Programming guide
H-2000-6396-00-A

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TRS1 non-contact broken tool detection system - Okuma controls

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TRS1 non-contact broken tool detection system

This guide describes how to use the TRS1 non-contact broken tool detection system software. The 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 are sent to the controller and the presence of the tool can 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

- O1000 (broken tool check) 1.40 kb of memory.

Machine tool controllers supported

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

OSP 700/7000M U10/100M E10/100M

Measurement values used in this guide

Throughout this guide, metric units of measurement, i.e. millimetres, are used in the examples.

Installing the software

Before installing the TRS1 software, read the guidelines contained in the readme file on the CD.

Setting data in macro (O1000)

Read the following variable descriptions then edit macro O1000 as described.

PV14 = ‘X’ axis laser beam position. This defines the position at which broken tool checking will take place in the X axis. (Machine positional values are required).

Default: 0

NOTE: If the installation requires no X move to position the tool in the beam, then PV14 requires no adjustment.

PV15 = ‘Y’ axis laser beam position. This defines the position at which broken tool checking will take place in the Y axis. (Machine positional values are required).

Default: 0

NOTE: If the installation requires no Y move to position the tool in the beam, then PV15 requires no adjustment.

PV16 = ‘Z’ axis laser beam position. This defines the position at which broken tool checking will take place in the Z axis. (Machine positional values are required).

Default: 0

PV17 = Spare variable for broken tool flag. Default VC98 will not clash with other Renishaw software. Select a variable that is not being already being used.

Default: 98

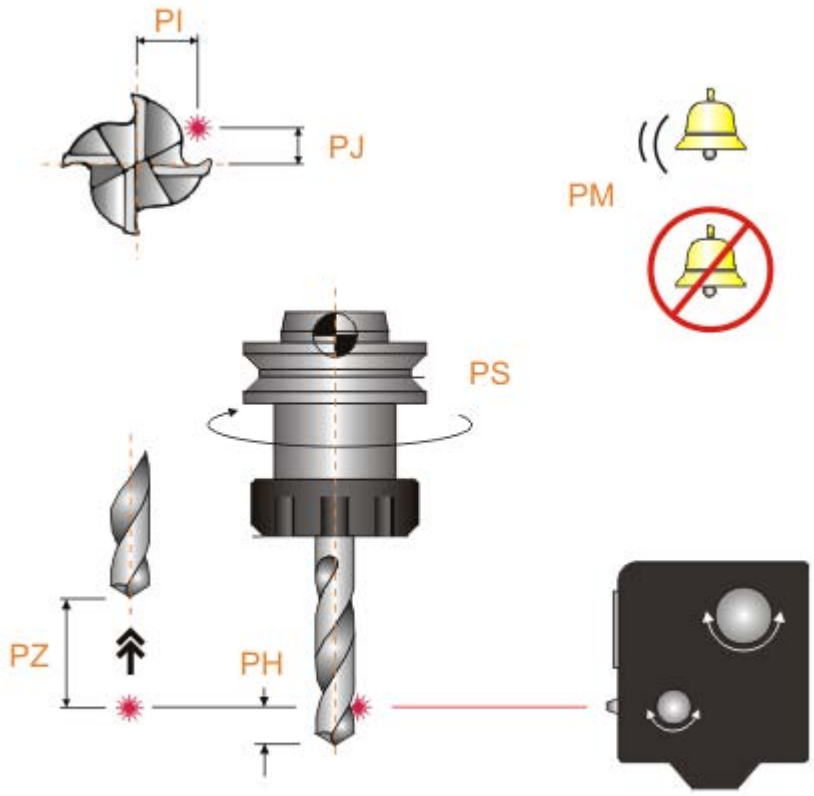
Line N70 Input check data number. This defines the CNC input that the TRS1 is connected to. (It does not need to be connected to skip). For all controls except OSP700/7000 this will be a four digit input relating to the 'Check No' and 'Bit No'. E.g. for iIN16 check number = 016 and bit number = F. Therefore, edit line shown below = 016F (refer to wiring diagram and Check Data page of the control). However, the OSP700/7000 control requires the input name – in this case IN16. This will need to be edited directly into the VIRD line as shown below.

N70
(EDIT FOLLOWING INPUT NUMBER)
IF[VIRD[**EDIT**] EQ 1]N120
change to
IF[VIRD[**016F**] EQ 1]N120

Broken tool detection – (macro O1000)

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

Macro O1000 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, the flank angle of a drill not being a suitable checking position.

The NC system then checks for the condition of the tool. The system looks for a signal a maximum of 1000 times. If, after 1000 checks no signal is received, a broken tool alarm is raised.

If the ‘Z’ macro input is used the tool retracts out of the beam to the position requested.

NOTE: If the ‘Z’ input is omitted the tool will retract to the spindle axis reference position.

Format

CALL O1000 [PH PM PZ PI PJ]

where [ ] denotes optional inputs

Example CALL O1000 PH=1.5 PM=1. PZ=10 PI=.1 PJ=-.25

Subroutine inputs

The following inputs are used with this subroutine:

PH — 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).

PM=1. — Tool broken flag.

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

PZ — Safety plane.

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

Default value: Spindle axis reference position

PI 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

PJ 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:

VC98 Broken tool flag.
(1 = broken tool, 0 = good tool)

NOTE: If VC98 cannot be used, edit PV17, in the macro program as described earlier.

Alarms

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

BROKEN TOOL

TOOL INACTIVE

FORMAT ERROR

EDIT PV16

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

Example: Broken tool detection

```
O????
M6T1                    (Adjust to suit machine)
G15 H2
G56 H1 Z200.
(complete the machining sequence with tool T1)

CALL O1000 PH=5 PZ=25
```

Make a broken tool check. Either a BROKEN TOOL alarm is raised and the program stops, or the program continues.

```
M6T2
```

Select the next tool and continue.

```
(continue machining)
```

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

```
CALL O1000 PH=2 PM=1 PZ=25
```

Make a broken tool check without raising an alarm.
The VC98 flag is set.

```
IF[VC98 EQ 1]N100
(continue program)
```

Block N100 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 TOOL INACTIVE

Meaning There is no active tool offset.

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.

Message EDIT PV16

Meaning Macro edits have not been completed.

Action Edit macro program as described earlier.

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