Programming guide
H-2000-6324-0A-A

RENISHAW
apply innovation™

TRS1 non-contact broken tool detection system - Siemens controls

Disclaimer

Considerable effort has been made to ensure that the contents of this document are free from inaccuracies and omissions. However, Renishaw makes no warranties with respect to the contents of this document and specifically disclaims any implied warranties. Renishaw reserves the right to make changes to this document and to the product described herein without obligation to notify any person of such changes.

Trademarks

RENISHAW® and the probe emblem used in the RENISHAW logo are registered trademarks of Renishaw plc in the UK and other countries.

apply innovation is a trademark of Renishaw plc.

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

Renishaw part no: H-2000-6324-0A-A

Issued: December 2005

Contents

TRS1 non-contact broken tool detection system

This guide describes how to use the Renishaw TRS1 (non-contact) broken tool detection system software. The Renishaw TRS1 is a laser non-contact system that provides high-speed/high accuracy broken tool detection for solid tools only. As tools are moved into the laser beam, the system detects reflection. Output signals sent to the controller allow the presence of the tool to be established. The TRS1 system allows the following parameters to be established:

- Detection of a broken tool.

NOTE: Solid tools – this means a tool where the cutting teeth do not protrude below the centre point of the tool. Tools such as drills, taps, etc. are considered suitable tools.

Machine spindle speed checking

All broken tool detection takes place at a fixed spindle speed of 1000 rpm.

The active spindle speed is stored at the beginning of the broken tool macro. The broken tool checking then takes place at 1000 rpm before restoring the spindle speed back to its original rpm.

Software memory requirements

- L999 (default inputs for L1000) 0.4kb (1.0 metres) of memory.
- L1000 (broken tool check) 1.5kb (3.75 metres) of memory.

Machine tool controllers supported

TRS1 system software is suitable for use on the following machine tool controllers.

Siemens 810D version 2 onwards, 840D version 4 onwards and 802D

Measurement values used in this guide

Throughout this guide, metric units of measurement, i.e. millimetres, are used in the examples. The equivalent imperial measurements, i.e. inches, are shown in brackets.

Installing the software

Before installing the TRS1 software, read the guidelines contained in the Readme file on the CD-ROM.

Setting data in macro (L1000)

Read the following variable descriptions then edit macro L1000 as described.

RENL[14] = 'X' axis laser beam position. This defines the position at which broken tool checking will take place in the X axis. (MCS positional values are required).

Default: 0

NOTE: If the installation requires no X move to position the tool in the beam, then RENL[14] requires no adjustment.

RENL[15] = 'Y' axis laser beam position. This defines the position at which broken tool checking will take place in the Y axis. (MCS positional values are required).

Default: 0

NOTE: If the installation requires no Y move to position the tool in the beam, then RENL[15] requires no adjustment.

RENL[16] = 'Z' axis laser beam position. This defines the position at which broken tool checking will take place in the Z axis. (MCS positional values are required).

Default: 0

RENL[17] = Measure input. The system can be wired into measuring input 1 or 2, this variable defines which input has been used.

Default: 1

Additional macro edits (L1000)

For installations where the “The Tool Management System” is in use, the following edit will be required.

NOTE: The value ‘n’ shown in the text below is the location number (usually 1) in the tool buffer (This is decided by the machine tool builder during commissioning).

RENL[20]=$P_TOOLNO

GOTOF LN10; REMOVE IF REQUIRED

RENL[20]=$TC_MPP6[9998,**n**]; TOOL MANAGEMENT

LN10:

The TRS1 system checks for the condition of the tool. The system looks for a signal within a 30 second time-frame and, if after 30 seconds no signal is received, then a broken tool alarm is raised.

The 30 second time-frame is attained by checking the input over a set number of repetitions. The number of repetitions may need to be adjusted depending on the speed of the PLC scan time.

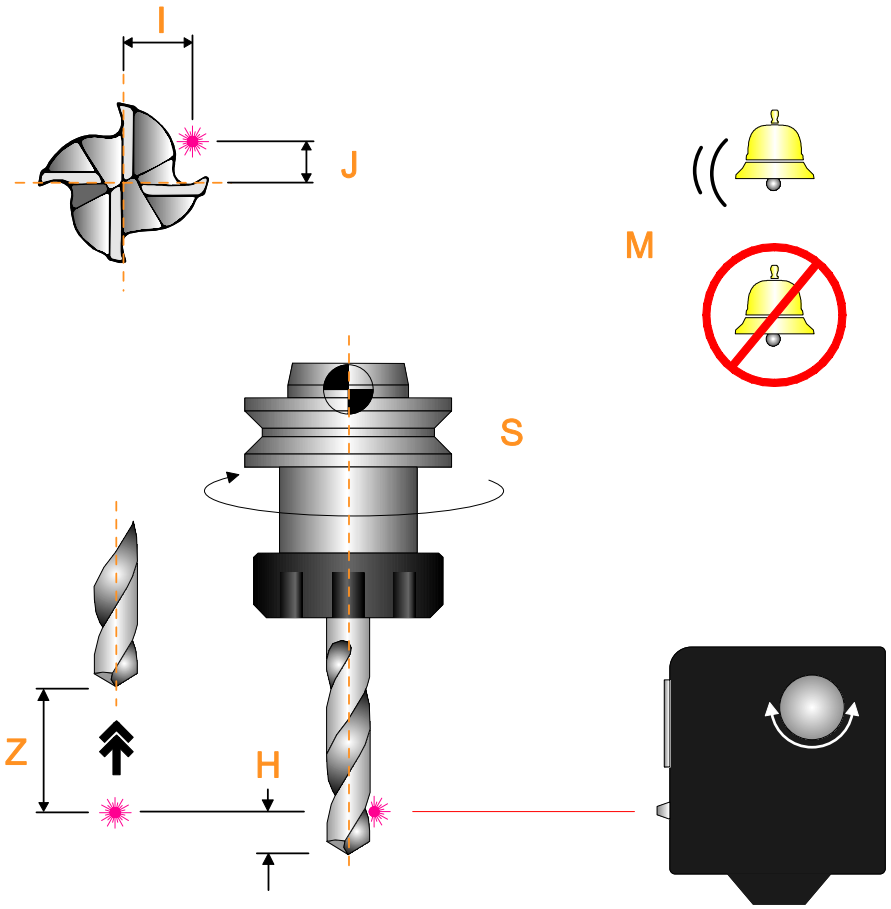
LN24:IF RENL[1] < ***600*** GOTOB LN16

In the above example, the number of repetitions is set to 600.

Broken tool detection – (macro L1000)

NOTE: The TRS1 can perform a broken tool detection cycle only on solid cutting tools, where the cutting teeth do not protrude below the centre point of the tool. Tools such as drills and taps can be considered suitable.

Macro L1000 is used to check for breakage of solid cutting tools. The broken tool cycle uses a plunge check, where the tool is moved into and out of the laser beam in the spindle axis.



Typically, a tool needs to be checked after a machining operation, to verify that it is not broken, before the next tool is selected.

Description

Detection of a broken tool occurs while the tool is rotated in the beam. Moves into and out of the beam are at the rapid feedrate.

The tool first moves in rapid traverse to the checking position in the spindle axis using the active tool length offset. The tool will then move at rapid traverse to the radial checking position if this is required.

NOTE: The checking position must be on a perpendicular section of the tool. i.e the flank angle of a drill is not a suitable checking position.

If the R26 input is used the tool retracts out of the beam to the position requested.

NOTE: If the default R26 input is not used the tool will retract to the spindle axis reference position.

Example

L999

R11=-10 R26=100

L1000

Subroutine inputs (L999)

The subroutine L999 contains all the inputs listed below with default values assigned. This subroutine **must always** be run before L1000. If the default values are not suitable then the required parameters will need to be re-assigned. See example program.

R11 Tolerance value that defines when the tool is out of tolerance.

NOTE: If the H input is used with a minus value assigned then the tool check position will be the tool length plus the tolerance value.

Default value: 3.0 mm (0.0197 in).

R13=1 Tool broken flag.

Using this flag prevents a BROKEN TOOL alarm from being raised.

R26 Safety plane.

The distance (in the spindle axis) to which the tool is retracted.

Default value: 9999 (Spindle axis Reference position)

R19 Spindle speed

Spindle speed at which checking for a broken tool takes place.

Default value: 1000

R4 Incremental adjustment distance (X axis).

This input allows the reflection point on the tool to be individually adjusted to attain maximum feedback.

NOTE: Only valid if a X move is used to position the tool to its checking position.

Default value: 0

R5 Incremental adjustment distance (Y axis).

This input allows the reflection point on the tool to be individually adjusted to attain maximum feedback.

NOTE: Only valid if a Y move is used to position the tool to its checking position.

Default value: 0

Outputs

The following output is always set when this cycle is executed.

R48 Broken tool flag.
(1 = broken tool, 0 = good tool)

NOTE: If R48 cannot be used, edit lines 8 and 28 in the macro program for a suitable replacement.

Alarms

The following alarms may be generated when this cycle is executed.

BROKEN TOOL

NO EDGE ACTIVE

FORMAT ERROR

For an explanation of the meaning of alarms, see “Error messages and alarms” on page 9.

Example: broken tool detection

```
%_N_????_MPF
T11 M06
G0 G54 X0 Y0
(complete the machining sequence with tool T11)

L999
R11=5 R26=50
L1000                    Make a broken tool check. Either a BROKEN TOOL
                         alarm is raised and the program stops, or the program
                         continues.

T2 M06                   Select the next tool and continue.

(continue machining)
```

If the broken tool flag method is used, the cycle call is modified as follows:

```
L999
R13=1
L1000                    Make a broken tool check without raising an alarm.
                         The R48 flag is set.
IF R48=1 GOTOF LN100
(continue program)
```

Block LN100 will contain corrective actions. For example, selecting a sister tool for use or selecting a new pallet/component.

Error messages and alarms

When an error state is detected, an error message is displayed on the screen of the controller. Error messages, their meaning, and typical actions needed to clear them are described below.

Message BROKEN TOOL

Meaning The tool is out of tolerance.

Action Replace the defective tool and establish the correct tool offset value.

Message NO EDGE ACTIVE

Meaning There is no active tool edge.

Action Correct the part program and run the program again.

Message FORMAT ERROR

Meaning A macro input is either missing or the value entered is incorrect.

Action Correct the macro input line then run again.

This page left intentionally blank

Renishaw plc

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

T +44 (0)1453 524524
F +44 (0)1453 524901
E uk@renishaw.com

www.renishaw.com

RENISHAW
apply innovation™

**For worldwide contact details,
please visit our main web site at
www.renishaw.com/contact**

H-2000-6324-0A