

Axis Compensation

Application Note 140

Version	Date	Editor	Comment
001	2021-09-14	dg	How to setup axis compensation

Document AN140_AxisCompensation_EP
 Version 001
 Source Q:\doc\ApplicationNotes\
 Destination T:\doc\Org\Templates
 Owner chm

Copyright © 2021	Triamec Motion AG	Phone +41 41 747 4040
Triamec Motion AG	Lindenstrasse 16	Email info@triamec.com
All rights reserved.	6340 Baar / Switzerland	Web www.triamec.com

Disclaimer

This document is delivered subject to the following conditions and restrictions:

- This document contains proprietary information belonging to Triamec Motion AG. Such information is supplied solely for the purpose of assisting users of Triamec products.
- The text and graphics included in this manual are for the purpose of illustration and reference only. The specifications on which they are based are subject to change without notice.
- Information in this document is subject to change without notice.

Table of Contents

1 Summary.....2	3 Implementational Considerations.....4
2 How to Setup the Axis Compensation.....2	3.1 Compensation Sign.....4
2.1 Transfer of the compensation data file:2	3.2 Switch on of the Compensation.....4
2.2 Load and run the Tama program:.....3	3.3 Interpolation Type.....4
	References.....4

1 Summary

The *Axis Compensation* module allows to compensate systematical position deviations of the axes. The axis compensation can significantly improve the absolute accuracy of the machine.

Usually the compensation data are based on calibration data recorded with an external measurement system. This data have to be converted to the binary *Triamec* table format **.TAMtbl* to load it to the drive. On the drive side, the compensation is evaluated and applied by a *Tama program*. This *Tama program* is provided by *Triamec Motion AG* on request. Also the source code is available and allows to implement user specific solutions.

This document first describes the required steps to setup the axis compensation. Afterwards some remarks about the implementation are provided.

2 How to Setup the Axis Compensation

2.1 Transfer of the compensation data file:

1. The compensation data need to be provided as a binary file in the *Triamec *.TAMtbl* format. A detailed description of the table format can be found in [1] chapter 4. Depending on the format of the calibration data a converter has to be programmed. *Triamec Motion AG* provides converters for some data formats. Please contact *Triamec Motion AG* for more information.
2. The transfer of the compensation data to the drive is done via the web server of the drive. See chapter 3 of [1] for how to access the web server with a browser. The table can be transferred to one of the predefined **.TAMtbl* files listed on the *Directory* page (Figure 1). It is recommended to copy the desired path from the list into the clipboard.
Change to the *transfer to drive* page and paste the file path to the 'Filepath in drive' text box. Click Browse to select the binary file containing the compensation data (Figure 2). Press Start to initialize the file transfer.
3. In case the Persistent register in the table header is set to true, the table is stored permanently to the drive. Alternatively the table can be stored persistently by setting the following registers:
Application.Tables.Small1.Header.Persistent = True
Application.Tables.Small1.Command = Commit

Directory

File	actual size bytes	maximum size bytes
tables/small1.TAMtbl	304	65360
tables/small2.TAMtbl	0	65360
tables/small3.TAMtbl	0	65360
tables/small4.TAMtbl	0	65360
tables/small5.TAMtbl	0	65360
tables/small6.TAMtbl	0	65360
tables/small7.TAMtbl	0	65360
tables/small8.TAMtbl	0	65360
tables/large1.TAMtbl	0	2096976
tables/large2.TAMtbl	0	2096976

Figure 1: Directory page.

Transfer a file to the drive

Filepath in drive:

Select from PC:

Figure 2: File transfer page.

2.2 Load and run the Tama program:

1. The source code of the *Tama* program `AxisCompensation.cs` can be requested from *Triamec Motion AG*.
2. The *Tama program* might be adjusted depending on the application. The following implementation needs to be verified and might be adjusted:
 - In the sample code table *small1.TAMtbl* is used for the compensation of `Axis[0]` and *small2.TAMtbl* for the compensation of `Axis[1]`. This needs to be adjusted depending to which table the compensation table was stored.
 - For one dimensional compensation the setpoint position of `Axis[0]` is used as the variable for the interpolation and for the two dimensional interpolation the setpoint for `Axis[0]` is used as the first variable and the setpoint of `Axis[1]` as the second variable for the bilinear interpolation.
 - The compensation is applied to `Axes[0].PositionController.Encoders[0]` by adding the interpolated compensation value.
 - In the sample the compensation is activated as soon as `Homing.State` is equal to `HomingDone` and the axis is enabled.
3. To build the *Tama program* Visual Studio (Express) 2017 is recommended.
4. See [2] for how to download the Tama program, enable the isochronous TamaVM and save it persistent on the drive (section 3.7.1).

3 Implementational Considerations

3.1 Compensation Sign

It is assumed that the value of the axis compensation Δx provided as the difference between the external reference position x_{Ref} and the encoder position x_{Enc} .

$$\Delta x = x_{Ref} - x_{Enc} \quad (1)$$

Therefore in the *Tama* program the evaluated axis compensation Δx is added to the current encoder position x_{Enc} program to reconstruct the reference position x_{Ref} .

3.2 Switch on of the Compensation

Initially, the connection of the compensation is smoothed via a ramp to avoid a jump. The duration of the ramp is defined by the constant `cRampTime`.

3.3 Interpolation Type

For the compensation within the set-points linear interpolation is used for one dimensional interpolation and bilinear interpolation for two dimensional interpolation.

The linear interpolation has the effect, that the velocity and its derivatives are discontinuous. This discontinuity can affect the surface at the location of the setpoint in some cases. If such an effect is detected, may an extension of the interpolator to a higher order may improve the situation, e.g. Qubic-B-Splines.

References

- [1] "Triamec File System", AN124_Filesystem_EP002, Triamec Motion AG, 2021
- [2] "Servo Drive Setup Guide, TSD and TSP Series", ServoDrive-SetupGuide_EP012.pdf, Triamec Motion AG, 2019