

TRS1 non-contact broken tool detection system - Mazak 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

Two Programs are supplied, if the broken tool check is to be called from a Mazatrol program then O1001 will need to be loaded to the control. If the program is going to be called from the ISO side the O1000 will require loading.

If the TRS1 is to be used in both Mazatrol and ISO then both programs can be loaded.

- O1000 (broken tool check ISO) 1.5 kb (3.75 metres) of memory.
- O1001 (broken tool check Mazatrol) 1.15 kb (2.875 metres) of memory.

Machine tool controllers supported

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

M32,M-Plus,Fusion 640

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.

Setting data in macro (O1000 or O1001)

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

#14 = '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 #14 requires no adjustment.

#15 = '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 #15 requires no adjustment.

#16 = '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

#17= Tool offset type.

1= Tool lengths stored in Mazatrol tool data.

2= Tool lengths stored in tool offsets (type A).

3= Tool lengths stored in ISO Tool data.

4= Tool lengths stored in tool offsets (type B).

#18= Skip code

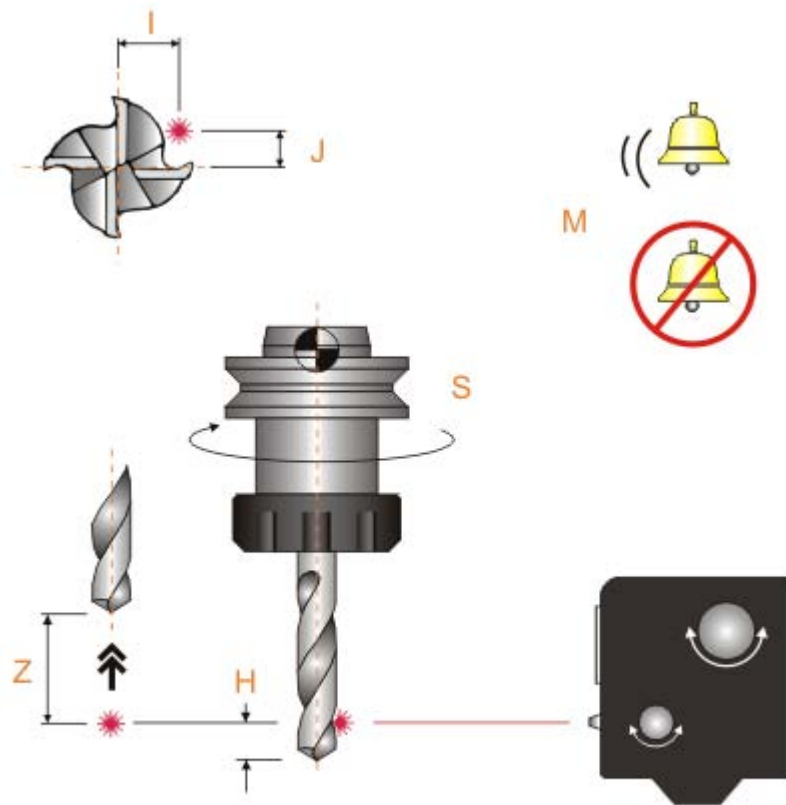
This setting must be checked. With the incorrect setting the machine will not detect a broken tool.

The machine should be connected so that G31.2 is used for the TRS1 move. If the machine is wired differently, change #18 to suit the skip command being used. The default value is #18= 31.2.

Broken tool detection – (macro O1000/O1001)

NOTE: The TRS1 can perform a broken tool detection cycle only on solid tools.

Solid tools – this means a tool 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/O1001 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 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 moving the spindle axis .50 mm @ F1. This can be adjusted by the installer.

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 - ISO/EIA

G65 P1000 [Hh Mm Zz Ss Ii Jj]

where [] denotes optional inputs

Example G65 P1000 H1.5 M1. Z10 I.1 J-.25

Subroutine inputs

The following inputs are used with this subroutine:

H 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).

M1. Tool broken flag.

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

Z Safety plane.

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

Default value: Spindle axis Reference position

S	Spindle speed Spindle speed at which checking for a broken tool takes place. Default value: 1000
I	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
J	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:

#148	Broken tool flag. (1 = broken tool, 0 = good tool)
------	--

NOTE: If #148 cannot be used, edit lines 10 and 60 in the macro program for a suitable replacement.

Alternative program calling methods

The broken tool cycle can be called using an 'M' code. This 'M' code can be called directly from Mazatrol or the ISO/EIA program.

To enable a 'M' code call the following parameters will need to be set

J73=1000 J74=350 J75=1 J76=1
 J77=1001 J78=351 J79=1 J80=1

G65P1000 becomes M350.
 G65P1001 becomes M351

Format - Mazatrol using M code call

The screenshot shows the MAZATROL : 1999 software interface. The main window displays tool data and parameters in a structured format. The top menu bar includes File, Window, and Help. The main display area is divided into several sections:

- Tool Data Section:**

UNo.	MAT.	INITIAL-Z	ATC MODE	MULTI MODE	MULTI FLAG	PITCH-X	PITCH-Y
0	ALUMINUM	100.	0	OFF	↑	↑	↑
- Unit Data Section:**

UNo.	UNIT	ADD. WPC	X	Y	th	Z	4
1	WPC-	0	-200.	-200.	0.	-300.	↑
- Tool Selection Section:**

UNo.	UNIT	TOOL	NOM-Ø No.
2	MANU PRO DRILL	10.	A
- Parameter Data Section:**

SN0.G1	G2	DATA 1	DATA 2	DATA 3	DATA 4	DATA 5	DATA 6	S	M/B
1									M351
- Continuation Data Section:**

UNo.	UNIT	CONTI.NUMBER	ATC	X	Y	Z	4	ANGLE
3	END		0				↑	↑ ↑

The bottom status bar displays the following information:

- TPS 0
- 2005/09/01
- 15:25
- 12% (Zoom)
- 100% (Zoom)
- 100% (Zoom)
- CONTINUE <Y:1, N:0> ?

Or

MAZATROL : 1999											
File Window Help											
UNo.	MAT.	INITIAL-Z	ATC MODE	MULTI MODE	MULTI FLAG	PITCH-X	PITCH-Y				
0	ALUMINUM	100.	0	OFF	↑	↑	↑				
UNo.	UNIT	ADD. WPC	X	Y	th	Z	4				
1	WPC-	0	-200.	-200.	0.	-300.	↑				
UNo.	UNIT	TOOL	NOM-Ø	No.							
2	MANU	PRO	DRILL	10.							
SN0.	G1	G2	DATA 1	DATA 2	DATA 3	DATA 4	DATA 5	DATA 6	S	M/B	
1	65	P	1001.	Z	30.						
UNo.	UNIT	CONTI.NUMBER	ATC	X	Y	Z	4	ANGLE			
3	END		0				↑	↑	↑		

						TPS 0	2005/09/01	15:24
12%			100%			100%		
TOOL ID CODE <MENU> ?								
A	B	C	D	E	F	G	H	HEAVY TOOL >>>

Format - ISO/EIA

G81Z-10.F100
G80

Or
M350

Or
M350Z100.

Or
G65P1000Z100.

Other parameter settings

The software supplied has O1000 as the program number, this can be edited by the installer to suit. If a 9000 series number is selected the following parameters can be set.

9000-series program lock

F81.0 1=locked
 0=unlocked

9000-series programs displayed

F81.1 1=not displayed
 0=displayed

Tool offset and tool data handling parameters

The following parameters control how ISO/EIA programs handle tool offset or tool data. The recommended settings are as follows:

F93.3=1 Tool lengths stored in Mazatrol,
and F94.7=1 and can be applied in an ISO/EIA program.

F93.3=0 Tool lengths stored in ISO tool offsets, and are applied in an ISO/EIA
and F94.7=0 program.

F93.3 Tool length of tool data for EIA/ISO program
0: Invalid
1: Valid

F94.7 Tool offset amount effectuated in an EIA/ISO program.
0: effectuates tool offset amount on the TOOL OFFSET display.
1: effectuates tool offset amount for EIA/ISO program on the TOOL DATA display.

K69-K71 G31.1 – G31.3 Skip conditions.
These parameters control where G31.1 to G31.3 codes will look for a trigger signal. See below for which parameter bit controls which input codes G31.1-G31.3 will look at.

Bit 0 diagnostic X178 (XSKIP plug pin no.2)

Bit 1 diagnostic X179 (XSKIP plug pin no.10)

Bit 2 diagnostic X17A (XSKIP plug pin no.3)

Bit 3 diagnostic X17B (XSKIP plug pin no.11)

The normal setting for these parameters are:

K69 = 00000010

G31.1 looks at X179

K70 = 00000100

G31.2 looks at X17A

K71 = 00001000

G31.3 looks at X17B

NOTE: On machines (FH4800) with high speed spindles that require cycling to pre-warm them, use the last probing (XSKIP pin 11).

Alarms

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

BROKEN TOOL

NO H OFFSET ACTIVE

FORMAT ERROR

For an explanation of the meaning of alarms, see “Error messages and alarms” on page 13.

Example: Broken tool detection

O????

M6Tt1 (Adjust to suit machine)

G43 H1 Z200.

(complete the machining sequence with tool T1)

G65 P1000 H5. Z25. Make a broken tool check. Either a BROKEN TOOL alarm is raised and the program stops, or the program continues.

M6Tt2 Select the next tool and continue.

(continue machining)

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

G65 P1000 H2. M1. Z25. S1000

Make a broken tool check without raising an alarm.
The #148 flag is set.

IF[#148EQ1]GOTO100

(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 NO H OFFSET ACTIVE

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.

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