



# DOCUMENTATION ISG-kernel

## Manual Tool data

Short Description:  
TOOL

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# Preface

## Legal information

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This documentation was produced with utmost care. The products and scope of functions described are under continuous development. We reserve the right to revise and amend the documentation at any time and without prior notice.

No claims may be made for products which have already been delivered if such claims are based on the specifications, figures and descriptions contained in this documentation.

## Personnel qualifications

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This description is solely intended for skilled technicians who were trained in control, automation and drive systems and who are familiar with the applicable standards, the relevant documentation and the machining application.

It is absolutely vital to refer to this documentation, the instructions below and the explanations to carry out installation and commissioning work. Skilled technicians are under the obligation to use the documentation duly published for every installation and commissioning operation.

Skilled technicians must ensure that the application or use of the products described fulfil all safety requirements including all applicable laws, regulations, provisions and standards.

## Further information

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Links below (DE)

<https://www.isg-stuttgart.de/produkte/softwareprodukte/isg-kernel/dokumente-und-downloads>

or (EN)

<https://www.isg-stuttgart.de/en/products/softwareproducts/isg-kernel/documents-and-downloads>

contains further information on messages generated in the NC kernel, online help, PLC libraries, tools, etc. in addition to the current documentation.

## Disclaimer

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It is forbidden to make any changes to the software configuration which are not contained in the options described in this documentation.

## Trade marks and patents

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# General and safety instructions

## Icons used and their meanings

This documentation uses the following icons next to the safety instruction and the associated text. Please read the (safety) instructions carefully and comply with them at all times.

## Icons in explanatory text

➤ Indicates an action.

⇒ Indicates an action statement.



### **⚠ DANGER**

#### **Acute danger to life!**

If you fail to comply with the safety instruction next to this icon, there is immediate danger to human life and health.



### **⚠ CAUTION**

#### **Personal injury and damage to machines!**

If you fail to comply with the safety instruction next to this icon, it may result in personal injury or damage to machines.



### **Attention**

#### **Restriction or error**

This icon describes restrictions or warns of errors.



### **Notice**

#### **Tips and other notes**

This icon indicates information to assist in general understanding or to provide additional information.



### **Example**

#### **General example**

Example that clarifies the text.



### **Programing Example**

#### **NC programming example**

Programming example (complete NC program or program sequence) of the described function or NC command.



### **Release Note**

#### **Specific version information**

Optional or restricted function. The availability of this function depends on the configuration and the scope of the version.

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## Overview of tool parameters

The overview of tool parameters offsets is sorted into a 4-column table.

- Column 1 contains the unambiguous identifier of the axis parameter called the “ID” which consists of the prefix “P-TOOL” and a unique 5-digit number, e.g. P-TOOL-00001.
- Column 2 represents the data structure which defines the parameter, e.g. wz[i].  
The structure is a categorisation aid and is described in the following section.
- Column 3 contains the “parameter” with its exact name, e.g. typ  
The important thing is that “structure”+“parameter” always belong together and must be configured in exactly the same way in the axis parameter list, e.g. wz[i].typ
- Column 4 contains the “functionality” in a summarised term/short description, e.g. Differentiation between tool types.

ID	Structure	Parameter	Functionality/short description
P-TOOL-00001 ▶ 13]	wz[i].	typ	Type
P-TOOL-00002 ▶ 14]	wz[i].	srk_lage	Cutter edge position
P-TOOL-00003 ▶ 15]	wz[i].	laenge	Tool length
P-TOOL-00004 ▶ 15]	wz[i].	radius	Tool radius
P-TOOL-00005 ▶ 18]	wz[i].	gueltig	Validity flag
P-TOOL-00006 ▶ 18]	wz[i].	ax_ersatz[j]	Axis offsets
P-TOOL-00007 ▶ 19]	wz[i].	param[j]	Additional tool parameters
P-TOOL-00008 ▶ 20]	wz[i].	mass_einheit	Unit of length, radius and axis offsets
P-TOOL-00009 ▶ 20]	wz[i].kinematic.	param[j]	Kinematic parameters
P-TOOL-00010 ▶ 21]	wz[i].	tool_fixed	Tool fixed / alignable
P-TOOL-00011 ▶ 21]	wz[i].	kin_id	Kinematic ID
P-TOOL-00012 ▶ 23]	wz[i].	log_ax_nr_spdl	Logical spindle axis number
P-TOOL-00013 ▶ 24]	wz[i].	vb_min	Minimum rotation speed

ID	Structure	Parameter	Functionality/short description
P-TOOL-00014 ▶ 24]	wz[i].	vb_max	Maximum rotation speed
P-TOOL-00015 ▶ 24]	wz[i].	a_max	Maximum acceleration
P-TOOL-00016 ▶ 25]	wz[i].	gear_ratio_num	Gear ratio of a tool (numerator)
P-TOOL-00017 ▶ 25]	wz[i].	gear_ratio_denom	Gear ratio of a tool (denominator)
P-TOOL-00018 ▶ 26]	wz[i].	gear_inv_direction	Reversal of rotation direction by gear
P-TOOL-00019 ▶ 27]	wz[i].	gear_inv_direction_no_stopm	Reversal of rotation direction without spindle standstill
P-TOOL-00020 ▶ 38]	wz[i].path[j].	radius	Tool radius
P-TOOL-00030 ▶ 28]	wz[i].	grinding_wear_const	Wear constant
P-TOOL-00031 ▶ 28]	wz[i].	grinding_max_infeed	Maximum discrete infeed
P-TOOL-00100 ▶ 30]	wz[i].linkpoint_data.	name	Name
P-TOOL-00101 ▶ 30]	wz[i].linkpoint_data.	mountpoint	Mountpoint
P-TOOL-00102 ▶ 31]	wz[i].linkpoint_data.	translation[k]	Translation of main axes
P-TOOL-00103 ▶ 31]	wz[i].linkpoint_data.	rotation[k]	Rotation of main axes
P-TOOL-00104 ▶ 31]	wz[i].linkpoint_data.	ax_nr	Axis number
P-TOOL-00105 ▶ 32]	wz[i].linkpoint_data.	trans_rot	Translation/rotation of linkpoint
P-TOOL-00106 ▶ 32]	wz[i].linkpoint_data.	inverse	Effect of the movement on the linkpoint
P-TOOL-00107 ▶ 32]	wz[i].linkpoint_data.	visible	Use of the linkpoint
P-TOOL-00108 ▶ 33]	wz[i].linkpoint_data.	fixed	Position of linkpoint after axis exchange
P-TOOL-00109 ▶ 33]	wz[i].linkpoint_data.	arm_len	Maximum lever arm length
P-TOOL-00120 ▶ 34]	wz[i].gobject_data[j].	name	Name of the graphical object
P-TOOL-00121 ▶ 34]	wz[i].gobject_data[j].	linkpoint	Linkpoint name



ID	Structure	Parameter	Functionality/short description
P-TOOL-00122 ▶ 34]	wz[i].gobject_data[j].	group[k]	Group name
P-TOOL-00123 ▶ 35]	wz[i].gobject_data[j].	translation[k]	Translation of object
P-TOOL-00124 ▶ 35]	wz[i].gobject_data[j].	rotation[k]	Rotation of object
P-TOOL-00125 ▶ 35]	wz[i].gobject_data[j].	relative	Effect of shift and rotation
P-TOOL-00126 ▶ 36]	wz[i].gobject_data[j].	file	File containing description of object data
P-TOOL-00127 ▶ 36]	wz[i].gobject_data[j].	key[k]	Key name
P-TOOL-00128 ▶ 36]	wz[i].gobject_data[j].	value[k]	Value name
P-TOOL-00129 ▶ 37]	wz[i].gobject_data[j].	changed	Information about a change
P-TOOL-00138 ▶ 29]	wz[i].	grinding_disc_tilt_angle	Grinding disc tilt angle
P-TOOL-00140 ▶ 39]		tool_data_with_id	Free assignment of the tool number
P-TOOL-00141 ▶ 39]	wz[i].tool_id.	basic	Basic tool number
P-TOOL-00142 ▶ 40]	wz[i].tool_id.	sister	Sister tool number
P-TOOL-00143 ▶ 40]	wz[i].tool_id.	variant	Variant tool number
P-TOOL-00144 ▶ 40]	wz[i].tool_id.	sister_valid	Validity flag of the sister tool
P-TOOL-00145 ▶ 41]	wz[i].tool_id.	variant_valid	Validity flag of the variant tool
P-TOOL-00146 ▶ 16]	wz[i].	orientation_vector[j]	Tool orientation by specifying a vector
P-TOOL-00147 ▶ 22]	wz[i].	additional_settings	Extended tool settings (modes)
P-TOOL-00148 ▶ 22]	wz[i].	kin_name	Name of the kinematic

# 1 General description

## 1.1 Links to other documents

For the sake of clarity, links to other documents and parameters are abbreviated, e.g. [PROG] for the Programming Manual or P-AXIS-00001 for an axis parameter.

For technical reasons these links only function in the Online Help (HTML5, CHM) but not in pdf files since pdfs do not support cross-linking.

## 1.2 Syntax and interpretation of ASCII list file

An interpreter copies the entries in the ASCII list file into identical internal structures which are then checked for plausibility. To ensure reliable controller start-up every time, defective entries found by the plausibility check are replaced by default values.

Unknown entries are not taken over. These irregularities are displayed by warning messages. We advise you to investigate the cause for these warning messages and remove defective entries from the ASCII list file.



### Notice

The following agreement applies to BOOLEAN data:

Value	Meaning
0	Definition of FALSE
1	Definition of TRUE

## 1.3 Comments in the ASCII list file

Comments can be in an entire line or can be added at the end of a line.

With a comment spanning an entire line, the comment character "#" must be placed at the start of the line and followed by a blank.

If a comment is to be inserted at the end of a line, only a blank is required before the comment. However, if a string was defined in the line, the comment must be preceded by the comment character "(".

Blank lines are also possible.



### Example

Comments in the ASCII list file

```
#
*****
# Data
#
*****
#
# Listing

dummy[1] 1 Comment
dummy[2] 1 # Comment
dummy[3] 1 ( Comment
dummy[4] 1 /* Comment
...
...
beispiel[0].bezeichnung STRING_2 (Comment: comment brackets required
here!)
```

## 2 Description of elements

### 2.1 Tool data (wz[i].\*)

The 'wz[i]' structure defines the data of a tool with the number 'i'.

Structure name	Index
wz[i]	i = 0 to 200 (number of tool data records: 201, application-specific)



#### Notice

The following relationship exists between the D function and the tool data index 'i'.

D function	Tool data index 'i'.
D 0	0
D 1	1
D 2	2
D 3	3
D 4	4
D 5	5
D 6	6
D 7	7

The tool data index 'i' therefore corresponds to the tool number programmed in the NC program using the T or D command.



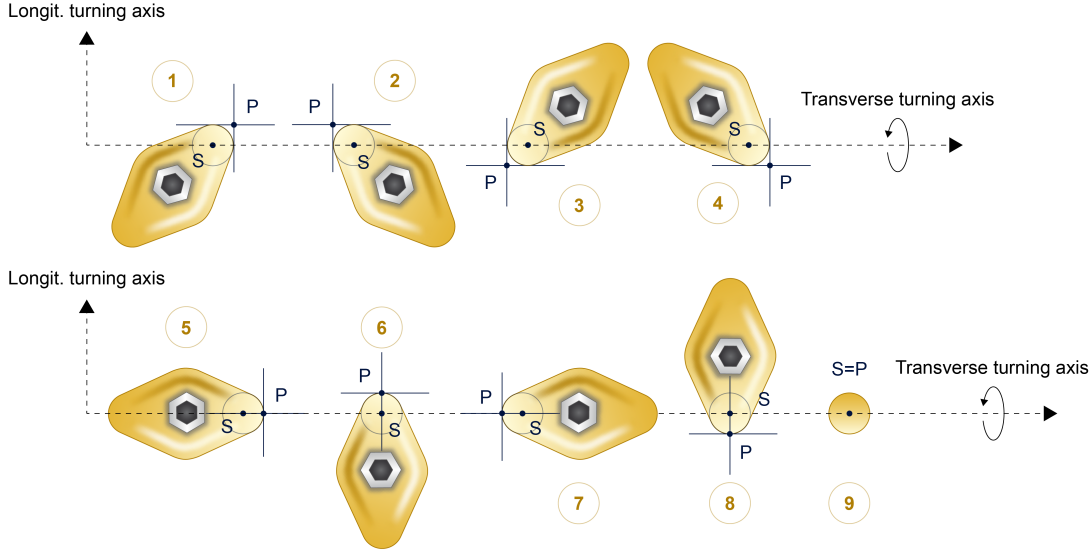
#### Attention

Data of the tool with index '0' is assigned the value '0' after the ASCII file is interpreted. In this way, all tool axis offsets can be calculated from the path motions by programming 'D0' in the NC program.

### 2.1.1 Type (P-TOOL-00001)

<b>P-TOOL-00001</b>	<b>Differentiation between tool types</b>
Description	This parameter is assigned to distinguish between tool types.
Parameter	wz[i].typ
Data type	UNS16
Data range	0: Milling tool 1: Turning tool 2: Grinding tool 3: Wire (erosion)
Unit	----
Default value	0
Remarks	Parameterisation example: Tool 5 is a milling tool <i>wz[5]typ 0</i>

## 2.1.2 Cutter position (P-TOOL-00002)

P-TOOL-00002	Cutter edge position
<p>Description</p>	<p>With rotary tools (P-TOOL-00001 [► 13] = 1), this parameter specifies the orientation of the cutter relative to the machining plane.</p>  <p>Ident. codes 1 to 9 for orientation of the turning tool tip in the machining plane.</p>
Parameter	wz[i].srk_lage
Data type	UNS16
Data range	0 < srk_lage ≤ 9
Dimension	----
Default value	0
Remarks	<p>For detailed information regarding machining with turning tools, see [PROG].</p> <p>Parameterisation example: The orientation of the cutter tip of Tool 6 is described by identification code 3.</p> <pre>wz[6].typ      1 wz[6].srk_lage 3</pre>

### 2.1.3 Tool length (P-TOOL-00003)

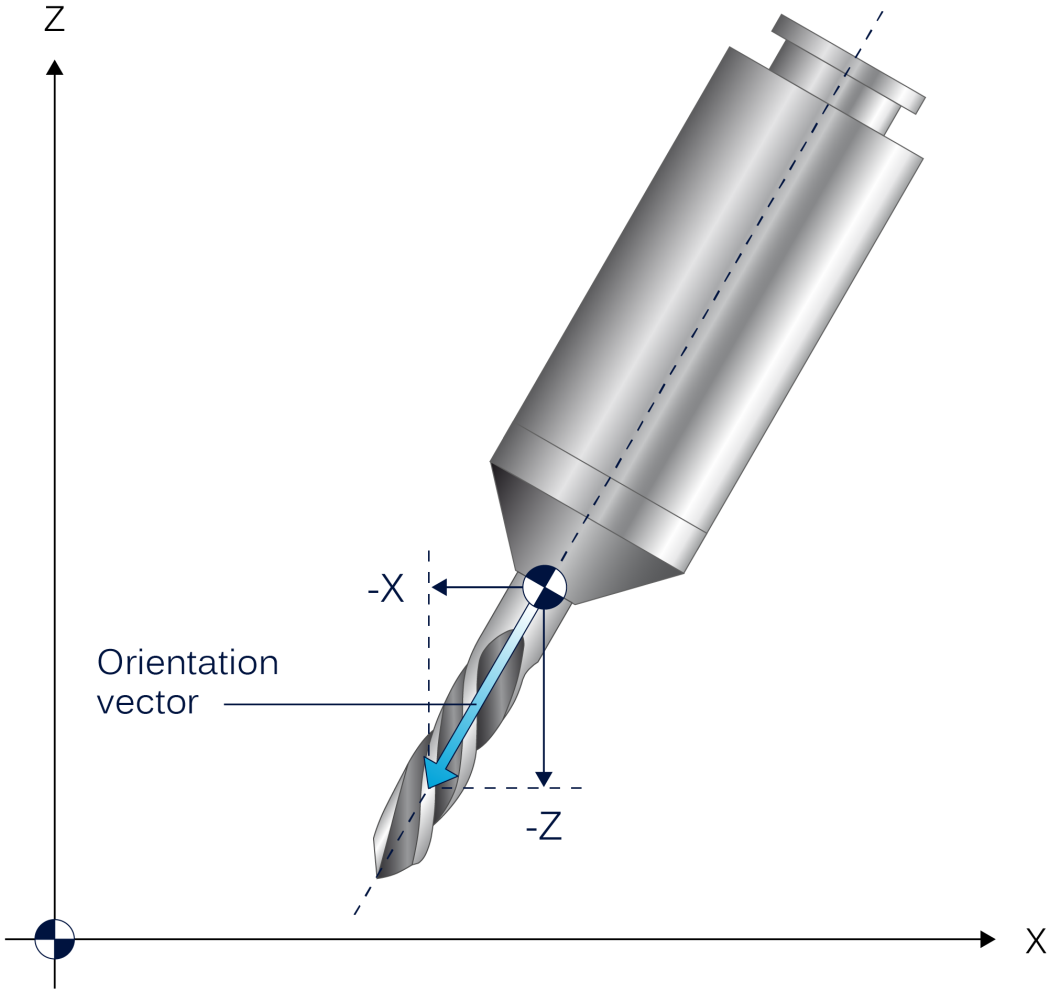
P-TOOL-00003	Tool length
Description	This parameter defines the tool length.
Parameter	wz[i].laenge
Data type	SGN32
Data range	$\text{MIN}(\text{SGN32}) < \text{length} < \text{MAX}(\text{SGN32})$
Dimension	0.1µm or 0.0001 inch
Default value	0
Remarks	Parameterisation example: The length of Tool 5 is 60 mm wz[5].laenge 600000

### 2.1.4 Tool radius (P-TOOL-00004)

P-TOOL-00004	Tool radius
Description	This parameter defines the tool radius.
Parameter	wz[i].radius
Data type	SGN32
Data range	$\text{MIN}(\text{SGN32}) \leq \text{radius} < \text{MAX}(\text{SGN32})$
Dimension	0.1µm or 0.0001 inch
Default value	0
Remarks	Parameterisation example: The radius of Tool 5 is 20 mm wz[5].radius 200000

## **2.1.5            Tool orientation (P-TOOL-00146)**



P-TOOL-00146	Tool orientation by specifying a vector
Description	<p>In 2.5D mode, if a tool is in parallel or at a fixed angle to the main axes of the machine coordinate system, this orientation can be described as a vector. Vector components are defined in the direction of the tool tip, either scaled or unscaled, starting at the tool mount point.</p> <p>When selecting the tool, the orientation vector is used to form axis-specific offset components of the tool length.</p> 
Parameter	wz[i].orientation_vector[j] where j=0...2
Data type	REAL64
Data range	$\text{MIN}(\text{REAL64}) \leq \text{orientation\_vector}[j] \leq \text{MAX}(\text{REAL64})$
Dimension	----
Default value	0.0
Remarks	<p>The vector position always refers to the machine coordinate system. If the orientation vector is not assigned (=0), the tool length is considered using the default method (plane-specific, #TLAX).</p> <p>Parameterisation example: Tool T1 is oriented opposite to the positive Z axis direction:</p> <pre>wz[1].orientation_vector[0]  0 wz[1].orientation_vector[1]  0</pre>

`wz[1].orientation_vector[2] -1`

## 2.1.6 Validity flag (P-TOOL-00005)

P-TOOL-00005	Validity flag
Description	If the data of a tool is allowed to be used, the validity flag must be set to TRUE.
Parameter	<code>wz[i].gueltig</code>
Data type	BOOLEAN
Data range	0/1
Dimension	----
Default value	0
Remarks	Parameterisation example: The data of Tool 5 is enabled. <code>wz[5].gueltig 1</code>

## 2.1.7 Axis offsets (P-TOOL-00006)

P-TOOL-00006	Axis offsets
Description	An offset parameter is defined for every tool and for every axis.
Parameter	<code>wz[i].ax_ersatz[j]</code> where $j = 0 \dots 31$ (Maximum number of axes per channel: 32, application-specific)
Data type	SGN32
Data range	$\text{MIN}(\text{SGN32}) < \text{ax\_ersatz}[j] < \text{MAX}(\text{SGN32})$
Dimension	0.1µm or 0.0001 inch
Default value	0
Remarks	<p>With active kinematic transformation, tool axis offsets are only considered in the axes which are not affected by the transformation function. Depending on the transformation type, they typically refer to all axes with index <math>&gt; 2</math> when RTCP is used.</p> <p>The axis-specific tool offsets of the first three axes (index 0, 1, 2) are <u>not</u> considered when transformation is active. If tool offsets are also to exert an effect on these axes during active transformation, enter the values in the specific kinematic offsets of the tool (P-TOOL-00009 [► 20]).</p> <p>Parameterisation example: The tool axis offsets are: 205 mm for the first axis, 206 mm for the second, 307 mm for the third and -408 mm for the fourth axis.</p> <pre> wz[5].ax_ersatz[0] 2050000 #Offset 1st axis 205 mm wz[5].ax_ersatz[1] 2060000 #Offset 2nd axis 206 mm wz[5].ax_ersatz[2] 3070000 #Offset 3rd axis 307 mm wz[5].ax_ersatz[3] -4080000 #Offset 4th Axis -408 mm </pre>

## 2.1.8 Additional tool parameters (P-TOOL-00007)

P-TOOL-00007	Additional tool parameters
Description	The user can use this parameter to freely define additional parameters for each tool.
Parameter	wz[i].param[j] where j = 0 ... 59 (number of additional freely defined parameters per tool: 60, application-specific)
Data type	REAL64
Data range	$\text{MIN}(\text{REAL64}) \leq \text{param}[j] \leq \text{MAX}(\text{REAL64})$
Dimension	----
Default value	0
Remarks	Parameterisation example: Additional free parameters are defined for Tool 5 wz[5].param[0] 1 wz[5].param[1] 20.5 wz[5].param[2] 120

## 2.1.9 Unit of length, radius and axis offsets (P-TOOL-00008)

P-TOOL-00008	Unit of length, radius and axis offsets
Description	This parameter defines the unit of length, radius and axis offsets of the tool.
Parameter	wz[i].mass_einheit
Data type	UNS16
Data range	0: Dimensional unit of length, radius and axis offsets is millimetres (10 <sup>-4</sup> mm) 1: Dimensional unit of length, radius and axis offsets is inch (10 <sup>-4</sup> inch)
Dimension	----
Default value	0
Remarks	<p>This parameter is only used to adopt tool data for length (P-TOOL-00003 [► 15]), radius (P-TOOL-00004 [► 15]) and axis offsets (P-TOOL-00006 [► 18]) from a tool list. This parameter has no meaning if tool data is adopted from an external tool management system (e.g. from the PLC).</p> <p>Parameterisation example: The tool data of length, radius and axis offsets is specified in the unit 'millimetre'.</p> <p><i>wz[5].mass_einheit 0</i></p>

### 2.1.10 Kinematic parameters (P-TOOL-00009)

P-TOOL-00009	Kinematic parameters
Description	These parameters are used for tool-dependent parameterisation of kinematic transformation (RTCP / TLC / TOOL ORI CS [PROG]). Assignment is defined application-specific.
Parameter	wz[i].kinematic.param[j] where j = 0 ... 74 (maximum number of kinematic parameters, application-specific, syntax as of V263 and higher)
Data type	SGN32
Data range	MIN(SGN32) < param[j] < MAX(SGN32)
Dimension	0.1µm
Default value	0
Remarks	<p><i>wz[i].kinematic.wz_kopf_ersatz[j]</i> (Syntax up to V260)</p> <p>In addition, it is possible to enter offsets for every kinematic parameter in the channel parameters P-CHAN-00094. If an element is assigned in both lists, the CNC performs an addition of the specified values.</p> <p>For more details regarding the parameterisation of kinematic transformation for 5-axis machining, see [KITRA] and [PROG].</p> <p>Parameterisation example:</p> <pre> wz[5].kinematic.param[0] 1538000 #Tool offset 1: 153.8 mm wz[5].kinematic.param[1] 25000 #Tool offset 2: 2.5 mm wz[5].kinematic.param[2] 0 #Tool offset 3: 0 mm wz[5].kinematic.param[5] 900000 #Tool offset 6: 90 mm </pre>

### 2.1.11 Tool fixed / alignable (P-TOOL-00010)

P-TOOL-00010	Tool fixed / alignable
Description	This parameter is assigned the value TRUE if the tool orientation relative to the machine axis coordinate system and in combination with the 'Machining Coordinate System' [PROG] functionality cannot and should not be changed (e.g. because of non existent rotary axes). In this case, tool axis offsets (P-TOOL-00006 [► 18]) as components of the tool offset vector always relate to the machine axes.
Parameter	wz[i].tool_fixed
Data type	BOOLEAN
Data range	0/1
Dimension	----
Default value	0
Remarks	Parameterisation example: This parameter indicates whether the measuring probe is aligned in parallel to the axes of the rotated coordinate system for measuring in the machining coordinate system <i>wz[5].tool_fixed 1 #Tool fixed</i>

### 2.1.12 Kinematic ID (P-TOOL-00011)

P-TOOL-00011	Kinematic ID
Description	The purpose of kinematic ID is to identify the machine or tool head specific kinematic types implemented in the controller.  This parameter defines the kinematic transformation to be used for the tool. When it is assigned the value 0, the kinematic ID results from the default setting as described in P-CHAN-00032 or from the programming in the NC program (#KIN ID [...] or #TRAFO [...]).  The kinematic ID always refers to a transformation which must be defined in the channel parameters in a data record of the first kinematic step (kin_step[0].trafo[*].id or trafo[*].id).
Parameter	wz[i].kin_id
Data type	UNS16
Data range	$0 \leq \text{kin\_id} \leq \text{MAX}(\text{UNS16})$
Dimension	----
Default value	0
Remarks	

### 2.1.13 Name of the assigned partial kinematic (P-TOOL-00148)

P-TOOL-00148	Name of the assigned partial kinematic
Description	<p>This parameter notes the name of the assigned partial kinematic.</p> <p>The name specified here is compared with the names of the partial kinematics (P-CHAN-00443) when coupling kinematics are used and a search is made for the corresponding partial kinematic. The parameter data configured in this tool is then transferred to the correct partial kinematic.</p>
Parameter	wz[i].kin_name
Data type	STRING
Data range	
Dimension	----
Default value	*
Remarks	<p>Parameterisation example:</p> <p><i>wz[1].kin_name   ROBOT</i></p> <p>* Note: The default value of variables is a blank string.</p> <p>The parameter is available as of V3.1.3080</p>

### 2.1.14 Dynamic and gear data

Depending on the application, it may be necessary to define specific dynamic data for some tools. This data is used in the spindle to limit speed and acceleration during machining. The logical axis number of the spindle must also be specified in order to transmit the dynamic data to the spindle with the assigned tool.

#### 2.1.14.1 Extended tool settings (P-TOOL-00147)

P-TOOL-00147	Extended tool settings (modes)
Description	<p>This parameter enables additional modes for the tool.</p> <p>The following modes are currently available:</p> <ul style="list-style-type: none"> <li>• <b>NONE</b>: no additional modes (default)</li> <li>• <b>GEAR_CHANGE_NO_STOP</b>: All the functions of the parameter P-TOOL-00019 [► 27] can be used when this mode is set. It permits a change in the rotation direction of M3/M4 or M4/M3 when this mode is set. In addition to P-TOOL-00019 [► 27] this mode can also differentiate between the gear ratios of the two tools. An “internal” gear change then takes place without the spindle stopping. However, the mode must be set for all the tools participating in the change.</li> </ul> <p><b>Note:</b> Only use this parameter if <u>no</u> physical tool change is linked to the D/T word (e.g. several drills/milling cutters on one machine).</p>
Parameter	wz[i].additional_settings
Data type	STRING
Data range	NONE, GEAR_CHANGE_NO_STOP
Unit	----
Default value	NONE
Remarks	Parameter available as of V3.01.3068.06

This parameter may be used for a tool system, for example, where the same spindle drives several drills simultaneously.

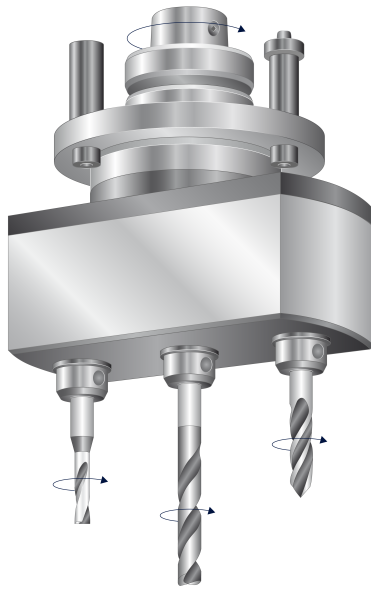


Fig. 1: Tool system with several drills

#### 2.1.14.2 Logical spindle axis number (P-TOOL-00012)

P-TOOL-00012	Logical spindle axis number
Description	<p>The dynamic data of the tool is assigned by the logical axis number of the spindle which will carry the tool after it is changed.</p> <p>If the logical axis number is assigned the value 0, no dynamic data is transferred to the spindle when the tool is changed.</p> <p>Dynamic data is modal in the spindle. It can either be overwritten</p> <ul style="list-style-type: none"> <li>• by the dynamic data of a new tool or</li> <li>• be reset by S[DEFAULT_DYNAMIK_DATA] to the default values configured.</li> </ul>
Parameter	wz[i].log_ax_nr_spdl
Data type	UNS16
Data range	$0 \leq \text{log\_ax\_nr\_spdl} \leq \text{MAX(UNS16)}$
Dimension	----
Default value	0
Remarks	<p>Parameterisation example: Assigning the dynamic data of Tool 5</p> <p>wz[5].log_ax_nr_spdl 6 #Logical axis number of the spindle</p>

### 2.1.14.3 Minimum rotation speed (P-TOOL-00013)

P-TOOL-00013	Minimum rotation speed
Description	Minimum tool rotation speed.
Parameter	wz[i].vb_min
Data type	REAL64
Data range	$0 \leq vb\_min \leq P\text{-}TOOL\text{-}00014 \text{ [ } \blacktriangleright 24 \text{ ]}$
Unit	0.001°/s
Default value	0
Remarks	The minimum rotation speed is only limited for endless turning. Parameterisation example: Assigning the dynamic data of Tool 5 <i>wz[5].vb_min 60000 #Minimum rotation speed</i>

### 2.1.14.4 Maximum rotation speed (P-TOOL-00014)

P-TOOL-00014	Maximum rotation speed
Description	Maximum tool rotation speed.
Parameter	wz[i].vb_max
Data type	REAL64
Data range	$1 \leq vb\_max \leq 2000000000$
Unit	0.001°/s
Default value	1
Remarks	Parameterisation example: Assigning the dynamic data of Tool 5 <i>wz[5].vb_max 3000000 #Maximum rotation speed</i>

### 2.1.14.5 Maximum acceleration (P-TOOL-00015)

P-TOOL-00015	Maximum acceleration
Description	Maximum tool acceleration.
Parameter	wz[i].a_max
Data type	REAL64
Data range	$1 \leq a\_max \leq 100000000$
Unit	°/s <sup>2</sup>
Default value	1
Remarks	Parameterisation example: Assigning the dynamic data of Tool 5 <i>wz[5].a_max 3000 #Maximum acceleration</i>



### 2.1.14.6 Numerator gear ratio of a tool (P-TOOL-00016)

P-TOOL-00016	Gear ratio of a tool (numerator)
Description	If the tool has a gear, this parameter specifies the gear ratio. A gear change occurs in the position controller after the tool is changed. The gear ratio need not then be considered when programming the tool rotary speed.
Parameter	wz[i].gear_ratio_num
Data type	SGN32
Data range	$0 \leq \text{gear\_ratio\_num} \leq \text{MAX}(\text{SGN32})$
Dimension	----
Default value	0
Remarks	It is only permitted to change a tool with a gear speed when the spindle is at standstill (P-TOOL-00012 [► 23]) If the numerator or the denominator is assigned the value 0, no gear change takes place.

### 2.1.14.7 Denominator gear ratio of tool (P-TOOL-00017)

P-TOOL-00017	Gear ratio of a tool (denominator)
Description	If the tool has a gear, this parameter specifies the gear ratio. A gear change occurs in the position controller after the tool is changed. The gear ratio need not then be considered when programming the tool rotary speed.
Parameter	wz[i].gear_ratio_denom
Data type	SGN32
Data range	$0 \leq \text{gear\_ratio\_denom} \leq \text{MAX}(\text{SGN32})$
Dimension	----
Default value	0
Remarks	It is only permitted to change a tool with a gear speed when the spindle is at standstill (P-TOOL-00012 [► 23]) If the numerator or the denominator is assigned the value 0, no gear change takes place.

### 2.1.14.8 Reversal of rotation direction by gear (P-TOOL-00018)

<b>P-TOOL-00018</b>	<b>Reversal of rotation direction by gear</b>
Description	If the direction of rotation is reversed by the tool gear, a change in the rotation direction can be defined in the position controller by setting this parameter to the value TRUE. This is executed as soon as a tool change is carried out.
Parameter	wz[i].gear_inv_direction
Data type	BOOLEAN
Data range	0/1
Dimension	----
Default value	0
Remarks	

## 2.1.14.9 Reversal of rotation direction without spindle standstill (P-TOOL-00019)

P-TOOL-00019	Reversal of rotation direction without spindle standstill
Description	<p>When changing a tool with a tool gear which changes the direction of rotation (see P-TOOL-00018 [► 26]), the spindle must be at standstill, otherwise the CNC generates the error message P-ERR-60290.</p> <p>If this parameter is assigned the value TRUE, a change in tool rotation direction is only evaluated when a programmed change in spindle direction takes place (M03/M04 or M04/M03). In this case, the spindle does not stop. Example: This is practical for a machine with several tools rotating at the same time.</p>
Parameter	wz[i].gear_inv_direction_no_stop
Data type	BOOLEAN
Data range	0/1
Dimension	----
Default value	0
Remarks	Only use this parameter if no physical tool change is linked to the D/T word (e.g. several drills/milling cutters on one machine).

## 2.1.15 Data for grinding applications

The following parameters are provided for grinding machining and the associated consideration and monitoring of tool wear (e.g. grinding disc).

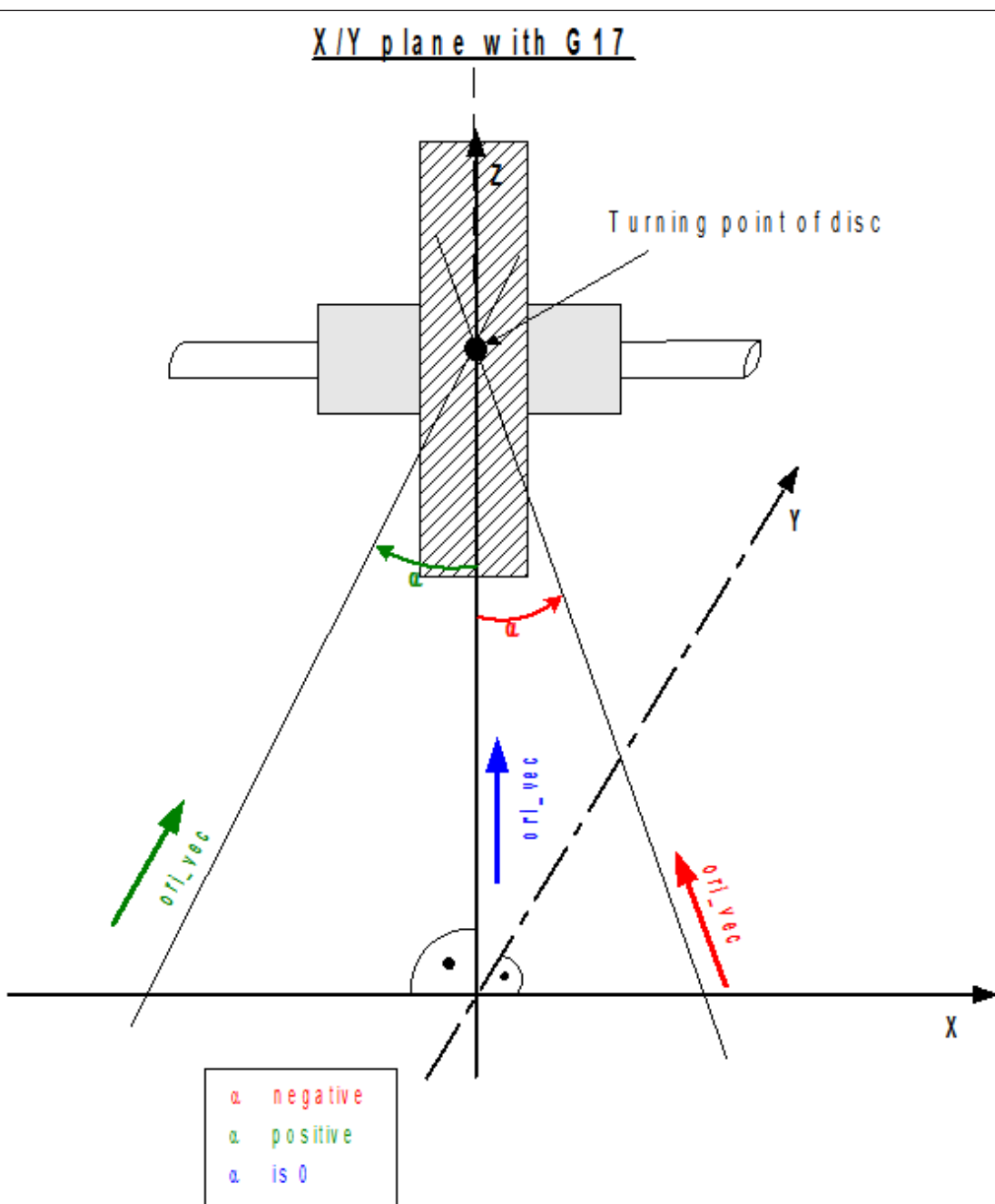
### 2.1.15.1 Wear constant (P-TOOL-00030)

P-TOOL-00030	Wear constant
Description	The wear constant is used to calculate continuous tool wear. Alternatively, it can also be defined in the NC program (#OTC [...]).
Parameter	wz[i].grinding_wear_const
Data type	REAL64
Data range	$0 \leq \text{grinding\_wear\_const}$
Dimension	0.1µm/m
Default value	0
Remarks	The wear constant should contain relatively small values. There is no special dynamic consideration based on the actual wear values.

### 2.1.15.2 Maximum discrete infeed (P-TOOL-00031)

P-TOOL-00031	Maximum discrete infeed
Description	The maximum discrete infeed defines the greatest relative change which is assignable by the PLC.
Parameter	wz[i].grinding_max_infeed
Data type	REAL64
Data range	$\text{MIN}(\text{SGN32}) \leq \text{grinding\_max\_infeed} \leq \text{MAX}(\text{SGN32})$
Dimension	0.1µm
Default value	0
Remarks	

### 2.1.15.3 Grinding disc tilt angle (P-TOOL-00138)

<b>P-TOOL-00138</b>	<b>Grinding disc tilt angle</b>
Description	The parameter defines the angle between the centre line of the grinding disc and the 3rd main axis for tilted grinding discs.
Parameter	wz[i].grinding_disc_tilt_angle
Data type	REAL64
Data range	$-45^{\circ} \leq \text{grinding\_disc\_tilt\_angle} \leq 45^{\circ}$
Dimension	0.0001°
Default value	0
Remarks	 <p>Grinding disc tilt angle</p>

## 2.1.16 Data for visualisation and collision monitoring

Tools and tool heads are displayed as graphical objects as part of machining simulation. An additional member of the kinematic chain, what is known as a linkpoint, is appended to the connected graphical tool objects for the purpose of visualisation.

The specific data required is transferred in the tool data at tool change and sent to the machining simulation by appropriate commands (#SCENE ..., V.G.WZ\_AKT.LINKPOINT...@[PROG]) in the NC program.



### Release Note

The availability of this function depends on the configuration and the scope of the version.

### 2.1.16.1 Linkpoint data (wz[i].linkpoint\_data.\*)

Linkpoint data (LINKPOINT) of the kinematic chain to which graphical tool objects are attached is entered in this structure.

#### 2.1.16.1.1 Linkpoint name (P-TOOL-00100)

P-TOOL-00100	Name of linkpoint
Description	Name of the new linkpoint of the kinematic chain.
Parameter	wz[i].linkpoint_data.name
Data type	STRING
Data range	Maximum 40 characters (application-specific)
Unit	----
Default value	-
Remarks	

#### 2.1.16.1.2 Mountpoint (P-TOOL-00101)

P-TOOL-00101	Mountpoint
Description	Name of the existing node of the kinematic chain to which the new node is attached.
Parameter	wz[i].linkpoint_data.mountpoint
Data type	STRING
Data range	Maximum 40 characters (application-specific)
Dimension	----
Default value	-
Remarks	

### 2.1.16.1.3 Translation of main axes (P-TOOL-00102)

P-TOOL-00102	Translation of main axes
Description	Shift of the link point in the main axes relative to the mountpoint.
Parameter	wz[i].linkpoint_data.translation[k] where k=0, 1, 2 (application-specific)
Data type	SGN32
Data range	$\text{MIN}(\text{SGN32}) < \text{translation}[k] < \text{MAX}(\text{SGN32})$
Dimension	0.1µm or 0.0001 inch
Default value	0
Remarks	

### 2.1.16.1.4 Rotation of main axes (P-TOOL-00103)

P-TOOL-00103	Rotation of main axes
Description	Eulerian angle by means of which current rotation of the link point is specified with respect to the mountpoint.
Parameter	wz[i].linkpoint_data.rotation[k] where k=0, 1, 2 (application-specific)
Data type	SGN32
Data range	$-360^\circ < \text{rotation}[k] < 360^\circ$
Dimension	0.001°
Default value	0
Remarks	

### 2.1.16.1.5 Axis number (P-TOOL-00104)

P-TOOL-00104	Axis number
Description	Logical axis number that leads to movement of the new linkpoint.
Parameter	wz[i].linkpoint_data.ax_nr
Data type	UNS16
Data range	$0 < \text{ax\_nr} \leq \text{MAX}(\text{UNS16})$
Dimension	----
Default value	0
Remarks	

### 2.1.16.1.6 Translation/rotation of linkpoint (P-TOOL-00105)

P-TOOL-00105	Translation/rotation of linkpoint
Description	Definition whether a movement of the axis leads to a translation in X / Y / Z or a rotation about X / Y / Z: 1-TRANS_X, 2-TRANS_Y, ..., 6-ROT_Z.
Parameter	wz[i].linkpoint_data.trans_rot
Data type	SGN32
Data range	MIN(SGN32) < trans_rot < MAX(SGN32)
Dimension	----
Default value	0
Remarks	

### 2.1.16.1.7 Effect of the movement on the linkpoint (P-TOOL-00106)

P-TOOL-00106	Effect of the movement on the linkpoint
Description	This parameter defines whether the programmed axis movements are to exert an inverting effect on the translation or rotation of the linkpoint.
Parameter	wz[i].linkpoint_data.inverse
Data type	BOOLEAN
Data range	0: Axis movement has no inverting effect on the linkpoint 1: Axis movement has an inverting effect on the linkpoint
Dimension	----
Default value	0
Remarks	

### 2.1.16.1.8 Use of the linkpoint (P-TOOL-00107)

P-TOOL-00107	Use of the linkpoint
Description	This parameter defines the method for handling the linkpoint during visualisation.
Parameter	wz[i].linkpoint_data.visible
Data type	BOOLEAN
Data range	0: Linkpoints are only for internal calculation of the chain. This means that the linkpoint is transferred once when added but it is not cyclically displayed. 1: Movements of the linkpoint are cyclically displayed when logged (e.g. via Data Factory).
Dimension	----
Default value	0
Remarks	



### 2.1.16.1.9 Position of linkpoint after axis exchange (P-TOOL-00108)

P-TOOL-00108	Position of linkpoint after axis exchange
Description	This parameter defines the method for handling a linkpoint attached to an axis during collision consideration if this axis is no longer available in the NC channel due to axis exchange.
Parameter	wz[i].linkpoint_data.fixed
Data type	BOOLEAN
Data range	0: Collision monitoring for this linkpoint can no longer be reliably executed. 1: Linkpoint position remains constant after axis exchange. Collision monitoring can be executed.
Dimension	----
Default value	0
Remarks	

### 2.1.16.1.10 Maximum lever arm length (P-TOOL-00109)

P-TOOL-00109	Maximum lever arm length
Description	Maximum lever arm length of the graphical objects attached to the (rotary) linkpoint. This is a segmentation aid for rotary axes.
Parameter	wz[i].linkpoint_data.arm_len
Data type	SGN32
Data range	MIN(SGN32) < arm_len < MAX(SGN32)
Dimension	0.1µm or 0.0001 inch
Default value	0
Remarks	

### 2.1.16.2 Object data (wz[i].gobject\_data[j].\*)

In this structure, enter data of graphical objects which are linked to the linkpoint (LINKPOINT). Application-specific objects <j> can be defined.

Structure name	Index
gobject_data[j]	j = 0 to 4 (Maximum number of graphical elements: 5, application-specific)

### 2.1.16.2.1 Name Name of graphical object (P-TOOL-00120)

P-TOOL-00120	Name of graphical object
Description	Name of the graphical object.
Parameter	wz[i].gobject_data[j].name
Data type	STRING
Data range	Maximum 40 characters (application-specific)
Unit	----
Default value	-
Remarks	

### 2.1.16.2.2 Linkpoint name (P-TOOL-00121)

P-TOOL-00121	Linkpoint name
Description	Name of the node (LINKPOINT) in the kinematics chain to which the graphical object is appended.
Parameter	wz[i].gobject_data[j].linkpoint
Data type	STRING
Data range	Maximum 40 characters (application-specific)
Dimension	----
Default value	-
Remarks	

### 2.1.16.2.3 Group name (P-TOOL-00122)

P-TOOL-00122	Group name
Description	Name of the group (summarised graphical objects) which is additionally attached to the new graphical object.
Parameter	wz[i].gobject_data[j].group[k] where k=0, 1, 2, 3, 4 (application-specific)
Data type	STRING
Data range	Maximum 40 characters (application-specific)
Dimension	----
Default value	-
Remarks	

#### 2.1.16.2.4 Translation of object (P-TOOL-00123)

P-TOOL-00123	Translation of object
Description	Shift of the graphical object or of the group with respect to the linkpoint (LINKPOINT) if specified absolutely or with respect to the previous coordinates if specified as relative (P-TOOL-00125 [► 35]).
Parameter	wz[i].gobject_data[j].translation[k] where k=0, 1, 2 (application-specific)
Data type	SGN32
Data range	MIN(SGN32) < translation[k] < MAX(SGN32)
Dimension	0.1µm or 0.0001 inch
Default value	0
Remarks	

#### 2.1.16.2.5 Rotation of object (P-TOOL-00124)

P-TOOL-00124	Rotation of object
Description	Eulerian angle by which the static rotation of the graphical object is specified relative to the node point (LINKPOINT).
Parameter	wz[i].gobject_data[j].rotation[k] where k=0, 1, 2 (application-specific)
Data type	SGN32
Data range	-360° < rotation[k] < 360°
Dimension	0.001°
Default value	0
Remarks	

#### 2.1.16.2.6 Effect of shift and rotation (P-TOOL-00125)

P-TOOL-00125	Effect of shift and rotation
Description	This parameter defines how the programmed shifts and rotations are to affect the current shifts and rotations.
Parameter	wz[i].gobject_data[j].relative
Data type	BOOLEAN
Data range	0: The specified shift/rotation replaces all previously activated shifts/rotations. 1: Shift and rotation have an accumulative effect on the current shift or rotation.
Dimension	----
Default value	0
Remarks	

### 2.1.16.2.7 File containing description of object data (P-TOOL-00126)

P-TOOL-00126	File containing description of object data
Description	Name of the file which additionally describes the graphical object (e.g. VRML file).
Parameter	wz[i].gobject_data[j].file
Data type	STRING
Data range	Maximum 40 characters (application-specific)
Dimension	----
Default value	-
Remarks	

### 2.1.16.2.8 Key name (P-TOOL-00127)

P-TOOL-00127	Key name
Description	Key name of a key/value pair (value name: P-TOOL-00128 [► 36]) which additionally describes the graphical object.
Parameter	wz[i].gobject_data[j].key[k] where k=0, 1, 2, 3, 4 (number of key/value pairs per tool: 5, application-specific)
Data type	STRING
Data range	Maximum 40 characters (application-specific)
Dimension	----
Default value	-
Remarks	

### 2.1.16.2.9 Value name (P-TOOL-00128)

P-TOOL-00128	Value name
Description	Value name of a key/value pair (key name: P-TOOL-00127 [► 36]) which additionally describes the graphical object.
Parameter	wz[i].gobject_data[j].value[k] where k=0, 1, 2, 3, 4 (number of key/value pairs per tool: 5, application-specific)
Data type	STRING
Data range	Maximum 40 characters (application-specific)
Dimension	----
Default value	-
Remarks	

**2.1.16.2.10 Information about a change (P-TOOL-00129)**

<b>P-TOOL-00129</b>	<b>Information about a change</b>
Description	This parameter informs about a data change by the external tool management system. The user decides whether to evaluate this information or not.
Parameter	wz[i].gobject_data[j].changed
Data type	BOOLEAN
Data range	0: No change of data 1: Data change by the external tool management system.
Dimension	----
Default value	0
Remarks	

## 2.1.17 Path-specific tool data (wz[i].path[j].\*)

In systems with so-called multipath programming, path-specific tool data can be defined in the structure "wz[i].path[j]".

Structure name	Index
path[j]	j = 0 (Path 1), 1 (Path 2)

### 2.1.17.1 Tool radius (P-TOOL-00020)

P-TOOL-00020	Tool radius
Description	Enter the tool radius for each path in this parameter
Parameter	wz[i].path[j].radius
Data type	SGN32
Data range	$\text{MIN}(\text{SGN32}) \leq \text{radius} < \text{MAX}(\text{SGN32})$
Dimension	0.1 µm or 0.0001 inch
Default value	0
Remarks	<p>Parameterisation example: The tool radius of Tool 5 for Path 1 is to be 10 mm and for Path 2 10.5 mm.</p> <p><i>wz[5].path[0].radius 100000 # Tool radius 10 mm in Path 1</i></p> <p><i>wz[5].path[1].radius 105000 # Tool radius 10.5 mm in Path 2</i></p>

## 2.1.18 Settings for the free configuration of the tool number

If the parameter P-TOOL-00140 [► 39] is set to 1, any numbers can be entered for the tool in the structure "wz[i].tool\_id.\*".

Structure name	Meaning
tool_id.*	Structure for any numbers for the basic, sister and variant tools

## 2.1.18.1 Enabling tool number assignment (P-TOOL-00140)

P-TOOL-00140	Enabling tool number assignment
Description	<p>The basic setting defines the tool number &lt;i&gt; by the index of the tool structure wz[&lt;i&gt;]. As a result, the structure size determines the maximum possible number of tools and their numbers. For example, if the structure wz[&lt;i&gt;] has 200 places, the tool number range is from 0 to 199.</p> <p>If P-TOOL-00140 is set to 1, any number can be entered in the structure wz[i].tool_id.* [► 38] independent of the index numbering for each tool.</p>
Parameter	tool_data_with_id
Data type	BOOLEAN
Data range	0: Determine the tool number by the index number 1: Any definition of the tool number from the tool ID
Dimension	----
Default value	0
Remarks	The index of wz[i] only determines the number of possible tools when the parameter P-TOOL-00140 is set.

## 2.1.18.2 Defining the tool number(/tool ID (wz[i].tool\_id.\*))

### 2.1.18.2.1 Basic tool number (P-TOOL-00141)

P-TOOL-00141	Basic tool number
Description	Enter the basic tool number in this parameter.
Parameter	wz[i].tool_id.basic
Data type	SGN32
Data range	MIN(SGN32) < P-TOOL-00141 < MAX(SGN32)
Dimension	----
Default value	0
Remarks	

### 2.1.18.2.2 Sister tool number (P-TOOL-00142)

P-TOOL-00142	Sister tool number
Description	Enter the sister tool number in this parameter.
Parameter	wz[i].tool_id.sister
Data type	SGN32
Data range	MIN(SGN32) < P-TOOL-00142 < MAX(SGN32)
Dimension	----
Default value	0
Remarks	

### 2.1.18.2.3 Variant tool number (P-TOOL-00143)

P-TOOL-00143	Variant tool number
Description	Enter the variant tool number in this parameter.
Parameter	wz[i].tool_id.variant
Data type	SGN32
Data range	MIN(SGN32) < P-TOOL-00143 < MAX(SGN32)
Dimension	----
Default value	0
Remarks	

### 2.1.18.2.4 Validity flag of the sister tool (P-TOOL-00144)

P-TOOL-00144	Validity flag of the sister tool
Description	This parameter indicates whether the sister tool P-TOOL-00142 [► 40] is valid.
Parameter	wz[i].tool_id.sister_valid
Data type	BOOLEAN
Data range	0 / 1
Dimension	----
Default value	0
Remarks	



### 2.1.18.2.5 Validity flag of the variant tool (P-TOOL-00145)

P-TOOL-00145	Validity flag of the variant tool
Description	This parameter indicates whether the variant tool is valid. It is specified by P-TOOL-00143 [► 40]
Parameter	wz[i].tool_id.variant_valid
Data type	BOOLEAN
Data range	0 / 1
Dimension	----
Default value	0
Remarks	

### 3 Example of assigning tool data

```
# *****
# Tool data
# *****
# Important note : Behind the comment character '#'
# a blank (space) must be added
# CAUTION: Tool dimensions are expected in the unit
# 0.1 µm or 0.0001 inch.
# *****
# =====
# Tool data for tool no. 5
# =====
Wz[5].laenge 6000 # Tool length
Wz[5].radius 54000 # Tool radius
Wz[5].gueltig 1 # Tool validity flag TRUE
Wz[5].mass_einheit 0 # Tool dimensional unit MM
Wz[5].ax_ersatz[0] 205000 # Offset 1. Axis
Wz[5].ax_ersatz[1] 206000 # Offset 2. Axis
Wz[5].ax_ersatz[2] 307000 # Offset 3. Axis
Wz[5].ax_ersatz[3] 408000 # Offset 4. Axis
Wz[5].log_ax_nr_spdl 6 # Logical axis number of spindle
Wz[5].vb_min 60000 # Minimum rotation speed
Wz[5].vb_max 3000000 # Maximum rotation speed
Wz[5].a_max 3000 # Maximum acceleration
# =====
# Tool data for tool no. 8
# =====
Wz[8].laenge 8000 # Tool length
Wz[8].radius 45000 # Tool radius
Wz[8].gueltig 1 # Tool validity flag TRUE
Wz[8].mass_einheit 0 # Tool dimensional unit MM
Wz[8].ax_ersatz[0] 225000 # Offset 1. Axis
Wz[8].ax_ersatz[1] -336000 # Offset 2. Axis
Wz[8].ax_ersatz[2] -457000 # Offset 3. Axis
Wz[8].ax_ersatz[3] 578000 # Offset 4. Axis
Wz[8].kinematic.param[0] 1538000 # Tool offset 1: 153.8 mm
Wz[8].kinematic.param[1] 25000 # Tool offset 2: 2.5 mm
Wz[8].kinematic.param[2] 0 # Tool offset 3: 0 mm
Wz[8].kinematic.param[5] 900000 # Tool offset 6; 90 mm
Wz[8].tool_fixed 1 # Tool fixed
Wz[8].kin_id 6 # Kinematic 6
# =====
# Tool data for tool no. 15
# =====
Wz[15].typ 1 # Turning tool
Wz[15].srk_lage 5 # Cutter position
Wz[15].laenge 8250 # Tool length
Wz[15].radius 200 # Tool radius
Wz[15].gueltig 1 # Tool validity flag TRUE
Wz[15].mass_einheit 0 # Tool dimensional unit MM
Wz[15].ax_ersatz[0] 0 # Offset 1. Axis
Wz[15].ax_ersatz[1] 0 # Offset 2. Axis
Wz[15].ax_ersatz[2] 0 # Offset 3. Axis
Wz[15].ax_ersatz[3] 0 # Offset 4. Axis
```

```
# =====
# Tool data for tool no. 23
# =====
wz[23].laenge 5000 # Tool length
wz[23].radius 10000 # Tool radius
wz[23].gueltig 1 # Tool validity flag TRUE
wz[23].mass_einheit 0 # Tool dimensional unit MM
wz[23].ax_ersatz[0] 565000 # Offset 1. Axis
wz[23].ax_ersatz[1] 236000 # Offset 2. Axis
wz[23].ax_ersatz[2] -233000 # Offset 3. Axis
wz[23].ax_ersatz[3] 566400 # Offset 4. Axis
#
# Example of GOBJECT description in internal tool data base
#
wz[1].gobject[0].name GO_NAME
wz[1].gobject[0].linkpoint GO_LINKPOINT
wz[1].gobject[0].group[0] GO_GROUP
wz[1].gobject[0].group[1] GO_GROUP_1
wz[1].gobject[0].group[2] GO_GROUP_2
wz[1].gobject[0].group[3] GO_GROUP_3
wz[1].gobject[0].group[4] GO_GROUP_4
wz[1].gobject[0].translation[0] 10000 # integer in [0.1 um]
wz[1].gobject[0].translation[1] 20000
wz[1].gobject[0].translation[2] 30000
wz[1].gobject[0].rotation[0] 300000 # integer in [0.0001 degree]
wz[1].gobject[0].rotation[1] 600000
wz[1].gobject[0].rotation[2] 900000
wz[1].gobject[0].relative 1
wz[1].gobject[0].changed 1
wz[1].gobject[0].file GO_FILE
wz[1].gobject[0].key[0] GO_KEY
wz[1].gobject[0].key[1] GO_KEY_1
wz[1].gobject[0].key[2] GO_KEY_2
wz[1].gobject[0].key[3] GO_KEY_3
wz[1].gobject[0].key[4] GO_KEY_4
wz[1].gobject[0].value[0] GO_VALUE
wz[1].gobject[0].value[1] GO_VALUE_1
wz[1].gobject[0].value[2] GO_VALUE_2
wz[1].gobject[0].value[3] GO_VALUE_3
wz[1].gobject[0].value[4] GO_VALUE_4
#
wz[1].gobject[1].name GO_1_NAME
wz[1].gobject[1].file GO_1_FILE
:
wz[1].gobject[2].name GO_2_NAME
wz[1].gobject[2].file GO_2_FILE
:
wz[1].gobject[3].name GO_3_NAME
wz[1].gobject[3].file GO_3_FILE
:
wz[1].gobject[4].name GO_4_NAME
wz[1].gobject[4].file GO_4_FILE
```

```
#  
# Example of LINKPOINT description in internal tool data base  
#  
wz[1].linkpoint.name LP_NAME  
wz[1].linkpoint.mountpoint LP_MOUNTPOINT  
wz[1].linkpoint.translation[0] 1  
wz[1].linkpoint.translation[1] 2  
wz[1].linkpoint.translation[2] 3  
wz[1].linkpoint.rotation[0] 30  
wz[1].linkpoint.rotation[1] 60  
wz[1].linkpoint.rotation[2] 90  
wz[1].linkpoint.ax_nr 1  
wz[1].linkpoint.trans_rot 1  
wz[1].linkpoint.inverse 0  
wz[1].linkpoint.visible 1  
wz[1].linkpoint.fixed 0  
wz[1].linkpoint.arm_len 1234  
#  
End
```

## 4 Appendix

### 4.1 References

[CHAN] Documentation of channel parameters

[PROG] CNC programming manual

### 4.2 Suggestions, corrections and the latest documentation

Did you find any errors? Do you have any suggestions or constructive criticism? Then please contact us at [documentation@isg-stuttgart.de](mailto:documentation@isg-stuttgart.de). The latest documentation is posted in our Online Help (DE/EN):



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