DOCUMENTATION ISG-kernel

Manual
Axis compensation

Short Description:
COMP

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Preface

Legal information

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

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

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.

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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 compensation parameters

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

- Column 1 contains the unambiguous identifier of the compensation parameter called the “ID” which consists of the prefix “P-COMP” and a unique 5-digit number, e.g. P-COMP-00001.
- Column 2 represents the data structure which defines the parameters, e.g. kopf.
  The structure is a categorisation aid and is described in the following section.
- Column 3 contains the “parameter” with its exact description, e.g. achs_nr. The important thing is that “structure”+”parameter” always belong together and must therefore be configured in exactly the same way in the compensation parameter list, e.g. kopf.achs_nr
- Column 4 contains the “functionality” in a summarised term/short description, e.g. logical axis number.

ID	Structure	Parameter	Functionality/ Short description
P-COMP-00001 [▸ 13]	kopf.	achs_nr	Logical axis number
P-COMP-00002 [▸ 13]	kopf.	log_achs_name	Axis name
P-COMP-00004 [▸ 15]	kw.crosscomp.	last_index	Last index of compensation value table (cross compensation)
P-COMP-00005 [▸ 15]	kw.crosscomp.	slave_ax_nr	Logical axis number of the master axis (cross compensation)
P-COMP-00006 [▸ 17]	kw.crosscomp.table[i].	setpoint	Interpolation point of the master axis (cross compensation)
P-COMP-00007 [▸ 17]	kw.crosscomp.table[i].	correction	Compensation values for the slave axis (cross compensation)
P-COMP-00009 [▸ 20]	kw.crosscomp2.	interval	Distance between interpolation points (plane compensation)
P-COMP-00010 [▸ 22]	kw.crosscomp2.	last_index_master1	Last index of master axis 1 (plane compensation)
P-COMP-00011 [▸ 22]	kw.crosscomp2.	last_index_master2	Last index of master axis 2 (plane compensation)
P-COMP-00012 [▸ 23]	kw.crosscomp2.	start_position_master1	Start position of master axis 1 (plane compensation)
P-COMP-00013 [▸ 23]	kw.crosscomp2.	start_position_master2	Start position of master axis 2 (plane compensation)
P-COMP-00014 [▸ 23]	kw.crosscomp2.	master1_ax_nr	Logical axis number of the master axis 1 (plane compensation)

ID	Structure	Parameter	Functionality/ Short description
P-COMP-00015 [▶ 24]	kw.crosscomp2.	master2_ax_nr	Logical axis number of the master axis 2 (plane compensation)
P-COMP-00016 [▶ 26]	kw.crosscomp2.table[i][j].	correction	Compensation values for the slave axis (plane compensation)
P-COMP-00017 [▶ 28]	kw.ssfk.	unit	Unit of the length/position entries (leadscrew error compens.)
P-COMP-00018 [▶ 29]	kw.ssfk.	interval	Distance between interpolation points (leadscrew error compens.)
P-COMP-00019 [▶ 29]	kw.ssfk.	kw_startpos	Start position of compensation values (leadscrew error compens.)
P-COMP-00020 [▶ 29]	kw.ssfk.	kw_nr_max	Number of compensation values (leadscrew error compens.)
P-COMP-00021 [▶ 30]	kw.ssfk.	bilateral	Operation mode of compensation (leadscrew error compens.)
P-COMP-00022 [▶ 30]	kw.ssfk.	modulo	Compensation of a modulo axis (leadscrew error compens.)
P-COMP-00023 [▶ 32]	kw.ssfk.table[i].	pos	Compensation value in positive direction (leadscrew error compens.)
P-COMP-00024 [▶ 32]	kw.ssfk.table[i].	neg	Compensation value in negative direction (leadscrew error compens.)
P-COMP-00025 [▶ 33]	kw.ssfk.table[i].	setpoint	Interpolation points of the axis (leadscrew error compens.)
P-COMP-00026 [▶ 16]	kw.crosscomp.	n_cycles	Number of cycles for ‘smooth switching’ (cross compensation)
P-COMP-00027 [▶ 24]	kw.crosscomp2.	n_cycles	Number of cycles for ‘smooth switching’ (cross compensation)
P-COMP-00028 [▶ 31]	kw.ssfk.	manual_activation	Manual activation (leadscrew error compens.)
P-COMP-00029 [▶ 16]	kw.crosscomp.	manual_activation	Manual activation (cross compensation)
P-COMP-00030 [▶ 25]	kw.crosscomp2.	manual_activation	Manual activation (plane compensation)
P-COMP-00031 [▶ 20]	kw.crosscomp2.	grid	Type of interpolation point grid (plane compensation)

ID	Structure	Parameter	Functionality/ Short description
P-COMP-00032 [▶ 21]	kw.crosscomp2.	interval1	Distance between the interpolation points of the first master axis (plane compensation)
P-COMP-00033 [▶ 21]	kw.crosscomp2.	interval2	Distance between the interpolation points on the second master axis (plane compensation)
P-COMP-00041 [▶ 36]	frict_comp.	mode	Friction compensation mode
P-COMP-00042 [▶ 36]	frict_comp.	table_entries	Number of elements in the compensation value table (friction compensation)
P-COMP-00043 [▶ 36]	frict_comp.	position_delay	Delay value for current build-up (friction compensation)
P-COMP-00044 [▶ 37]	frict_comp.	reversal_lookahead	Reversal look ahead (friction compensation)
P-COMP-00045 [▶ 37]	frict_comp.	scaling_factor	Scaling factor for the compensation values friction compensation)
P-COMP-00046 [▶ 37]	frict_comp.table[i].	in	Velocity input variable (friction compensation)
P-COMP-00047 [▶ 38]	frict_comp.table[i].	out	Measured friction (motor current) – output variable (friction compensation)
P-COMP-00057 [▶ 31]	kw.ssfk.	set_pos_without_comp	Consideration of other axis compensations
P-COMP-00058 [▶ 38]	frict_comp.	delay_cycles	Delay time for the compensation values (friction compensation)
P-COMP-00059 [▶ 28]	kw.ssfk.	max_points	Max. table entries (leadscrew error compens.)
P-COMP-00060 [▶ 14]	kw.crosscomp.	max_points	Max. table entries (cross compensation)
P-COMP-00061 [▶ 19]	kw.crosscomp2.	max_points	Max. table entries (plane compensation)
P-COMP-00062 [▶ 35]	frict_comp.	max_points	Max. table entries (friction compensation)
P-COMP-00063 [▶ 39]	kw.crosstalk.	master_ax_nr	Log. Axis number of the master axis
P-COMP-00064 [▶ 39]	kw.crosstalk.	n_cycles	Number of cycles for ‘smooth switching’
P-COMP-00065 [▶ 40]	kw.crosstalk.	last_index	Last index of compensation value table

ID	Structure	Parameter	Functionality/ Short description
P-COMP-00066 [▸ 40]	kw.crosstalk.table[i].	acceleration	Accelerations of the master axis
P-COMP-00067 [▸ 40]	kw.crosstalk.table[i].	correction	Compensation values for the slave axis
P-COMP-00073 [▸ 41]	kw.crosstalk.master_ax_nr	manual_activation	Manual activation of crosstalk compensation

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 Classification of compensation data

Compensation data for the compensation process is filed for each axis in compensation value lists (*achskw*.lis*).

The following compensation processes are available:

- Cross compensation
- Plane compensation
- Leadscrew error compensation
- Friction compensation

These compensation value lists are read in during controller start-up or they can be updated at a later time.

Some specific entries must be present in the start-up description in order to signal the compensation table to the control system [STUP].

The compensation value list consists of a list header in which general data is entered and the list body in which the compensation algorithm is parameterised and which contains the actual compensation table.

Compensation is activated in the associated axis machine record:

Compensation procedure	Activation parameters
Cross compensation	P-AXIS-00047
Plane compensation	P-AXIS-00174
Leadscrew error compensation	P-AXIS-00175
Friction compensation	P-AXIS-00522

1.3 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

1.4 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 The compensation list header (kopf.*)

The list header is identified in the list by the variable name 'kopf'. It includes the following elements.

Attention

If the compensation value list is configured by the TwinCAT System Manager, these entries are made automatically in the compensation value list.

2.1 Logical axis number (P-COMP-00001)

P-COMP-00001	**Logical axis number**	
Description	The logical axis number is a system-wide unique identifier for each axis. The compensation value list is assigned to the corresponding logical axis using this parameter.	
Parameter	kopf.achs_nr	
Data type	UNS16	
Data range	0 < achs_nr < MAX(UNS16)	
Axis types	T, R, S	
Dimension	T: ----	R,S: ----
Default value	0	
Remarks	It is not allowed to use the same logical axis number more than once. The logical axis number "0" is not allowed.	

2.2 Axis name (P-COMP-00002)

P-COMP-00002	**Axis name**	
Description	This axis name of the axis is used only for diagnostic purposes and has otherwise no meaning.	
Parameter	kopf.log_achs_name	
Data type	STRING	
Data range	Maximum 16 characters (length of axis name, application-specific)	
Axis types	T, R, S	
Dimension	T: ----	R,S: ----
Default value	0	
Remarks		

3 General compensation value data (kw.*)

The list body contains general data and the compensation tables. The entries in the list body are identified by the structure variable **kw** . For the specific compensation processes it contains the following substructures.

3.1 Cross compensation (kw.crosscomp.*)

Cross compensation (also called sag compensation) permits the correction of an axis position depending on the command position of another axis.

Cross compensation data is defined in the correction value list of the master axis. General data of the list body is entered in the structure **kw.crosscomp***. It contains the following elements.

3.1.1 Maximum number of table entries for cross compensation (P-COMP-00060)

P-COMP-00060	**Maximum number of table entries for cross compensation**	
Description	This cross compensation parameter (FCT-C5) saves the memory space required for a particular number of table entries. The size of the actually used compensation table is defined by `last_index` (P-COMP-00004 [▶ 15]) and `last_index` must be smaller than `max_points`.	
Parameter	kw.crosscomp.max_points	
Data type	UNS32	
Data range	0 <= P-COMP-00060	
Axis types	T, R, S	
Dimension	T: ----	R,S: ----
Default value	1001	
Remarks	The parameter value can no longer be changed after start-up or after lists are reloaded. Otherwise error ID 110639 is output. If P-COMP-00060 is not specified (or assigned the value 0), the default value is assigned to P-COMP-00060 for downward compatibility reasons. To avoid the default assignment, memory can be saved for an axis that does not use cross compensation by assigning the value 1 to P-COMP-00060. This parameter is available as of CNC Build V3.3079.06	

3.1.2 Last index of compensation value table (P-COMP-00004)

P-COMP-00004	**Last index of compensation value table**	
Description	This parameter determines the last valid index in the table of the master axis. The table always starts with index 0	
Parameter	kw.crosscomp.last_index	
Data type	SGN32	
Data range	0 ≤ last_index < P-COMP-00060 [▸ 14]	
Axis types	T, R, S	
Dimension	T: ----	R,S: ----
Default value	0	
Remarks	P-COMP-00060 [▸ 14] is available as of Build V3.1.3079.06. The upper limit in previous CNC versions is 1000.	

3.1.3 Logical axis number of the master axis (P-COMP-00005)

P-COMP-00005	**Logical axis number of the master axis**	
Description	This parameter determines the logical number of the master axis whose command position is used to calculate the input variable of the compensation value table of the slave axis.	
Parameter	kw.crosscomp.master_ax_nr	
Data type	UNS16	
Data range	1 ≤ master_ax_nr ≤ MAX (UNS16)	
Axis types	T, R, S	
Dimension	T: ----	R,S: ----
Default value	0	
Remarks		

3.1.4 Number of cycles for ‘smooth switching’ (P-COMP-00026)

P-COMP-00026	**Number of cycles for ‘smooth switching’**	
Description	This parameter determines the number of cycles for which cross compensation is activated/ deactivated smoothly.	
Parameter	kw.crosscomp.n_cycles	
Data type	UNS16	
Data range	0 ≤ n_cycles ≤ 20 (maximum number of cycles for which cross compensation is activated/ deactivated, application-specific)	
Axis types	T, R, S	
Dimension	T: ----	R,S: ----
Default value	0	
Remarks		

3.1.5 Manual activation (P-COMP-00029)

P-COMP-00029	**Manual activation**	
Description	Cross compensation is automatically activated by the CNC if it selected in the axis parameters (P-AXIS-00047) and the required conditions are met (e.g. axis is homed). If the parameter is set to the value 1, cross compensation must be activated explicitly by an NC command (see [PROG//Selecting/deselecting axis compensations in the NC program]. In addition, compensation is deselected at the end of the NC program, at CNC reset and on axis release.	
Parameter	kw.crosscomp.manual_activation	
Data type	BOOLEAN	
Data range	0: Automatic activation 1: Manual activation in NC program	
Axis types	T, R, S	
Dimension	T: ----	R,S: ----
Default value	0	
Remarks		

3.1.6 Table of compensation values (kw.crosscomp.table[i].*)

For each interpolation point (maximum 1000 values) in the table kw.crosscomp.table[i].* the corresponding compensation value of the slave axis is entered. The compensation table is valid for positive and negative directions of motion. It contains the following elements.

Structure name	Index
table[i]	0 ≤ i ≤ 999 (maximum 1000 values)

3.1.6.1 Interpolation point of the master axis (P-COMP-00006)

P-COMP-00006	Interpolation point of the master axis	
Description	This parameter determines the interpolation points of the master axis on which the slave axis has to be corrected.	
Parameter	kw.crosscomp.table[i].setpoint	
Data type	SGN32	
Data range	MIN(SGN32) ≤ setpoint < MAX(SGN32)	
Axis types	T, R, S	
Dimension	T: 0.1 µm or increments	R,S: 0.0001° or increments
Default value	0	
Remarks		

3.1.6.2 Compensation values for the slave axis (P-COMP-00007)

P-COMP-00007	Compensation values for the slave axis	
Description	This parameter determines the relative compensation values for the slave axis at interpolation points 'i'.	
Parameter	kw.crosscomp.table[i].correction	
Data type	SGN32	
Data range	MIN(SGN32) ≤ correction < MAX(SGN32)	
Axis types	T, R, S	
Dimension	T: 0.1 µm or increments	R,S: 0.0001° or increments
Default value	0	
Remarks		

3.1.7 Example of a compensation value list

```
# ****************************************
# Axis compensation data for Z-axis
# ****************************************

kopf.achs_nr                          3
kopf.log_achs_name                    Z
kw.crosscomp.last_index               99  /*Last valid index of the
table*/
kw.crosscomp.master_ax_nr             1   /*Log. ax. number of the mas-
ter axis*/
kw.crosscomp.unit                     1   /*0:Incr. 1:Metric in 0.1 µm*/
kw.crosscomp.n_cycles                 10
#
kw.crosscomp.table[0].setpoint        10735
kw.crosscomp.table[0].correction      3
kw.crosscomp.table[1].setpoint        11523
kw.crosscomp.table[1].correction      5
:
:
kw.crosscomp.table[99].setpoint       10000000  /*at 1000 mm of axis 3*/
kw.crosscomp.table[99].correction     1000      /*corr. of 0.1 mm for
axis 1*/
```

3.2 Plane compensation (kw.crosscomp2.*)

Plane compensation allows the correction of an axis position depending on the actual positions of two axes. The axis for which correction is active is called the slave axis. The two axes whose command positions influence the compensation value are called master axes.

The data for plane compensation is defined in the compensation value list of the slave axis. General data of the list body is entered in the structure **kw.cross comp2**.*. It contains the following elements.

3.2.1 Maximum number of table entries for plane compensation (P-COMP-00061)

P-COMP-00061	**Maximum number of table entries for plane compensation**	
Description	This plane compensation parameter (FCT-C5) saves the memory space required for a particular number of table entries. The size of the actually used compensation table is defined by `last_index:master1` (P-COMP-00010 [▶ 22]) and `last_index_master2` (P-COMP-00011 [▶ 22]) and the following must apply: (`last_index_master1` + 1) * (`last_index_master2` + 1) <= `max_points` If `max_points` is not specified (or assigned the value 0), the previous restrictions apply to `last_index_master1` and `last_index_master2`. • 0 <= `last_index_master1 [▶ 22]` <= 100 • 0 <= `last_index_master2 [▶ 22]` <= 100	
Parameter	kw.crosscomp2.max_points	
Data type	UNS32	
Data range	0 <= P-COMP-00061	
Axis types	T, R, S	
Dimension	T: ----	R,S: ----
Default value	10201 (*)	
Remarks	The parameter value can no longer be changed after start-up or after lists are reloaded. Otherwise error ID 110640 is output. If P-COMP-00061 is not specified (or assigned the value 0), the default value is assigned to P-COMP-00061 for downward compatibility reasons. To avoid the default assignment, memory can be saved for an axis that does not use plane compensation by assigning the value 1 to P-COMP-00061. * composition of the default value: 101*101 =10201 This parameter is available as of CNC Build V3.3079.06	

3.2.2 Type of interpolation point grid (P-COMP-00031)

P-COMP-00031	**Type of interpolation point grid**	
Description	This parameter defines whether the identical interpolation point distance is used for the two master axes or whether the distances for the two master axes are defined individually.	
Parameter	kw.crosscomp2.grid	
Data type	STRING	
Data range	QUADRATIC: The identical interpolation point distance interval (P-COMP-00009) [▸ 20] is used for the two master axes. RECTANGULAR: Different interpolation point distances interval1 (P-COMP-00032) [▸ 21] and interval2 (P-COMP-00033) [▸ 21] can be set for the two master axes.	
Axis types	T, R, S	
Dimension	T: ----	R,S: ----
Default value	QUADRATIC	
Remarks		

3.2.3 Distance between interpolation points (P-COMP-00009)

P-COMP-00009	**Distance between interpolation points**	
Description	This parameter defines the distance between two interpolation points if both axes use an identical grid (P-COMP-000031 [▸ 20](grid) = QUADRATIC).	
Parameter	kw.crosscomp2.interval	
Data type	UNS32	
Data range	0 < interval < MAX(UNS32)	
Axis types	T, R, S	
Dimension	T: 0.1 µm or increments	R,S: 0.0001° or increments
Default value	0	
Remarks		

3.2.4 Distance between the interpolation points of the first master axis (P-COMP-00032)

P-COMP-00032	**Distance between the interpolation points of the first master axis**	
Description	The parameter defines the interval between two interpolation points for the first master axis if both master axes use a different grid (P-COMP-00031 [▸ 20](grid) = RECTANGULAR).	
Parameter	kw.crosscomp2.interval1	
Data type	UNS32	
Data range	0 < interval1 < MAX(UNS32)	
Axis types	T, R, S	
Dimension	T: 0.1 µm or increments	R,S: 0.0001° or increments
Default value	0	
Remarks		

3.2.5 Distance between interpolation points on the second master axis (P-COMP-00033)

P-COMP-00033	**Distance between the interpolation points on the second master axis**	
Description	The parameter defines the interval between two interpolation points for the first master axis if both master axes use a different grid (P-COMP-00031 [▸ 20](grid) = RECTANGULAR).	
Parameter	kw.crosscomp2.interval2	
Data type	UNS32	
Data range	0 < interval2 < MAX(UNS32)	
Axis types	T, R, S	
Dimension	T: 0.1 µm or increments	R,S: 0.0001° or increments
Default value	0	
Remarks		

3.2.6 Last index of master axis 1 (P-COMP-00010)

P-COMP-00010	**Last index of master axis 1**	
Description	This parameter determines the last valid index in the table of master axis 1 (maximum value is 100). The table always starts with index 0.	
Parameter	kw.crosscomp2.last_index_master1	
Data type	SGN32	
Data range	0 ≤ P-COMP-00010 <= 100	
Axis types	T, R, S	
Dimension	T: ----	R,S: ----
Default value	0	
Remarks	As of Build V3.1.3079.06, P-COMP-00010 is freely assignable. There is no upper limit. However, the condition of P-COMP-00061 [▸ 19] must be complied with. P-COMP-00010 * P-COMP-00011 [▸ 22] <= P-COMP-00061 [▸ 19] **Attention**: If this parameter is re-interpreted, all the values in the compensation value table [▸ 26] (P-COMP-00016 [▸ 26]) must be read in again.	

3.2.7 Last index of master axis 2 (P-COMP-00011)

P-COMP-00011	**Last index of master axis 2**	
Description	This parameter determines the last valid index in the table of the two master axes (maximum 100 values). The table always starts with index 0.	
Parameter	kw.crosscomp2.last_index_master2	
Data type	SGN32	
Data range	0 ≤ P-COMP-00011 <= 100	
Axis types	T, R, S	
Dimension	T: ----	R,S: ----
Default value	0	
Remarks	As of Build V3.1.3079.06, P-COMP-00011 is freely assignable. There is no upper limit. However, the condition of P-COMP-00061 [▸ 19] must be complied with. P-COMP-00010 [▸ 22] * P-COMP-00011 <= P-COMP-00061 [▸ 19] **Attention**: If this parameter is re-interpreted, all the values in the compensation value table [▸ 26] (P-COMP-00016 [▸ 26]) must be read in again.	

3.2.8 Start position of master axis 1 (P-COMP-00012)

P-COMP-00012	**Start position of master axis 1**	
Description	This parameter determines the start position of master axis 1 in the compensation table.	
Parameter	kw.crosscomp2.start_position_master1	
Data type	SGN32	
Data range	MIN(SGN32) ≤ start_position_master1 < MAX(SGN32)	
Axis types	T, R, S	
Dimension	T: 0.1 µm or increments	R,S: 0.0001° or increments
Default value	0	
Remarks		

3.2.9 Start position of master axis 2 (P-COMP-00013)

P-COMP-00013	**Start position of master axis 2**	
Description	This parameter determines the start position of master axis 2 in the compensation table.	
Parameter	kw.crosscomp2.start_position_master2	
Data type	SGN32	
Data range	MIN(SGN32) ≤ start_position_master2 < MAX(SGN32)	
Axis types	T, R, S	
Dimension	T: 0.1 µm or increments	R,S: 0.0001° or increments
Default value	0	
Remarks		

3.2.10 Logical axis number of the master axis 1 (P-COMP-00014)

P-COMP-00014	**Logical axis number of the master axis 1**	
Description	This parameter defines the logical axis number of the first master axis.	
Parameter	kw.crosscomp2.master1_ax_nr	
Data type	UNS16	
Data range	1 ≤ master1_ax_nr ≤ MAX (UNS16)	
Axis types	T, R, S	
Dimension	T: ----	R,S: ----
Default value	0	
Remarks		

3.2.11 Logical axis number of the master axis 2 (P-COMP-00015)

P-COMP-00015	**Logical axis number of the master axis 2**	
Description	This parameter defines the logical axis number of the second master axis.	
Parameter	kw.crosscomp2.master2_ax_nr	
Data type	UNS16	
Data range	1 ≤ master2_ax_nr ≤ MAX (UNS16)	
Axis types	T, R, S	
Dimension	T: ----	R,S: ----
Default value	0	
Remarks		

3.2.12 Number of cycles for ‘smooth switching’ (P-COMP-00027)

P-COMP-00027	**Number of cycles for ‘smooth switching’**	
Description	This parameter determines the number of cycles for which plane compensation is activated/ deactivated smoothly.	
Parameter	kw.crosscomp2.n_cycles	
Data type	UNS16	
Data range	0 ≤ n_cycles ≤ 20 (maximum number of cycles for which cross compensation is activated/ deactivated, application-specific)	
Axis types	T, R, S	
Dimension	T: ----	R,S: ----
Default value	0	
Remarks		

3.2.13 Manual activation (P-COMP-00030)

P-COMP-00030	**Manual activation**	
Description	Plane compensation is automatically activated by the CNC if it selected in the axis parameters (P-AXIS-00174) and the required conditions are met (e.g. axis is homed). If the parameter is set to value 1, plane compensation must be activated explicitly by an NC command (see [PROG//Selecting/deselecting axis compensations in the NC program]. In addition, compensation is deselected at the end of the NC program, at CNC reset and on axis release.	
Parameter	kw.crosscomp2.manual_activation	
Data type	BOOLEAN	
Data range	0: Automatic activation 1: Manual activation in NC program	
Axis types	T, R, S	
Dimension	T: ----	R,S: ----
Default value	0	
Remarks		

3.2.14 Table of compensation values (kw.crosscomp2.table[j][i].*)

The corresponding compensation value of the slave axis is entered for each interpolation point in the table kw.crosscomp2.table[j][i].*.

Structure name	Index
table[j][i]	0 ≤ j ≤ last_index_master2 (P-COMP-00011 [▸ 22]) 0 ≤ i ≤ last_index_master1 (P-COMP-00010 [▸ 22])

3.2.14.1 Compensation values for the slave axis (P-COMP-00016)

P-COMP-00016	Compensation values for the slave axis	
Description	This parameter defines the relative compensation values of the slave axis at interpolation points [j][i]. When indexing the interpolation points in the compensation list, the first index j refers to the second master axis.	
Parameter	kw.crosscomp2.table[j][i].correction	
Data type	SGN32	
Data range	MIN(SGN32) ≤ correction < MAX(SGN32)	
Axis types	T, R, S	
Dimension	T: 0.1 µm or increments	R,S: 0.0001° or increments
Default value	0	
Remarks		

3.2.15 Example of a compensation value list

```
# ****************************************
# Axis compensation data for Z-axis
# ****************************************
kopf.achs_nr                                  1
kopf.log_achs_name                            X

kw.crosscomp2.interval                        100000    /* 10 mm */
kw.crosscomp2.last_index_master1              100
kw.crosscomp2.last_index_master2              100
kw.crosscomp2.start_position_master1         -400000    /* -40 mm */
kw.crosscomp2.start_position_master2         -700000    /* -70 mm */
kw.crosscomp2.unit                            1         /* 0.1 my */
kw.crosscomp2.n_cycles                        10
kw.crosscomp2.master1_ax_nr                   2
kw.crosscomp2.master2_ax_nr                   3

kw.crosscomp2.table[ 0][ 0].correction       -3
kw.crosscomp2.table[ 0][ 1].correction       -1
kw.crosscomp2.table[ 0][ 2].correction        4
kw.crosscomp2.table[ 0][ 3].correction        9
kw.crosscomp2.table[ 0][ 4].correction       13
kw.crosscomp2.table[ 0][ 5].correction       17
kw.crosscomp2.table[ 0][ 6].correction       42
kw.crosscomp2.table[ 0][ 7].correction       53
...
kw.crosscomp2.table[100][ 90].correction     82
kw.crosscomp2.table[100][ 91].correction     77
kw.crosscomp2.table[100][ 92].correction     68
kw.crosscomp2.table[100][ 93].correction     63
kw.crosscomp2.table[100][ 94].correction     61
kw.crosscomp2.table[100][ 95].correction     59
kw.crosscomp2.table[100][ 96].correction     57
kw.crosscomp2.table[100][ 97].correction     52
kw.crosscomp2.table[100][ 98].correction     56
kw.crosscomp2.table[100][ 99].correction     58
kw.crosscomp2.table[100][100].correction     49
End
```

3.3 Leadscrew error compensation (kw.ssfk.*)

Leadscrew error compensation (referred to below as SSFK) is an axial correction. The position setpoint of the compensated axis is changed by a compensation value in the position controller timing, in order to compensate for leadscrew errors, for instance. This correction is cancelled by computation for the measured actual position values so that the correction performed does not appear in the display data of the controller.

SSFK data is stored in the corresponding compensation value list for each axis. General data of the list body is entered in the structure **kw.ssfk**.*. It contains the following elements.

3.3.1 Maximum number of table entries for leadscrew error compensation (P-COMP-00059)

P-COMP-00059	**Maximum number of table entries for leadscrew error compensation**	
Description	This leadscrew error compensation parameter (FCT-C5) sets the memory space required for a particular number of table entries. The size of the actually used compensation table is defined by `kw_nr_max` (P-COMP-00020 [▶ 29]) and `kw_nr_max` must be smaller than `max_points`.	
Parameter	kw.ssfk.max_points	
Data type	UNS32	
Data range	0 <= P-COMP-00059	
Axis types	T, R, S	
Dimension	T: ----	R,S: ----
Default value	1500	
Remarks	The parameter value can no longer be changed after start-up or after lists are reloaded. Otherwise error ID 110638 is output. If P-COMP-00059 is not specified (or assigned the value 0), the default value is assigned to P-COMP-00059 for downward compatibility reasons. To avoid the default assignment, memory can be saved for an axis that does not use leadscrew error compensation by assigning the value 1 to P-COMP-00059. This parameter is available as of CNC Build V3.3079.06	

3.3.2 Unit of the length entries (P-COMP-00017)

P-COMP-00017	**Unit of the length entries**	
Description	This parameter defines the unit of the length / position entries.	
Parameter	kw.ssfk.unit	
Data type	BOOLEAN	
Data range	0: Encoder increments 1: Metric (in 0.1 µm)	
Axis types	T, R, S	
Dimension	T: ----	R,S: ----
Default value	0	
Remarks		

3.3.3 Distance between interpolation points (P-COMP-00018)

P-COMP-00018	**Distance between interpolation points**	
Description	The parameter defines the distance between interpolation points of the compensation table when equidistant interpolation points are used. If this parameter is = 0, the position of each interpolation point must be specified separately.	
Parameter	kw.ssfk.interval	
Data type	SGN32	
Data range	0 ≤ interval < MAX(SGN32)	
Axis types	T, R, S	
Dimension	T: 0.1 µm or increments	R,S: 0.0001° or increments
Default value	0	
Remarks		

3.3.4 Start position of compensation values (P-COMP-00019)

P-COMP-00019	**Start position of compensation values**	
Description	This parameter determines the position of the axis at which the compensation table starts.	
Parameter	kw.ssfk.kw_startpos	
Data type	SGN32	
Data range	MIN(SGN32) ≤ kw_startpos < MAX(SGN32)	
Axis types	T, R, S	
Dimension	T: 0.1 µm or increments	R,S: 0.0001° or increments
Default value	0	
Remarks		

3.3.5 Number of compensation values (P-COMP-00020)

P-COMP-00020	**Number of compensation values**	
Description	This parameter defines the number of entries in the compensation table.	
Parameter	kw.ssfk.kw_nr_max	
Data type	SGN32	
Data range	0 ≤ kw_nr_max < P-COMP-00059 [▸ 28]	
Axis types	T, R, S	
Dimension	T: ----	R,S: ----
Default value	0	
Remarks	P-COMP-00059 [▸ 28] is available as of Build V3.1.3079.06.	

3.3.6 Operation mode of compensation (P-COMP-00021)

P-COMP-00021	**Operation mode of compensation**	
Description	This parameter defines whether compensation is unilateral or bilateral.	
Parameter	kw.ssfk.bilateral	
Data type	BOOLEAN	
Data range	0: Unilateral compensation 1: Bilateral compensation	
Axis types	T, R, S	
Dimension	T: ----	R,S: ----
Default value	0	
Remarks		

3.3.7 Compensation of a modulo axis (P-COMP-00022)

P-COMP-00022	**Compensation of a modulo axis**	
Description	This parameter defines the compensation table for a modulo axis. A modulo transition also takes place in the compensation table on the modulo transition of the axis position. The number of compensation values must then be equal to the number of entries in the compensation value table.	
Parameter	kw.ssfk.modulo	
Data type	BOOLEAN	
Data range	0: Compensation without modulo handling 1: Compensation for a modulo axis	
Axis types	T, R, S	
Dimension	T: ----	R,S: ----
Default value	0	
Remarks		

3.3.8 Manual activation (P-COMP-00028)

P-COMP-00028	**Manual activation**	
Description	Leadscrew error compensation is automatically activated by the CNC if it selected in the axis parameters (P-AXIS-00175) and the required conditions are met (e.g. axis is homed). If the parameter is set to value 1, leadscrew error compensation must be explicitly activated by an NC command (see [PROG//Selecting/deselecting axis compensations in the NC program]. In addition, compensation is deselected at the end of the NC program, at CNC reset and on axis release.	
Parameter	kw.ssfk.manual_activation	
Data type	BOOLEAN	
Data range	0: Automatic activation 1: Manual activation in NC program	
Axis types	T, R, S	
Dimension	T: ----	R,S: ----
Default value	0	
Remarks		

3.3.9 Consideration of other axis compensations (P-COMP-00057)

P-COMP-00057	**Consideration of other axis compensations**	
Description	By default, leadscrew error compensation also considers the compensation values generated from other axis compensations, e.g. cross and plane compensation. With direction-dependent spindle leadscrew error compensation (see P-COMP-00021 [▸ 30]) this may result in the undesirable occurrence of backlash under certain circumstances. The parameter **set_pos_without_comp** can disable the inclusion of other compensation values in the calculation.	
Parameter	kw.ssfk.set_pos_without_comp	
Data type	BOOLEAN	
Data range	0: Compensation values of other compensations are considered in the leadscrew error compensation. 1: Compensation values of other compensations are not considered.	
Axis types	T, R, S	
Dimension	T: ----	R,S: ----
Default value	0	
Remarks		

3.3.10 Table of compensation values (kw.ssfk.table[i].*)

Compensation values are specified in the table 'kw.ssfk.table[i].*' The array index i may assume a number of values determined by P-COMP-00020 [▸ 29] . Compensation values are specified as absolute position errors in the unit specified in P-COMP-00017 [▸ 28] .

Structure name	Index
table[i]	0 ≤ i ≤ kw_nr_max (P-COMP-00020 [▸ 29])

The table of compensation values contains the following elements.

3.3.10.1 Compensation value in positive direction (P-COMP-00023)

P-COMP-00023	Compensation value in positive direction	
Description	This parameter defines a compensation value in case of movement in positive direction at interpolation point 'i'.	
Parameter	kw.ssfk.table[i].pos	
Data type	SGN32	
Data range	MIN(SGN32) ≤ pos < MAX(SGN32)	
Axis types	T, R, S	
Dimension	T: 0.1 µm or increments	R,S: 0.0001° or increments
Default value	0	
Remarks		

3.3.10.2 Compensation value in negative direction (P-COMP-00024)

P-COMP-00024	Compensation value in negative direction	
Description	This parameter defines a compensation value in case of movement in negative direction at interpolation point 'i'.	
Parameter	kw.ssfk.table[i].neg	
Data type	SGN32	
Data range	MIN(SGN32) ≤ neg < MAX(SGN32)	
Axis types	T, R, S	
Dimension	T: 0.1 µm or increments	R,S: 0.0001° or increments
Default value	0	
Remarks		

3.3.10.3 Interpolation points of the axis (P-COMP-00025)

P-COMP-00025	**Interpolation points of the axis**	
Description	This parameter determines the interpolation points of the axis for which the axis must be corrected.	
Parameter	kw.ssfk.table[i].setpoint	
Data type	SGN64	
Data range	MIN(SGN64) ≤ setpoint < MAX(SGN64)	
Axis types	T, R, S	
Dimension	T: 0.1 µm or increments	R,S: 0.0001° or increments
Default value	0	
Remarks	In CNC Builds V2.11.20xx and higher, the data type is SGN32 and so is the related data range.	

3.3.11 Example of a compensation value list

The diagram below shows a compensation value table with the properties:

- Non-equidistant interpolation points (kw.ssfk.interval = 0)
- Bilateral compensation table (kw.ssfk.bilateral = 1)
- Position specifications in metric system (kw.ssfk.unit = 1)
- Compensation value table with 140 entries (kw.ssfk.kw_nr_max = 140). The index of the position and setpoint entries goes from 0 to 139.
- The following values were measured at the third gauged position (table[2]):

Programmed position $s_{soll,i}$ ith setpoint	Measured value pos $s_{ist,i}$ ith actual value (pos direction)	Measured value neg $s_{ist,i}$ ith actual value (neg direction)	pos calculated compensation value $\Delta s_i = s_{ist,i} - s_{soll,i}$	neg calculated compensation value $\Delta s_i = s_{ist,i} - s_{soll,i}$
19866.7 µm	19856.5 µm	19874.7 µm	-102 x 0.1 µm	80 x 0.1 µm

Programing Example

Example of a compensation value list

```
kopf.log_achs_nr                    2
kopf.log_achs_name                  Y-ACHSE
kw.ssfk.interval                    0
kw.ssfk.kw_startpos                 -200000
kw.ssfk.kw_nr_max                   140
kw.ssfk.unit                        1
kw.ssfk.bilateral                   1
kw.ssfk.table[0].setpoint           -200000
kw.ssfk.table[1].setpoint           -199306
kw.ssfk.table[2].setpoint           -198667
kw.ssfk.table[3].setpoint           -198001
...
kw.ssfk.table[138].setpoint         334488
kw.ssfk.table[139].setpoint         335591
kw.ssfk.table[0].pos                0
kw.ssfk.table[1].pos                24
kw.ssfk.table[2].pos                -102
...
kw.ssfk.table[139].pos              -55
kw.ssfk.table[0].neg                0
kw.ssfk.table[1].neg                67
kw.ssfk.table[2].neg                80
...
kw.ssfk.table[139].neg              114
```

3.4 Friction compensation (frict_comp.*)

The purpose of friction compensation is to compensate actually existing friction torque by way of an additional torque. Therefore, it works like speed-dependent feed forward control of motor current.

Friction compensation reduces following error and backlash. For more information see [FCT-C25].

Friction compensation parameters are defined in the compensation value list and is currently available for drive types CANopen and SERCOS. It includes the following elements.

3.4.1 Maximum number of table entries for friction compensation (P-COMP-00062)

P-COMP-00062	**Maximum number of table entries for friction compensation**	
Description	This friction compensation parameter (FCT-C25) saves the memory space required for a particular number of table entries. The size of the actually used compensation table is defined by `table_entries` (P-COMP-00042 [▶ 36]) and `table_entries` must be smaller than `max_points`.	
Parameter	frict_comp.max_points	
Data type	UNS32	
Data range	0 <= P-COMP-00062	
Axis types	T, R, S	
Dimension	T: ----	R,S: ----
Default value	20	
Remarks	The parameter value can no longer be changed after start-up or after lists are reloaded. Otherwise error ID 110641 is output. If P-COMP-00062 is not specified (or assigned the value 0), the default value is assigned to P-COMP-00062 for downward compatibility reasons. To avoid the default assignment, memory can be saved for an axis that does not use friction compensation by assigning the value 1 to P-COMP-00062. This parameter is available as of CNC Build V3.3079.06	

3.4.2 Friction interpolation mode (P-COMP-00041)

P-COMP-00041	**Friction compensation mode**	
Description	The parameter defines the operation mode for friction compensation. If the parameter is assigned the value 0, friction compensation is deactivated.	
Parameter	frict_comp.mode	
Data type	UNS16	
Data range	0: Deactivate friction compensation 3: Compensation with additive current taking into account the commanded speed	
Axis types	T, R, S	
Dimension	T: ----	R,S: ----
Default value	0	
Remarks	To activate friction compensation, the mode must and P-AXIS-00522 must be set.	

3.4.3 Number of elements in the compensation value table (P-COMP-00042)

P-COMP-00042	**Number of elements in the compensation value table**	
Description	This parameter defines the number of entries in the compensation table.	
Parameter	frict_comp.table_entries	
Data type	UNS16	
Data range	0 ≤ table_entries ≤ P-COMP-00062 [▸ 35]	
Axis types	T, R, S	
Dimension	T: ----	R,S: ----
Default value	0	
Remarks	P-COMP-00062 [▸ 35] is available as of Build V3.1.3079.06. The default upper limit is 20.	

3.4.4 Delay value for current build-up (P-COMP-00043)

P-COMP-00043	**Delay value for current build-up**	
Description	This parameter defines the delay value for current built-up at start-up. Its purpose is to prevent abrupt changes. Current build-up is linear.	
Parameter	frict_comp.position_delay	
Data type	SGN32	
Data range	0 ≤ position_delay ≤ 10	
Axis types	T, R, S	
Dimension	T: 0.1µm	R,S: 0.0001°
Default value	0	
Remarks		

3.4.5 Reversal look ahead (P-COMP-00044)

P-COMP-00044	**Reversal look ahead**	
Description	This parameter defines the number of cycles over which the motor current decays before motion reversal.	
Parameter	frict_comp.reversal_lookahead	
Data type	UNS16	
Data range	0 ≤ reversal_lookahead ≤ 4	
Axis types	T, R, S	
Dimension	T: Cycles	R,S: Cycles
Default value	0	
Remarks		

3.4.6 Scaling factor for the compensation values (P-COMP-00045)

P-COMP-00045	**Scaling factor for compensation values**	
Description	This parameter defines the scaling of all compensation values in the list.	
Parameter	frict_comp.scaling_factor	
Data type	SGN16	
Data range	MIN(SGN16) < scaling_factor < MAX(SGN16)	
Axis types	T, R, S	
Dimension	T: 0.1%	R,S: 0.1%
Default value	1000	
Remarks		

3.4.7 Velocity input variable (P-COMP-00046)

P-COMP-00046	**Velocity input variable**	
Description	This parameter defines the velocities for which the additional motor currents specified in P-COMP-00047 [▸ 38] are to be output to the additive current interface. The values must be entered in ascending order.	
Parameter	frict_comp.table[i].in where i= P-COMP-00042 [▸ 36]	
Data type	SGN32	
Data range	0 < table[i].in < MAX(SGN32)	
Axis types	T, R, S	
Dimension	T:	R,S: [0.001°/s]
Default value	0	
Remarks		

3.4.8 Measured friction (motor current) – output variable (P-COMP-00047)

P-COMP-00047	**Measured friction (motor current) – output variable**	
Description	This parameter defines the current which is to be additionally output at the additive current interface.	
Parameter	frict_comp.table[i].out where i= P-COMP-00042 [▸ 36]	
Data type	SGN32	
Data range	MIN(SGN32) < table[i].out < MAX(SGN32)	
Axis types	T, R, S	
Dimension	T: *	R,S: *
Default value	0	
Remarks	* The dimension of the motor current depends on the internal data of the related drive. In CANopen and SERCOS, this value corresponds to the contents of the CNC object *dig_drv.act_torque*.	

3.4.9 Delay time for the compensation values (P-COMP-00058)

P-COMP-00058	**Delay time for compensation values**	
Description	This parameter defines the delay time of all compensation values.	
Parameter	frict_comp.delay_cycles	
Data type	SGN16	
Data range	0 ≤ delay_cycles < 249	
Axis types	T, R, S	
Dimension	T: Cycles	R,S: Cycles
Default value	0	
Remarks		

3.5 Crosstalk compensation (kw.crosstalk.*)

The crosstalk compensation function is activated by P-AXIS-00789.

3.5.1 Logical axis number of the master axis (P-COMP-00063)

P-COMP-00063	**Logical axis number of the master axis**	
Description	This parameter determines the logical number of the master axis whose acceleration is used as the input variable of the compensation value table of the slave axis.	
Parameter	kw.crosstalk.master_ax_nr	
Data type	UNS16	
Data range	1 ≤ P-COMP-00063 ≤ MAX (UNS16)	
Axis types	T, R, S	
Dimension	T: ----	R,S: ----
Default value	0	
Remarks	Parameter available as of CNC Build V3.1.3079.32 and higher	

3.5.2 Number of cycles for ‘smooth switching’ (P-COMP-00064)

P-COMP-00064	**Number of cycles for ‘smooth switching’**	
Description	This parameter determines the number of cycles for which crosstalk compensation is coupled/decoupled softly.	
Parameter	kw.crosstalk.n_cycles	
Data type	UNS16	
Data range	0 ≤ P-COMP-00064 ≤ 20 (maximum number of cycles above which coupling or decoupling is to occur,	
Axis types	T, R, S	
Dimension	T: ----	R,S: ----
Default value	0	
Remarks	Parameter available as of CNC Build V3.1.3079.32 and higher	

3.5.3 Last index of compensation value table (P-COMP-00065)

P-COMP-00065	**Last index of compensation value table**	
Description	This parameter determines the last valid index in the table of the master axis. The table always starts with index 0	
Parameter	kw.crosstalk.last_index	
Data type	SGN32	
Data range	0 ≤ P-COMP-00065 < 5	
Axis types	T, R, S	
Dimension	T: ----	R,S: ----
Default value	0	
Remarks	Parameter available as of CNC Build V3.1.3079.32 and higher	

3.5.4 Accelerations of the master axis (P-COMP-00066)

P-COMP-00066	**Accelerations of the master axis**	
Description	This parameter defines the accelerations of the master axis requiring a correction of the slave axis.	
Parameter	kw.crosstalk.table[i].acceleration	
Data type	SGN32	
Data range	MIN(SGN32) ≤ P-COMP-00066 < MAX(SGN32)	
Axis types	T	
Dimension	T: mm/s^2	R,S: ---
Default value	0	
Remarks	Parameter available as of CNC Build V3.1.3079.32 and higher	

3.5.5 Correction values for the slave axis (P-COMP-00067)

P-COMP-00067	**Correction values for the slave axis**	
Description	This parameter determines the correction values for the slave axis at accelerations 'i'.	
Parameter	kw.crosstalk.table[i].correction	
Data type	SGN32	
Data range	MIN(SGN32) ≤ P-COMP-00067 < MAX(SGN32)	
Axis types	T, R, S	
Dimension	T: 0.1 µm	R,S: ---
Default value	0	
Remarks	Parameter available as of CNC Build V3.1.3079.32 and higher	

3.5.6 Manual activation of crosstalk compensation (P-COMP-00073)

P-COMP-00073	**Manual activation of crosstalk compensation**	
Description	The CNC enables crosstalk compensation automatically if it is selected in the axis parameters (P-AXIS-00789) and if the necessary conditions are fulfilled. If parameter P-COMP-00073 is set to the value 1, crosstalk compensation must be explicitly activated by an NC command. [PROG// Selecting/deselecting axis compensations in the NC program (COMP)]. Compensation is deactivated at the end of the NC program, when the CNC is reset or when the compensating axis is released.	
Parameter	kw.crosstalk.manual_activation	
Data type	BOOLEAN	
Data range	0: Automatic activation 1: Explicit activation in NC program	
Axis types		
Dimension	T, R, S	
Default value	0	
Remarks	Parameter available as of CNC Build V3.1.3079.32 and higher	

4 Appendix

4.1 Discontinued parameters

4.1.1 Unit of the length entries (P-COMP-00003)

P-COMP-00003	**Unit of the length entries**	
Description	The parameter defines the unit to be used for the length entries of compensation values.	
Parameter	kw.crosscomp.unit	
Data type	BOOLEAN	
Data range	0: Encoder increments 1: Metric (in 0.1 µm)	
Axis types	T, R, S	
Dimension	T: ----	R,S: ----
Default value	0	
Remarks		

4.1.2 Unit of the length entries (P-COMP-00008)

P-COMP-00008	**Unit of the length entries**	
Description	This parameter defines the unit of the length / position entries.	
Parameter	kw.crosscomp2.unit	
Data type	BOOLEAN	
Data range	0: Encoder increments 1: Metric (in 0.1 µm)	
Axis types	T, R, S	
Dimension	T: ----	R,S: ----
Default value	0	
Remarks		

4.2 References

[STUP] Documentation of start-up list

[CHAN] Documentation of channel parameters

[AXIS] Documentation of axis parameters

4.3 Suggestions, corrections and the latest documentation

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P

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