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FAQ

Changing the modulo length of technology objects at runtime

TIA Portal V19 / SIMATIC S7-1500(T) / SIMATIC S7-1200

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Table of content

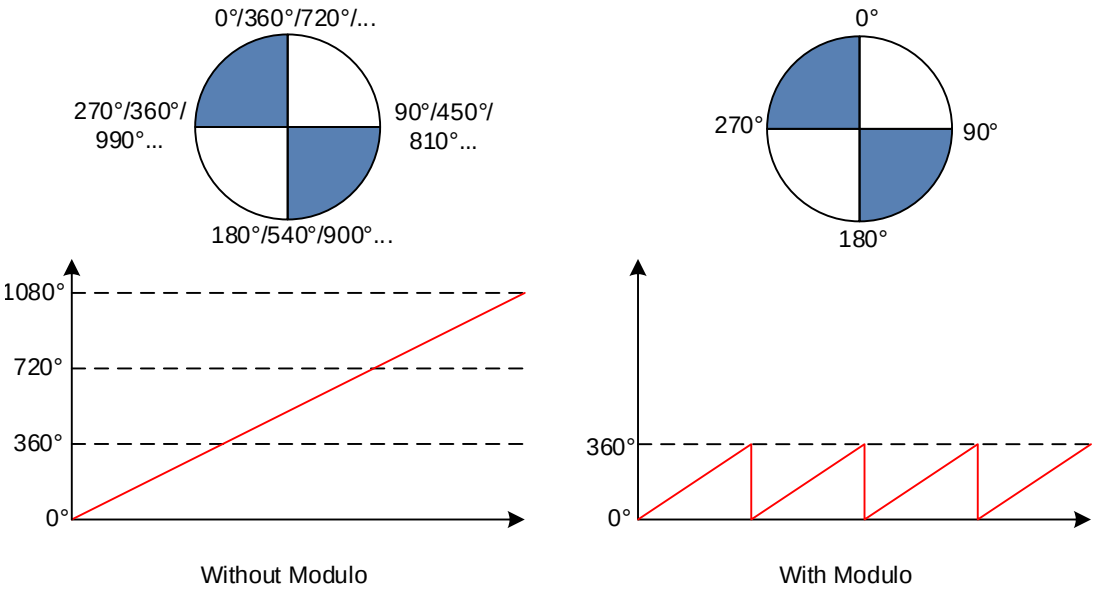
1. Basics 3
1.1. Introduction 3
1.2. Prerequisites 4
2. Implementation 6
2.1. Parameterization in the technology object 6
2.2. Programming 6
2.3. Peculiarities 9

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1. Basics

1.1. Introduction

If axes are to be used in SIMATIC Motion Control via axis technology objects that can only be moved within a defined travel range without this travel range being mechanically limited, then the modulo function of the axis technology objects can be used.
Rotary axes, for example, only have a travel range that maps the axis position to the full circle in the range from 0° to 360°. Even motion commands over 360° end up at a position within 0° to 360°. The modulo function can be used to limit the position range of a rotary axis to the range from 0° to 360°. If the rotary axis reaches the 360° position, this is equated with the 0° position by the modulo function and the position count starts again from the beginning.



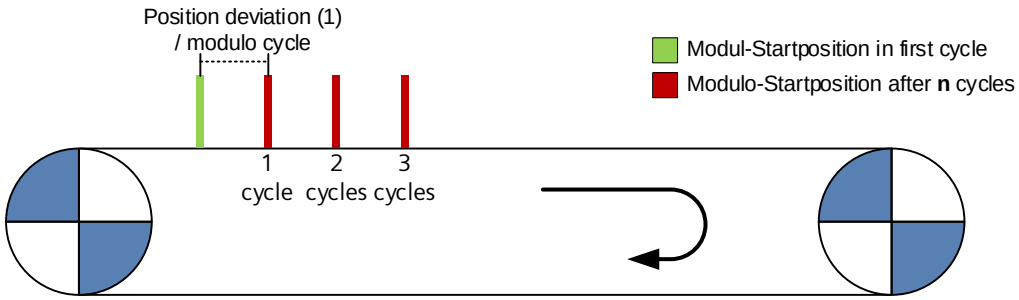
However, the modulo function can also be used to advantage when processing products on a continuous web. For example, it can be used to standardize the positions within consecutive products on a product path. In this case, the resulting modulo length is not the full circle of the rotary axis, but the length of the individual products on the continuous web.

If the length of the products is to be changed in this application, the modulo length must then be changed at machine runtime in order to be able to precisely adjust the position range within the product again. This document describes how you can implement the change of the modulo length at runtime and thus use the modulo function of the axis technology objects for the position reference of passing products.

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1.2. Prerequisites

When using modulo axes, it is particularly important to adapt the configuration of the mechanics in the technology object to the real mechanics of the machine. Deviations between the real position of the machine and the position calculated from the mechanical parameters in the axis technology object are added up with each modulo cycle. This means that even a minimal deviation in the mechanics configuration can result in a large position deviation (1) between the real mechanics and the axis technology object in the controller over time.

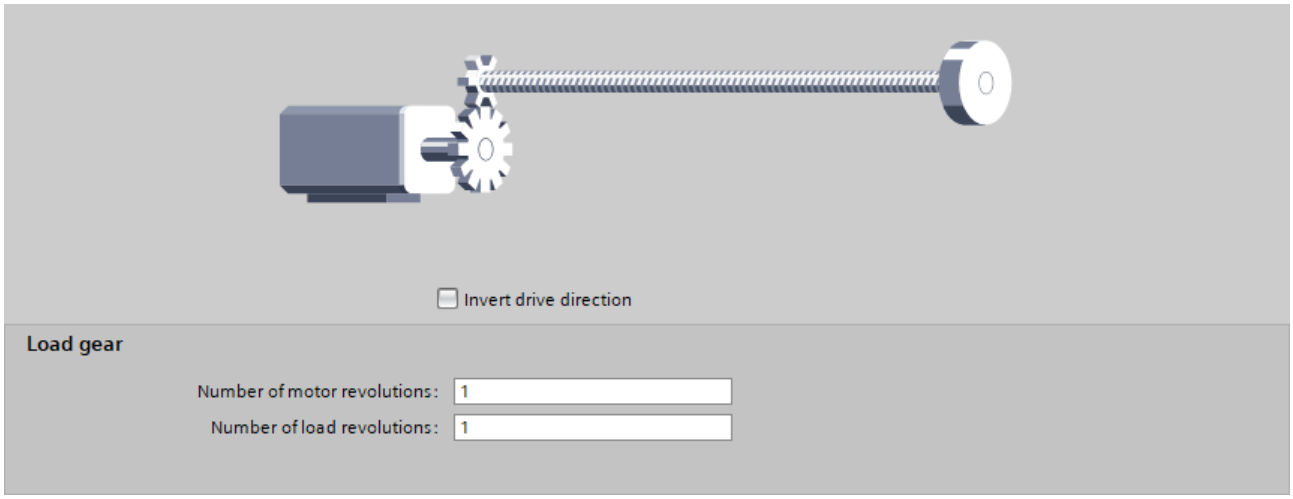


It is therefore advisable to move the axis several modulo cycles during commissioning on the real machine and to check the position (e.g. by precise remeasurement). If there is a position deviation, you can adjust the configuration of the mechanics in the technology object accordingly.

Configuration of the mechanics for rotary axes

For rotary axes, you only need to enter the motor revolutions and the resulting load revolutions. To compensate for minimal mechanical inaccuracies, you can also enter a multiple of the calculated values:

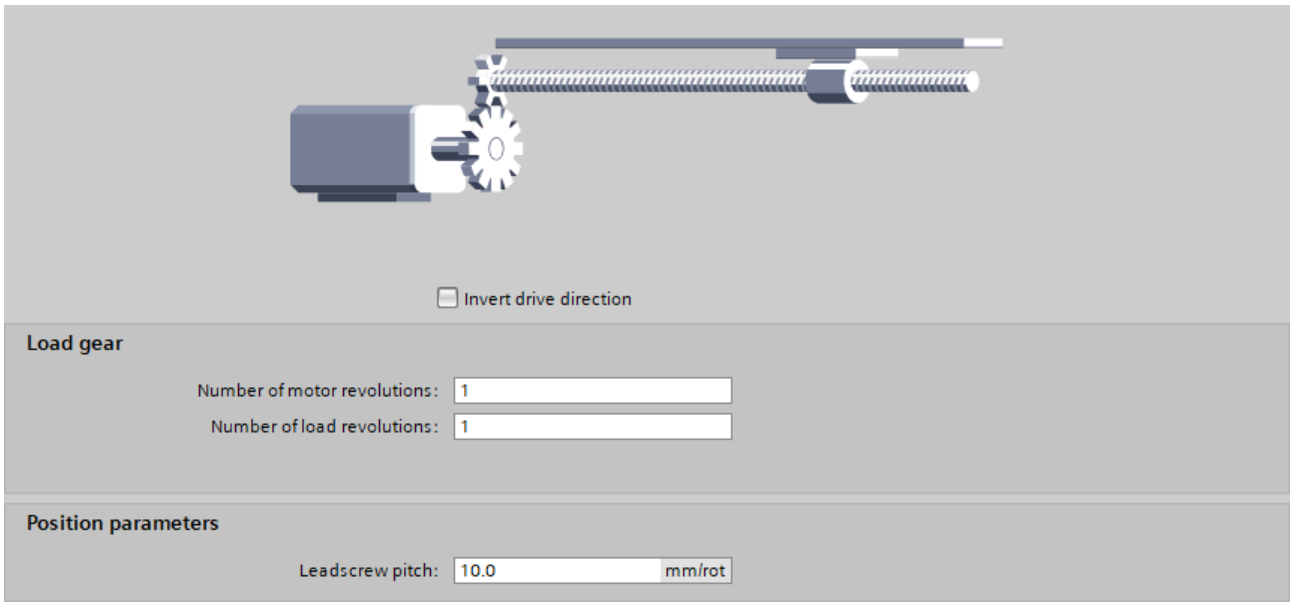
A gear factor of 1:1 was calculated. During commissioning, an inaccuracy of 1% is noticeable. In this case, the gear factor can be adjusted to 100:101 in order to compensate for the inaccuracy and adapt the configuration of the technology object to the real mechanics.



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Configuration of the mechanics for linear axes

A gearbox factor is configured for linear axes in the same way as for rotary axes. In addition to the gearbox factor, a spindle pitch is specified, which converts the rotary movement of the motor into a linear movement.



NOTE The spindle pitch specifies how much distance the linear mechanism travels per revolution of the load side of the motor gearbox or the motor itself in the case of motors without a gearbox. The spindle pitch is not only used for linear mechanisms with spindle drives, but also for other mechanisms such as belt drives. In this case, the spindle pitch corresponds to the circumference of the roller via which the belt is driven.

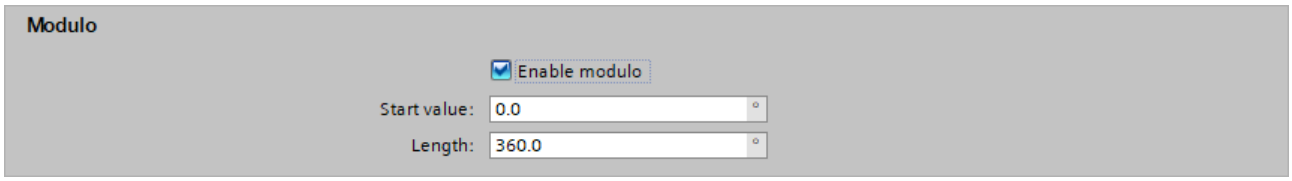
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2. Implementation

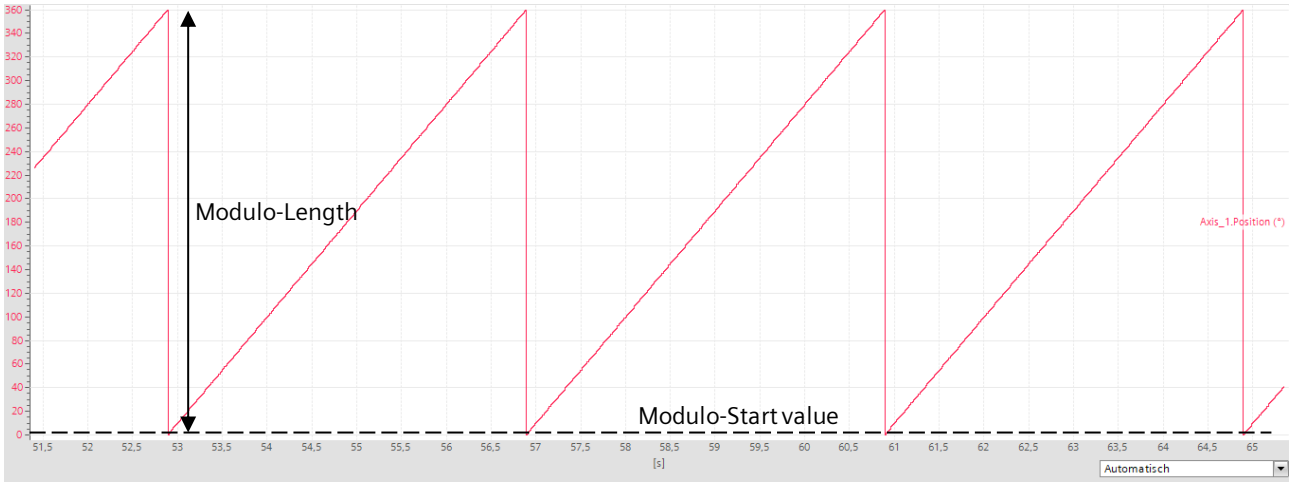
2.1. Parameterization in the technology object

To change the modulo parameterization at runtime, first configure the "Start values" in the parameterization of the technology object. To do this, first activate the modulo function in the basic parameterization of the technology object.

Then define the modulo range via the modulo start value at which the position count begins and the modulo length after which the position value is reset to the start value.



This parameterization is transferred to the controller when the technology object is loaded and is directly active so that the axis moves between 0° and 360°.

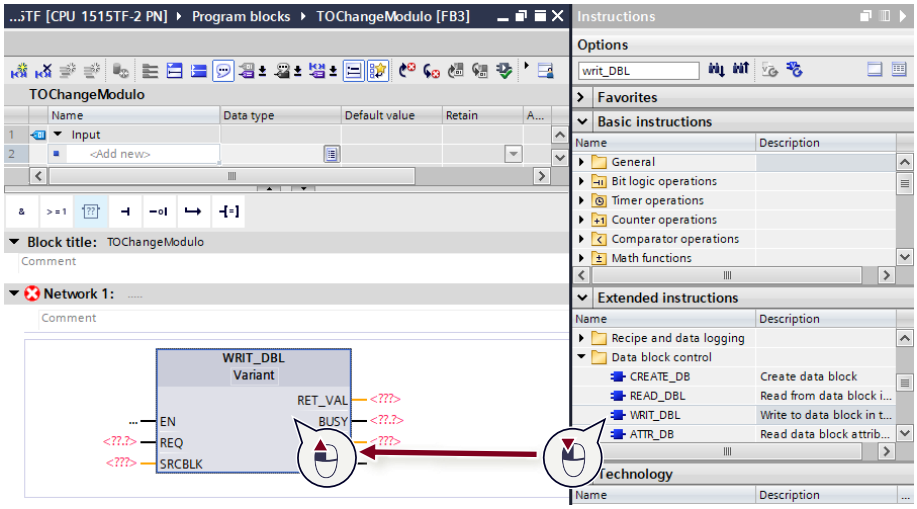


2.2. Programming

Once you have activated the modulo function in the technology object, you must create the user program that is responsible for changing the parameterization of the modulo function during the runtime of the user program. However, the programming can also be used to change the start value. Carry out the following steps to integrate the change to the modulo parameterization into your user program:

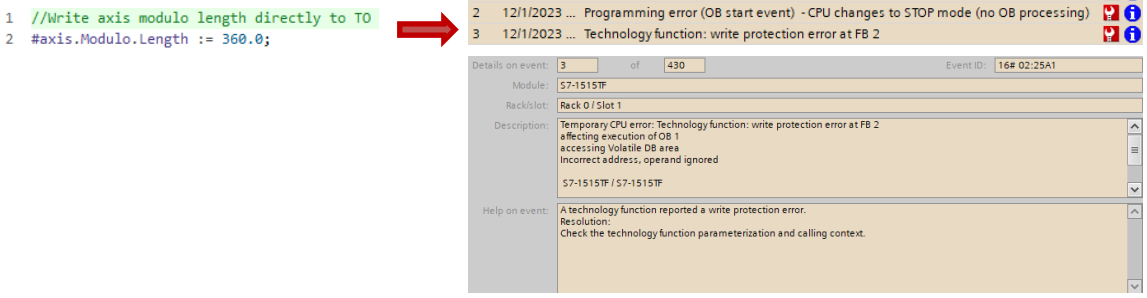
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No.	Action
1.	Drag the "WRIT_DBL" function from the Extended Instructions into your user program.

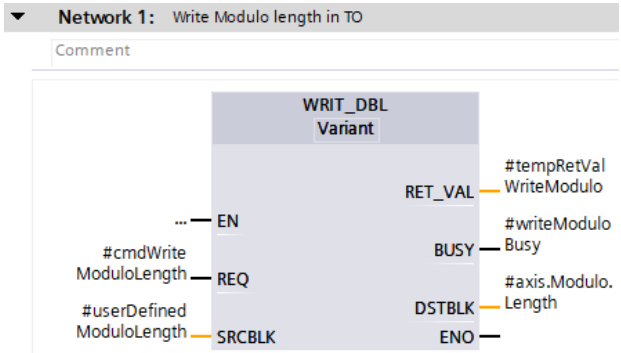
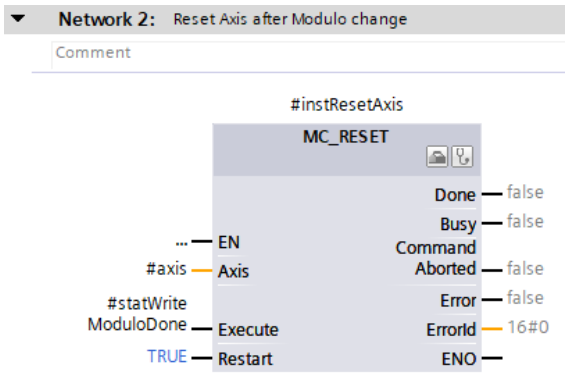


Note:
The modulo parameterization is defined when configuring the technology object in the TIA Portal and transferred to the load memory during commissioning by loading the controller. To change values in the load memory, you must use the "WRIT_DBL" system function. This function makes it possible to write values to the controller's load memory and thus change them.

If you try to change the values in the load memory via a "normal" write access, a programming error is detected in the SIMATIC S7 controller and it switches to the "STOP" operating state, provided the error organization block for handling programming errors is not present in the user program and therefore cannot be called.



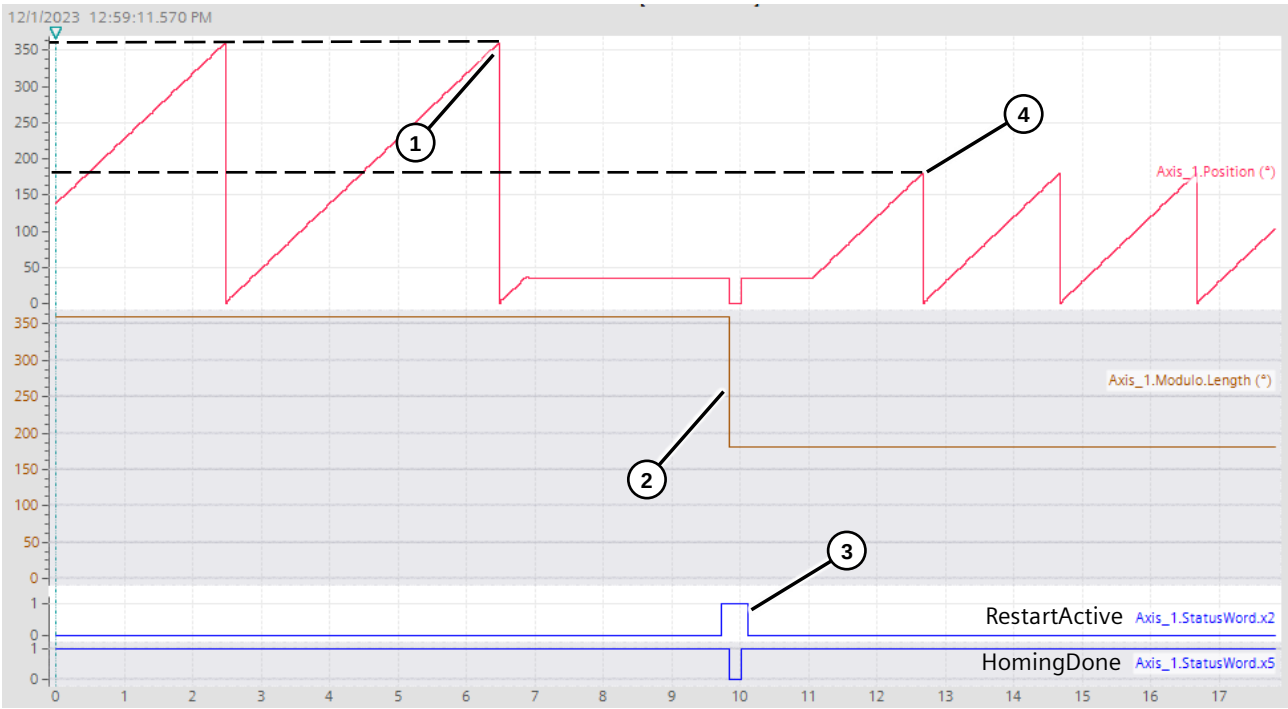
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No.	Action
2.	Connect the inputs and outputs of the "WRIT_DBL" function: • REQ: Start of the write process via a TRUE signal at the input. This starts the transfer of the transferred variable to the load memory. • SCRBLK: Pointer to the data area in the working memory that contains the value to be changed. The data type must correspond to the target data type. A variable of the data type "LREAL" can be transferred to the function block here, which contains the parameter value to be changed. • RET_VAL: Returns the error information. If the value W#16#0000 is returned here, the function was executed without errors. • BUSY: The write process is not yet complete and the parameter value is still being transferred. • DSTBLK: Pointer to the data area in the load memory that is to be written to. The corresponding parameter of the technology object must be specified here.  Connect a variable or a constant with the value that you want to use as the new modulo length or as the modulo start value to the "SRCBLK" input of the "WRIT_DBL" instruction. Specify the variable of the axis technology object to be written at the "DSTBLK" output. Use the following variables to change the modulo parameterization: • Modulo start value: <TO>.Modulo.StartValue • Modulo length: <TO>.Modulo.Length **Note:** A more detailed description of the "WRIT_DBL" function can be found in the TIA Portal online help or in the SIMATIC Motion Control manual: https://support.industry.siemens.com/cs/ww/en/view/109817883
3.	After writing the new modulo length to the technology object, it does not become active immediately. The technology object continues to use the previous modulo length. In order for the new modulo length to become active, a restart must be carried out on the technology object via the Motion Control instruction "MC_Reset" with "Restart" = TRUE.  **Note:** To perform the restart, the technology object must not be enabled via the Motion Control instruction "MC_Power" and must therefore also be at a standstill. **Note:** For example, you can use the negative edge of the "BUSY" output of the "WRIT_DBL" function as a trigger condition for the restart. It must only be ensured that the axis is not enabled when the restart is to be executed.

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The following trace shows the behavior with the programming explained above when changing the modulo length:

1. The axis moves with a modulo length of 360°.
2. The modulo length is adjusted to 180° using the "WRIT_DBL" function.
3. A restart is carried out on the technology object via the "MC_Reset" motion control instruction.
4. The axis moves with a modluo length of 180°



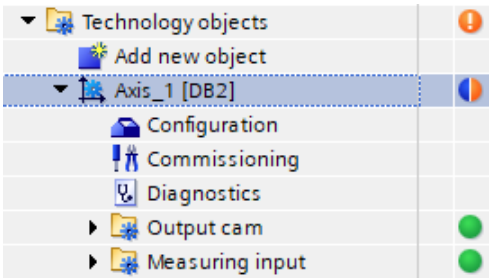
2.3. Peculiarities

Behavior of the position values of the technology object

After the modulo length has been adjusted, the "referenced" status is retained on the technology object. However, the absolute position value may differ from the position value before the change. This change in the position value depends on the encoder used and whether it is a virtual or simulated axis. It may therefore be necessary to reference the technology object again via the motion control instruction "MC_Home" after the modulo length or the modulo start value has been changed.

Online status of the technology object

After changing the modulo length via "WRIT_DBL", online/offline differences are displayed in the TIA Portal.



These differences are due to the change in the load memory. When the technology object is reloaded into the controller, the values changed at runtime are reset to the value configured in the TIA Portal for the modulo length.

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