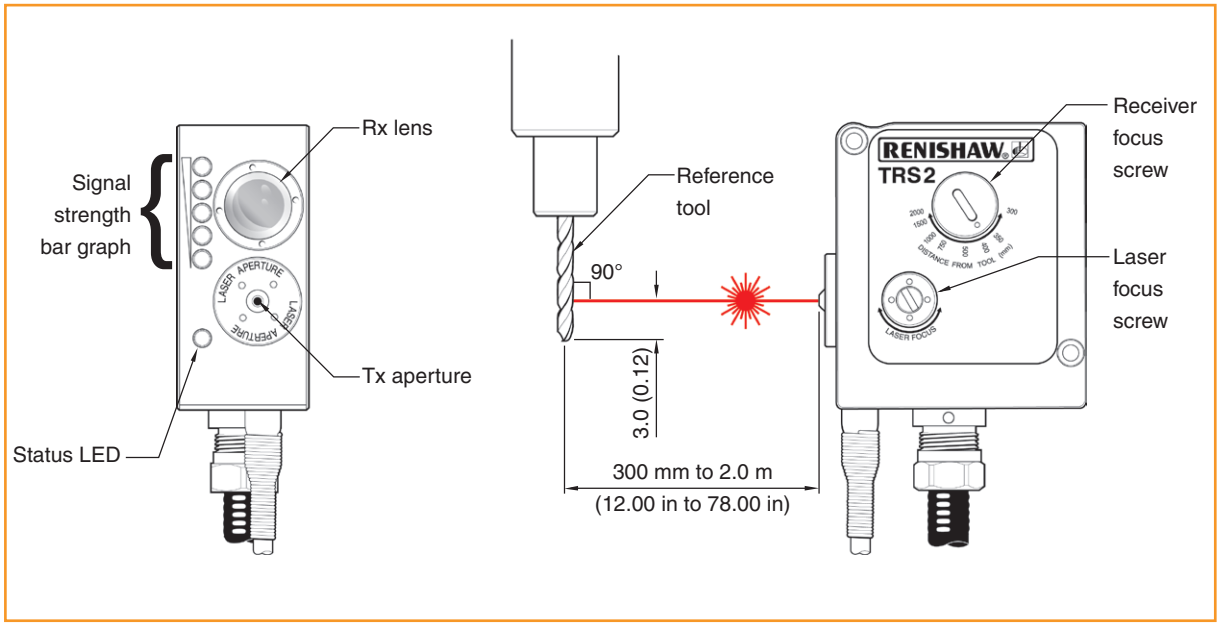
Determining the checking position

1. If using the mounting bracket (supplied), slightly loosen the M6 mounting screws, using a 10 mm AF spanner and a 5 mm AF hex driver.
2. Loosen the M6 locking screw on the underside of the unit.
3. Rotate the reference tool at the chosen spindle speed (5000 r/min, 1000 r/min or 200 r/min).
4. Position the end of the tool approximately 3.0 mm (0.12 in) into the laser beam (see the figure below). Move the position of the laser beam by sweeping it across the tool until the greatest number of LEDs in the bar graph is lit (for more information, see "Bar graph display" on page 2.2 of Chapter 2, "TRS2 basics").

   If the bar graph display is obscured, the signal monitor function may be used (for instructions describing how to use the signal monitor function, see "Using the signal monitor function" on page 3.10).

   Alternatively, if the diameter of the reference tool is smaller than the laser beam, place a piece of white paper behind the tool. Move the laser beam until the shadow of the tool falls in the middle of the red laser beam spot on the paper.

   At 2.0 m (78.74 in) separation, it may be possible to illuminate only one green LED on the bar graph display with the smallest tool. The received signal will increase as the separation distance is reduced.



5. Tighten the mounting screws as follows:

   For M6 mounting screws, tighten to 14.0 Nm (10.3 lbf. ft) using a 10 mm AF spanner and a 5 mm AF hex driver, while checking that the TRS2 unit does not move.

   For M4 mounting screws, tighten to 4.0 Nm (2.9 lbf. ft) using a 3 mm AF hex driver, while checking that the TRS2 unit does not move.

6. When the TRS2 unit is rear mounted, fit the M6 locking screw and washer to the underside of the unit and tighten to 14.0 Nm (10.30 lbf. ft) using a 5 mm AF hex driver.

7. Make a note of the X and Y co-ordinates of the checking position. An installation on which the TRS2 system does not move with the X or Y axes requires only the Z co-ordinate to be input.

8. Move the tool position in Z only until the laser beam is only just shining on the tip of the tool. Make a note of the Z co-ordinate.

9. Add the length of the reference tool to the Z co-ordinate value.

10. Input this checking position into the memory locations that are accessed by the high-speed tool detection program (refer to the programming guide appropriate to your machine controller by visiting **www.renishaw.com/trs2**).

    The default checking position is 3.0 mm (0.12 in) from the tip of the tool, but this distance can be modified by the user (refer to the programming guide).

11. It is the user's responsibility to ensure that every tool can be detected at the checking position.

Using the signal monitor function

The signal monitor function is available only on the version of TRS2 that is fitted with a connector.

If the bar graph on the front of the TRS2 is obscured, for example, blocked by a shutter, the signal monitor function can then be used to monitor the reflected light signal level. Do this as follows:

1. Connect the pink (+) and blue (–) wires to a digital voltmeter (DVM).

2. Move the position of the TRS2 unit side to side relative to the tool until the highest voltage reading is obtained.

3. After you have finished, disconnect the DVM.

   Connect the blue wire to the 0 V supply.

   Cut off the exposed core of the pink wire and insulate the end of the wire with tape to prevent shorting.

Cleanliness

During cutting cycles it is recommended that low pressure coolant washes the TRS2 unit on a regular basis. This will help prevent the build-up of swarf and dried coolant on the receiver lens. To do this, direct a coolant nozzle at the front of the TRS2 unit.

Maintenance

Maintenance – TRS2 system

Introduction

The TRS2 system requires minimal maintenance, having been designed to operate as a permanent fixture on a CNC machining centre in an environment of hot metal chips and coolant.

Only the maintenance routines described in this guide should be undertaken. Further dismantling and repair of Renishaw equipment is a highly specialised operation and must be carried out only at authorised Renishaw service centres.

Equipment requiring repair, overhaul or attention under warranty should be returned to your supplier.

Guidelines

- The TRS2 is a precision tool and must be handled with care.
- A low pressure coolant wash should be used during cutting cycles to keep the TRS2 clear of swarf.
- Ensure that the system is firmly secured to its rigid mounting.
- Do not allow excessive waste material to build up around the system.
- Keep electrical contacts clean.
- A continuous stream of clean air protects the TRS2 system. Approximately every 3 months, inspect the optics for contamination. The service interval may be extended or reduced dependent upon experience (for more information, see “Air supply” on page 3.3 of Chapter 3, “System installation”).

About cleaning

Cleaning may be required if the air to the TRS2 becomes contaminated or if the system is left with the air off when coolant is present. Excessive contamination of the transmitter’s air cap will block the laser beam and prevent the TRS2 from functioning. In this condition, the status LED will not change state when a good tool is checked.

If contamination is suspected, identify the cause and rectify the problem before cleaning the system. If necessary, change the air pipe (for more information, see “Air supply” on page 3.3 of Chapter 3, “System installation”).

If either the transmitter’s air cap or receiver lens is contaminated, clean it as described here.

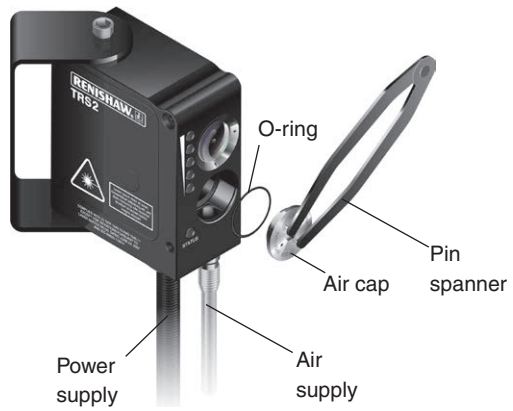
Equipment required

- Pin spanner (P-TL09-0005).
- Solvent cleaner plus, RS Components Ltd part no. 132-481 (recommended) or isopropyl alcohol.
- Dust remover clean air spray (RS Components Ltd part no. 846-698).
- 2 × wrapped polyester swabs (RS Components Ltd part no. 408-1794).

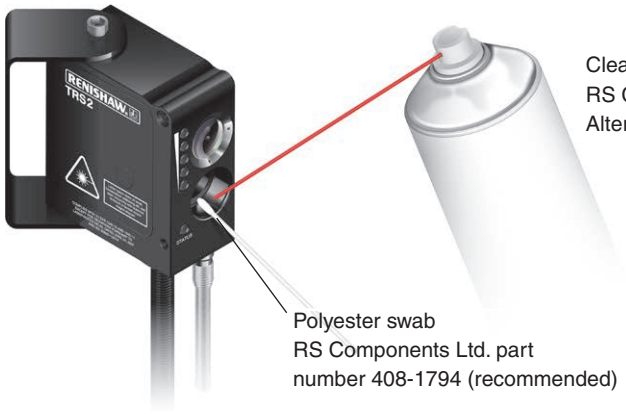
Cleaning the system

CAUTION: Before removing the air cap, switch off electrical power to avoid exposure to the laser beam.

1. Make a note of the air supply pressure, then switch off the air supply and power supply.
2. Remove the air cap and O-ring from the transmitter using the pin spanner provided. Note that a replacement air cap is available (for more information, see Chapter 6, “Parts list”).



3. Switch on the air supply and increase the pressure to purge out coolant that may be present in the pipe work. If coolant is found in the lines, they will need to be cleaned or replaced.
4. When no further coolant is emitted, switch off the air supply.



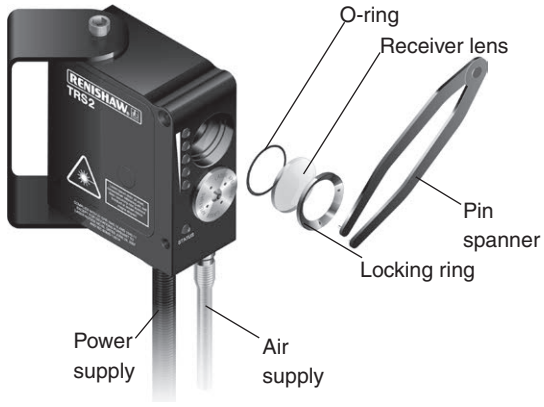
5. Wipe out any oil that may be present.
6. Spray the solvent onto the lens surface and clean off using a swab.
7. Clean the air cap to remove all traces of oil and debris.
8. Refit the O-ring and air cap, ensuring that the O-ring is seated correctly. Tighten the air cap to 2.0 Nm (1.48 lbf.ft).
9. Next, clean the receiver lens as described in steps 10 to 13.
10. Spray the solvent cleaner onto the lens surface and clean off using a swab.
11. Switch on the air supply and set the pressure to the value noted in step 1.
12. Switch on the power supply.
13. Now check that the laser beam displays a good spot (for more information, see "Air supply" on page 3.3 of Chapter 3, "System installation").

Replacing the receiver lens

Under severe conditions the receiver lens may become damaged or contaminated and therefore need to be replaced (for more information, see Chapter 6, "Parts list").

1. Make a note of the air supply pressure, then switch off the air supply and power supply.
2. Remove the receiver lens locking ring using the pin spanner provided.

CAUTION: Take great care to ensure that coolant and swarf do not enter the housing.



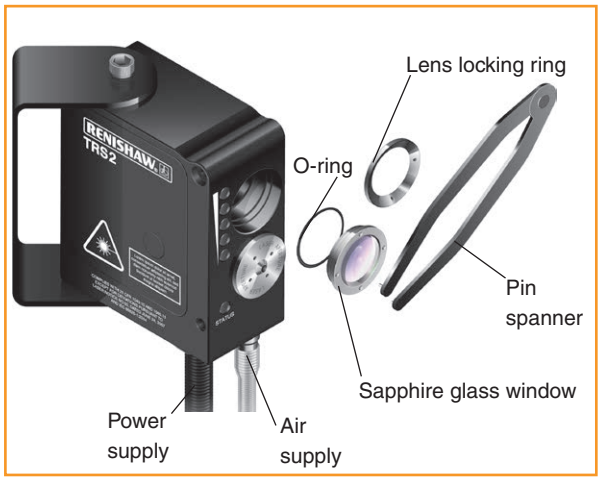
1. Remove and discard the lens and O-ring.
2. Fit the replacement O-ring and lens, making sure the O-ring is seated correctly.
3. Refit the lens locking ring and tighten to 2.0 Nm (1.48 lbf.ft).
4. Switch on the air supply and set the pressure to the value noted in step 1.
5. Switch on the power supply.

Fitting a sapphire glass window

If the TRS2 receiver lens is likely to become scratched due to bombardment by swarf, it can be protected by a hard sapphire glass window (for more information, see Chapter 6, “Parts list”).

After fitting the sapphire glass window there may be a reduction in the signal level, as registered by the bar graph LEDs. Fewer green LEDs may be lit. This is perfectly normal. However, it may affect the detection of some small, dark tools.

1. Make a note of the air supply pressure, then switch off the air supply and power supply.



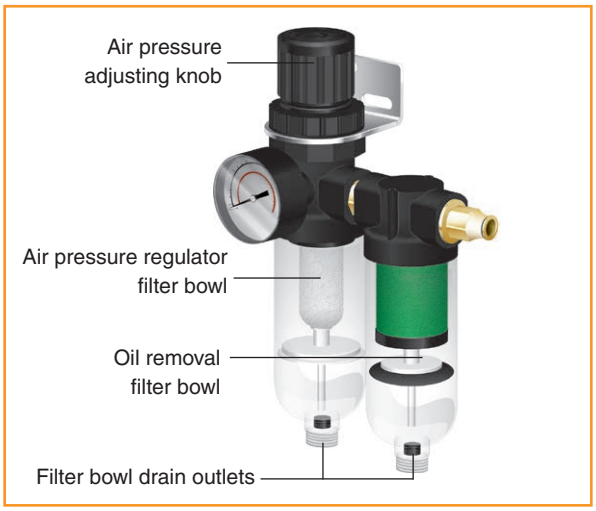
2. Remove the receiver lens locking ring, using the pin spanner, and discard. Do not remove the receiver lens.
3. Fit the O-ring supplied with the sapphire glass window then fit the sapphire glass window in place of the lens locking ring. Using the pin spanner, tighten it to 2.0 Nm (1.48 lbf.ft).
4. Turn on the air supply and set the pressure to the value noted in step 1.
5. Switch on the power supply.

Maintenance – air regulator unit

The procedures described in this section apply only to the air regulator system (A-2253-5120) that is available from Renishaw plc.

Checking the liquid level

Regularly check the level of the accumulated liquid in each of the filter bowls. It is important that the level is kept below the filter element.



Draining the liquid

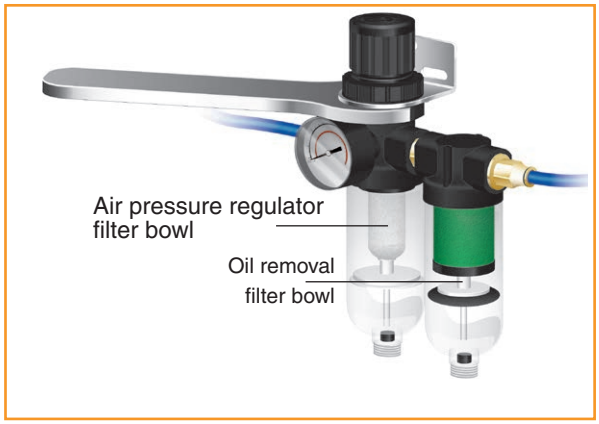
Drain the liquid that has accumulated in the filter bowls as follows:

1. Make a note of the air supply pressure, then switch off the air supply. A quantity of liquid will drain from the bowls.
2. Switch on the air supply and set the pressure to the value noted in step 1.
3. Repeat steps 1 and 2 until the bowls are empty.

Removing and refitting filter elements

Regularly inspect the filter element in each filter bowl. They should be replaced when dirty or wet and at least once each year. For each filter bowl, do this as follows:

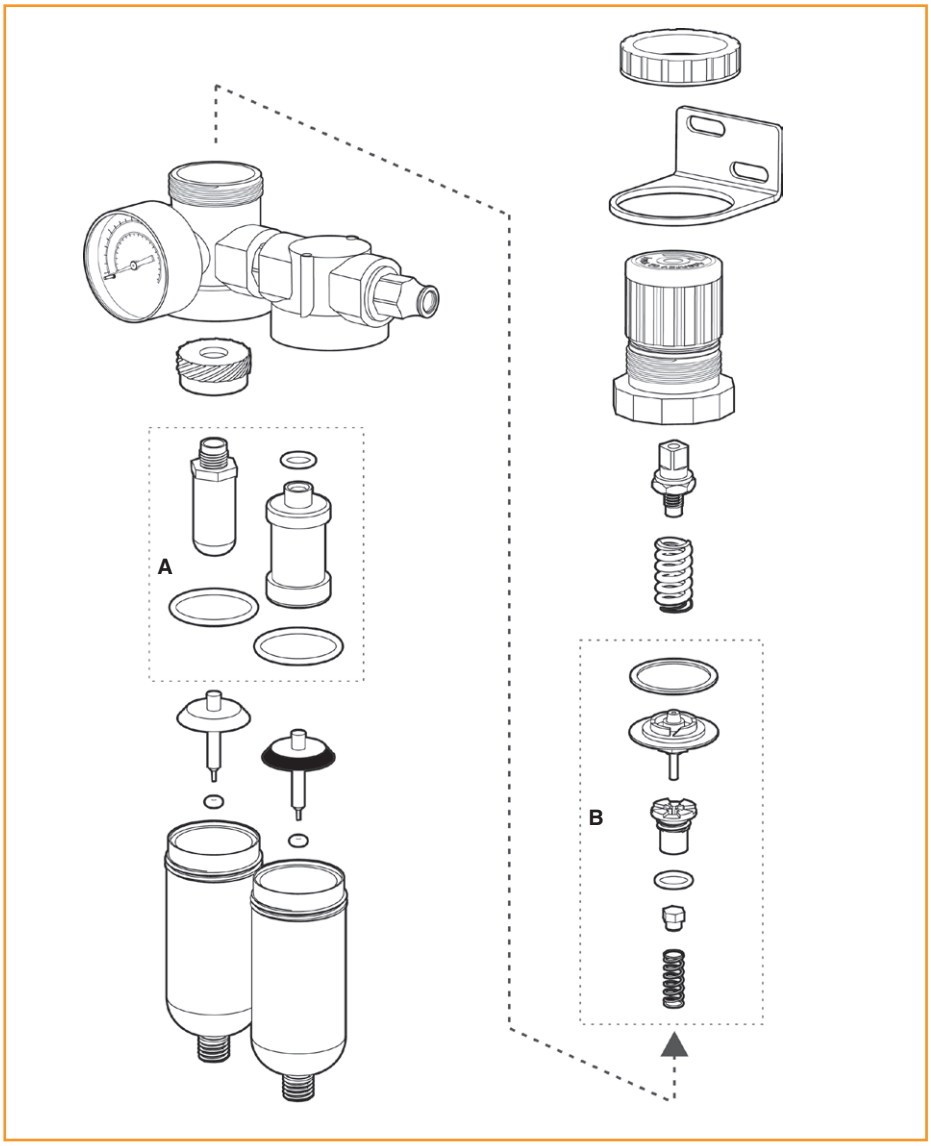
1. Make a note of the air supply pressure, then switch off the air supply.
2. Unscrew the filter bowl by hand (for more information on how to do this see the figure on page 4.6).
3. Remove the O-ring from the recess in the filter bowl. Discard the O-ring.
4. Unscrew and remove the filter element.
5. Fit the replacement filter and, where applicable, the O-ring (these are shown in dotted box A in the figure on page 4.6).
6. Fit a new O-ring into the recess in the filter bowl.
7. Refit the filter bowl and screw hand tight.
8. Switch on the air supply and set the pressure to the value noted in step 1.



Replacing other service kit components

1. Make a note of the air supply pressure, then switch off the air supply.
2. Using a 38 mm AF spanner, remove the regulator head.
3. Remove the components (shown in dotted box B in the figure below) from the body of the regulator.
4. Fit the new components to the regulator body.
5. Refit the regulator head and tighten to 7.7 Nm (5.7 lbf.ft).
6. Switch on the air supply and set the pressure to the value noted in step 1.

NOTE: Items shown within dotted boxes A and B are included in the air filter service kit obtainable from Renishaw (for more information, see Chapter 6, “Parts list”).



Fault-finding

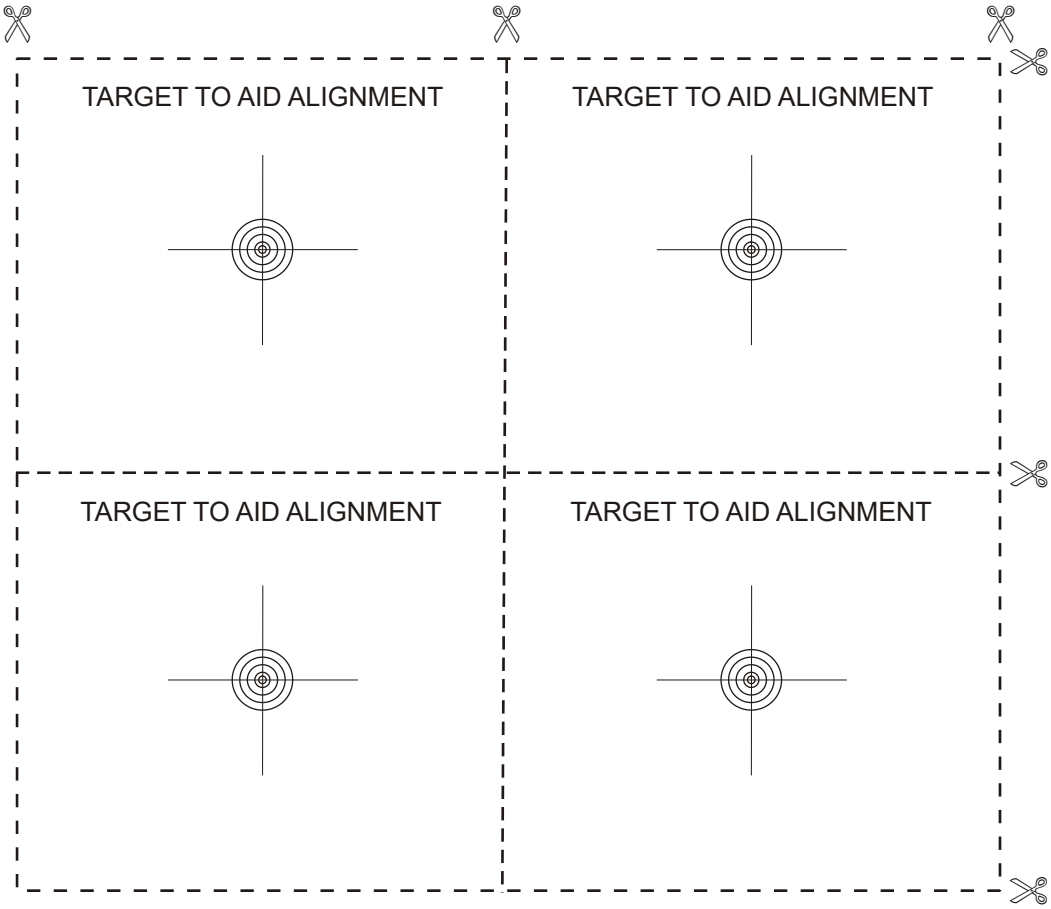
Symptom	Action
The status LED is not lit.	Check the power connection. Check for damage to the cable.
The status LED changes, but there is no skip at the controller.	Ensure that the correct relay contact is being used (normally open or normally closed).
	Check the connection at the controller.
	Check that the correct skip is active.
There is no laser beam.	Check the Tx aperture for blockage.
	Check the power connection.
The TRS2 fails to detect all good tools.	Check that the spindle speed is set to 5000 r/min, 1000 r/min or 200 r/min with no spindle override set.
	Check the Rx lens for contamination or damage.
	Check that the range is between 300.0 mm (11.81 in) and 2.0 m (78.74 in).
	Check the system alignment in the X, Y and Z axes.
	Check that the unit is rigidly mounted.

Symptom	Action
The TRS2 fails to detect all good tools (continued)**.**	Check the tool position in the laser beam at the checking point.
	Check that the laser focus screw is set correctly.
	Check that the receiver focus screw is set correctly.
	Check that the beam hits the tool at 90° to the tool axis of rotation.
The TRS2 fails to detect a specific good tool.	Check that the tool gives enough good reflection (at least one green LED on the bar graph display must be lit).
	Check that coolant on the tool is not disrupting the beam's sight of the tool. If it is, move to a cleaner part of the tool or remove coolant with a spin, air blast or other method.
	If the tool has 12 or more flutes, it may not be detected.
	If the tool does not have a solid centre, it may not be detected.
Dispersed laser beam.	Clean the Tx optics and identify the source of contamination.
	Check that the air supply conforms to the specified requirements (for more information, see "Air supply" on page 3.3 of Chapter 3, "System installation").

Parts list

Type	Part number	Description
TRS2 (unit only)	A-5450-0400	TRS2 unit with 10.0 m (32.80 ft) cable, mounting bracket, pin spanner, product documentation, beam terminator, and laser warning sign (P-LA01-1066).
TRS2 (full kit)	A-5450-1000	Contains all the items in kit A-5450-0400, plus 4.0 m (13.12 ft) cable conduit, air assembly kit, 25.0 m (82.02 ft) air pipe, and 2 × 2 m air pipe conduit.
TRS2 with cable connector (unit only)	A-5450-0420	TRS2 unit with cable connector, mounting bracket, pin spanner, product documentation, beam terminator, laser warning sign (P-LA01-1066).
TRS2 with cable connector (full kit)	A-5450-1500	Contains all the items in kit A-5450-0420, plus 12.5 m (41.01 ft) cable with mating connector, air assembly kit, 4.0 m (13.12 ft) cable conduit, 2 × 2 m air pipe conduit.
TRS2-S (unit only)	A-5450-0410	TRS2-S unit with 10.0 m (32.12 ft) cable, mounting bracket, pin spanner, product documentation, beam terminator, laser warning sign (P-LA01-1066).
TRS2-S (full kit)	A-5450-1100	Contains all the items in kit A-5450-0410, plus air assembly kit, 4.0 m (13.12 ft) cable conduit, 2 × 2 m air pipe conduit.
Pin spanner	P-TL09-0005	Used for removing the air cap.
Air assembly kit	A-2253-5120	Filter/regulator, Ø4.0 mm (0.16 in) tube x 25.0 m (82.02 ft) air tube, Ø4 mm (0.16 in) tee-fitting.
Air filter service kit	P-FI01-S002	Replacement filters for air filter/regulator unit.
Cable conduit	P-CF01-0001	Sold per metre.
Air pipe	P-PF26-0010	25.0 m (82.02 ft) × Ø4.0 mm (0.16 in) black nylon tube.
Deluxe air filter	P-FI01-0008	Air regulator with blocked filter indication and auto drain.
Air pipe conduit	M-2253-0207	2.0 m (78.74) × Ø7.0 mm (0.28 in) stainless steel air pipe protector.
Cable gland	P-CF02-0001	Cable gland for cable conduit.
Cable gland	P-CA61-0054	Cable gland (domed).
Locknut	P-NU09-0016	M16 x 1.5 mm locknut.
Air cap	A-5450-0440	Replacement air cap and O-ring.
Cable and connector	A-2253-6107	12.5 m (41.01 ft) of cable with connector. For use with A-5450-0420.

Type	Part number	Description
Air blast kit	A-5299-5571	Air blast (no nozzle), solenoid kit and spring cover.
Air pipe (Ø6 mm)	P-PF26-0008	10.0 m (32.80 ft) × Ø6.0 mm (0.24 in) black nylon tube (used in conjunction with the solenoid kit).
Receiver lens	A-5450-0470	Replacement lens and O-ring.
Sapphire glass window	A-5450-0460	Hard sapphire glass protective window and locking ring.
Publications. These can be downloaded from our web site at **www.renishaw.com**.		
TRS2	H-5450-8501	Quick-start guide: for rapid set-up of the TRS2 non-contact broken tool detection system.
Software programs and features	H-2000-2298	Data sheet: Probe software for machines tools – programs and features.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