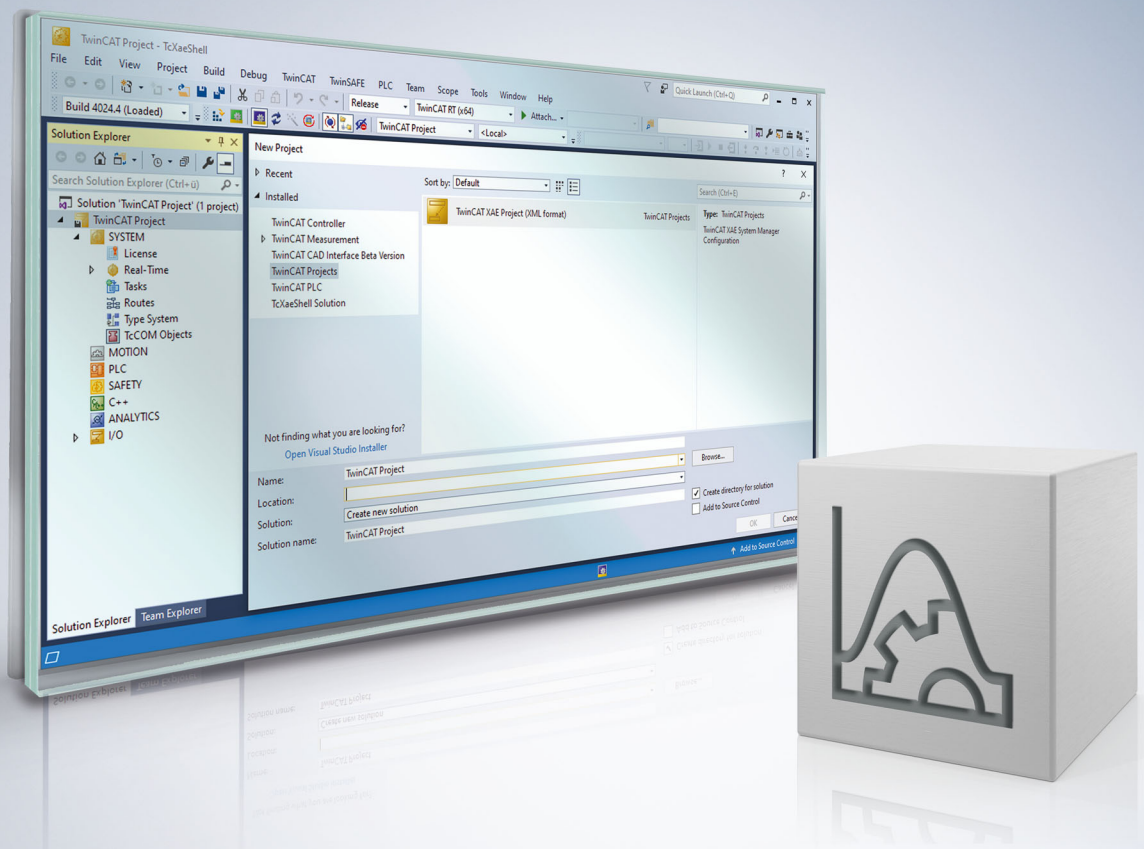
BECKHOFF New Automation Technology

Manual | EN

TF5060

TwinCAT 3 | NC FIFO AXES



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1 Foreword

1.1 Notes on the documentation

This description is only intended for the use of trained specialists in control and automation engineering who are familiar with applicable national standards.
It is essential that the documentation and the following notes and explanations are followed when installing and commissioning the components.
It is the duty of the technical personnel to use the documentation published at the respective time of each installation and commissioning.

The responsible staff must ensure that the application or use of the products described satisfy all the requirements for safety, including all the relevant laws, regulations, guidelines and standards.

Disclaimer

The documentation has been prepared with care. The products described are, however, constantly under development.
We reserve the right to revise and change the documentation at any time and without prior announcement.
No claims for the modification of products that have already been supplied may be made on the basis of the data, diagrams and descriptions in this documentation.

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1.2 Safety instructions

Safety regulations

Please note the following safety instructions and explanations!
Product-specific safety instructions can be found on following pages or in the areas mounting, wiring, commissioning etc.

Exclusion of liability

All the components are supplied in particular hardware and software configurations appropriate for the application. Modifications to hardware or software configurations other than those described in the documentation are not permitted, and nullify the liability of Beckhoff Automation GmbH & Co. KG.

Personnel qualification

This description is only intended for trained specialists in control, automation and drive engineering who are familiar with the applicable national standards.

Description of symbols

In this documentation the following symbols are used with an accompanying safety instruction or note. The safety instructions must be read carefully and followed without fail!

⚠ DANGER

Serious risk of injury!

Failure to follow the safety instructions associated with this symbol directly endangers the life and health of persons.

⚠ WARNING

Risk of injury!

Failure to follow the safety instructions associated with this symbol endangers the life and health of persons.

⚠ CAUTION

Personal injuries!

Failure to follow the safety instructions associated with this symbol can lead to injuries to persons.

NOTE

Damage to the environment or devices

Failure to follow the instructions associated with this symbol can lead to damage to the environment or equipment.

Tip or pointer

This symbol indicates information that contributes to better understanding.

1.3 Notes on information security

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To stay informed about information security for Beckhoff products, subscribe to the RSS feed at https://www.beckhoff.com/secinfo.

2 Overview

TF5060 TwinCAT 3 NC FIFO Axes

In many applications it is necessary to synchronise two or more axes. Axes can be coupled together in the TwinCAT NC PTP. A master axis is then actively controlled, and the position of one or more coupled slave axes is synchronously controlled by the NC.

The simplest type of coupling is linear coupling with a fixed ratio of transmission (an electronic gearbox).

Some applications require a more complex coupling of master and slave, one which can not be described by a simple mathematical formula. Such a dependency can be described by means of a table that specifies an associated slave position for every master position.

The TwinCAT NC PTP offers the possibility of coupling a slave axis to a master axis by means of a table (electronic camshaft). Here the table contains a certain number of prescribed reference points, and the NC interpolates position and speed between them.

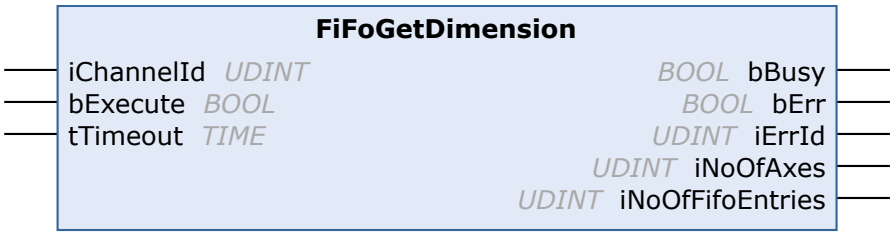
FIFO axes extend the table concept for any number of sequences that do not usually recur cyclically. In this case, rather than having one master-slave table prescribed in advance, the latest axis positions are constantly "topped up" by a PLC program. Because the FIFO axes are combined into a FIFO group, synchronised axis motions can be implemented.

Details.

3 PLC Library

The library **Tc2_NcFifoAxes** allows to transfer externally generated position setpoint values to an axis group during runtime. In this process the setpoint value generation is designed in such a way that as well the setpoint position as the setpoint velocity are determined as the FIFO inputs are worked through in sequence. Between two neighboring FIFO inputs will be interpolated if necessary.

3.1 FiFoGetDimension



The function block FiFoGetDimension determines the dimensioning, i.e. the number of the axes and the maximum number of FIFO entries in a FIFO channel.

Inputs

```
VAR_INPUT
    iChannelId   : UDINT;
    bExecute     : BOOL;
    tTimeout     : TIME;
END_VAR
```

Name	Type	Description
iChannelId	UDINT	Channel ID of the FIFO channel
bExecute	BOOL	Edge-triggered signal for execution of the command
tTimeout	TIME	ADS timeout (about 1 second)

Outputs

```
VAR_OUTPUT
    bBusy             : BOOL;
    bErr              : BOOL;
    iErrId            : UDINT;
    iNoOfAxes         : UDINT;
    iNoOfFifoEntries  : UDINT;
END_VAR
```

Name	Type	Description
bBusy	BOOL	Becomes TRUE with a rising edge at bExecute, and remains TRUE until the block has executed the command.
bErr	BOOL	Becomes TRUE if an error occurs while executing the command.
iErrId	UDINT	Error number (ADS or NC error number)
iNoOfAxes	UDINT	Number of axes for which the FIFO channel has been parameterised.
iNoOfFifoEntries	UDINT	Number of FIFO entries for which the FIFO channel has been parameterised.

Requirements

Development environment	Target platform	PLC libraries to be linked
TwinCAT V3.1.0	PC or CX (x86 or x64)	Tc2_NcFifoAxes

3.2 FiFoGroupIntegrate

The function block FiFoGroupIntegrate integrates an initially independent PTP axis into a FIFO channel. *iGroupPosition* specifies the logical sequence, and indicates the position within the channel at which the axis is to be inserted.

Inputs

```
VAR_INPUT
    iChannelId     : UDINT;
    iAxisId        : UDINT; (* [1..n] *)
    iGroupPosition : UDINT; (* [1..m] *)
    bExecute       : BOOL;
    tTimeout       : TIME;
END_VAR
```

Name	Type	Description
iChannelId	UDINT	Channel ID of the FIFO channel
iAxisId	UDINT	Axis ID of an axis that is to be inserted into the FIFO channel
iGroupPosition	UDINT	Position of the axis within the FIFO channel (iGroupPosition>=1)
bExecute	BOOL	Edge-triggered signal for execution of the command
tTimeout	TIME	ADS timeout (about 1 second)

Outputs

```
VAR_OUTPUT
    bBusy    : BOOL;
    bErr     : BOOL;
    iErrId   : UDINT;
END_VAR
```

Name	Type	Description
bBusy	BOOL	Becomes `TRUE` with a rising edge at bExecute, and remains `TRUE` until the block has executed the command.
bErr	BOOL	Becomes `TRUE` if an error occurs while executing the command
iErrId	UDINT	Error number (ADS or NC error number)

Requirements

Development environment	Target platform	PLC libraries to be linked
TwinCAT V3.1.0	PC or CX (x86 or x64)	Tc2_NcFifoAxes

3.3 FiFoGroupDisintegrate

The function block FiFoGroupDisintegrate dismantles a FIFO channel. This means that all the axes are removed from the FIFO channel and are placed in the standard PTP channel as independent PTP axes.

Inputs

```
VAR_INPUT
    iChannelId   : UDINT;
    bExecute     : BOOL;
    tTimeout     : TIME;
END_VAR
```

Name	Type	Description
iChannelId	UDINT	Channel ID of the FIFO channel
bExecute	BOOL	Edge-triggered signal for execution of the command
tTimeout	TIME	ADS timeout (about 1 second)

Outputs

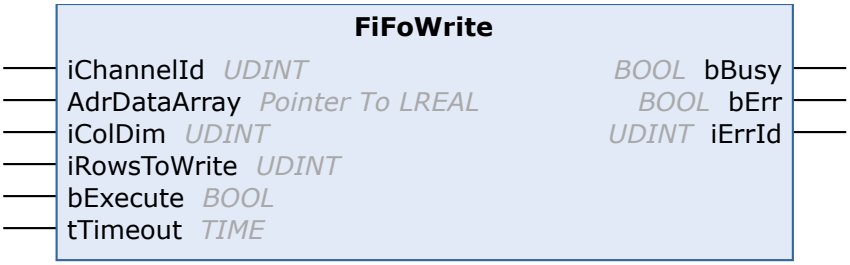
```
VAR_OUTPUT
    bBusy        : BOOL;
    bErr         : BOOL;
    iErrId       : UDINT;
END_VAR
```

Name	Type	Description
bBusy	BOOL	Becomes `TRUE` with a rising edge at bExecute, and remains `TRUE` until the block has executed the command.
bErr	BOOL	Becomes `TRUE` if an error occurs while executing the command
iErrId	UDINT	Error number (ADS or NC error number)

Requirements

Development environment	Target platform	PLC libraries to be linked
TwinCAT V3.1.0	PC or CX (x86 or x64)	Tc2_NcFifoAxes

3.4 FiFoWrite



The function block FiFoWrite reads position data for *iColDim* FIFO channel axes from *AdrDataArray* and transfers *iRowsToWrite* entries to the FIFO.

Inputs

```
VAR_INPUT
    iChannelId    : UDINT;
    AdrDataArray  : POINTER TO LREAL; (* PLC: ARRAY[ ROWS, COLUMNS ] OF LREAL *)
    iColDim       : UDINT; (* second array dimension (COLUMNS) *)
    iRowsToWrite  : UDINT; (* number of rows to write <= RowDim *)
    bExecute      : BOOL;
    tTimeout      : TIME;
END_VAR
```

Name	Type	Description
iChannelId	UDINT	Channel ID of the FIFO channel
AdrDataArray	POINTER TO LREAL	The address of a data field containing position data for the master and slave axes. The first of the field's dimensions describes the table lines, and the second dimension describes the columns.
iColDim	UDINT	Number of columns in the data field. This value must correspond to the actual size of the second field dimension.
iRowsToWrite	UDINT	Number of table lines. This value may be less than or equal to the size of the first field dimension.
bExecute	BOOL	Edge-triggered signal for execution of the command
tTimeout	TIME	ADS timeout (about 1 second)

Outputs

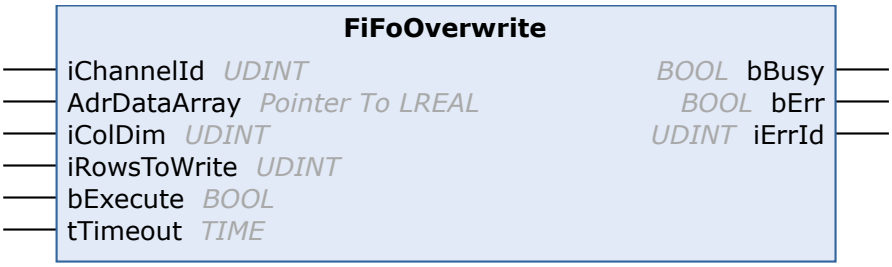
```
VAR_OUTPUT
    bBusy       : BOOL;
    bErr        : BOOL;
    iErrId      : UDINT;
END_VAR
```

Name	Type	Description
bBusy	BOOL	Becomes `TRUE` with a rising edge at bExecute, and remains `TRUE` until the block has executed the command.
bErr	BOOL	Becomes `TRUE` if an error occurs while executing the command
iErrId	UDINT	Error number (ADS or NC error number)

Requirements

Development environment	Target platform	PLC libraries to be linked
TwinCAT V3.1.0	PC or CX (x86 or x64)	Tc2_NcFifoAxes

3.5 FiFoOverwrite



The function block FiFoOverwrite reads position data for *iColDim* FIFO channel axes from *AdrDataArray* and transfers *iRowsToWrite* entries to the FIFO. Existing FIFO data will be overwritten.

Inputs

```
VAR_INPUT
    iChannelId    : UDINT;
    AdrDataArray  : POINTER TO LREAL; (* PLC: ARRAY[ ROWS, COLUMNS ] OF LREAL *)
    iColDim       : UDINT; (* second array dimension (COLUMNS) *)
    iRowsToWrite  : UDINT; (* number of rows to write <= RowDim *)
    bExecute      : BOOL;
    tTimeout      : TIME;
END_VAR
```

Name	Type	Description
iChannelId	UDINT	Channel ID of the FIFO channel
AdrDataArray	POINTER TO LREAL	The address of a data field containing position data for the master and slave axes. The first of the field's dimensions describes the table lines, and the second dimension describes the columns.
iColDim	UDINT	Number of columns in the data field. This value must correspond to the actual size of the second field dimension.
iRowsToWrite	UDINT	Number of table lines. This value may be less than or equal to the size of the first field dimension.
bExecute	BOOL	Edge-triggered signal for execution of the command
tTimeout	TIME	ADS timeout (about 1 second)

Outputs

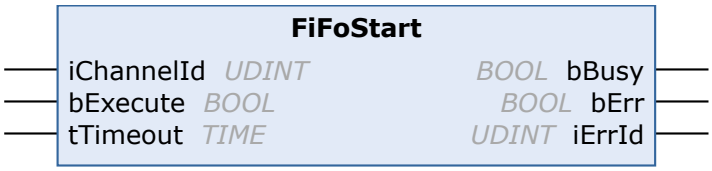
```
VAR_OUTPUT
    bBusy   : BOOL;
    bErr    : BOOL;
    iErrId  : UDINT;
END_VAR
```

Name	Type	Description
bBusy	BOOL	Becomes `TRUE` with a rising edge at bExecute, and remains `TRUE` until the block has executed the command.
bErr	BOOL	Becomes `TRUE` if an error occurs while executing the command
iErrId	UDINT	Error number (ADS or NC error number)

Requirements

Development environment	Target platform	PLC libraries to be linked
TwinCAT V3.1.0	PC or CX (x86 or x64)	Tc2_NcFifoAxes

3.6 FiFoStart



The function block FiFoStart initiates processing of the FIFO channel, so that all the axes in the FIFO channel are driven in accordance with the position data previously provided to the FIFO.

Inputs

```
VAR_INPUT
    iChannelId  : UDINT;
    bExecute    : BOOL;
    tTimeout    : TIME;
END_VAR
```

Name	Type	Description
iChannelId	UDINT	Channel ID of the FIFO channel
bExecute	BOOL	Edge-triggered signal for execution of the command
tTimeout	TIME	ADS timeout (about 1 second)

Outputs

```
VAR_OUTPUT
    bBusy   : BOOL;
    bErr    : BOOL;
    iErrId  : UDINT;
END_VAR
```

Name	Type	Description
bBusy	BOOL	Becomes `TRUE` with a rising edge at bExecute, and remains `TRUE` until the block has executed the command.
bErr	BOOL	Becomes `TRUE` if an error occurs while executing the command
iErrId	UDINT	Error number (ADS or NC error number)

Requirements

Development environment	Target platform	PLC libraries to be linked
TwinCAT V3.1.0	PC or CX (x86 or x64)	Tc2_NcFifoAxes

3.7 FiFoStop

The function block FiFoStop halts a FIFO channel. Processing of the position data from the FIFO stops, and all the axes in the FIFO channel are halted.

Inputs

```
VAR_INPUT
    iChannelId  : UDINT;
    bExecute    : BOOL;
    tTimeout    : TIME;
END_VAR
```

Name	Type	Description
iChannelId	UDINT	Channel ID of the FIFO channel
bExecute	BOOL	Edge-triggered signal for execution of the command
tTimeout	TIME	ADS timeout (about 1 second)

Outputs

```
VAR_OUTPUT
    bBusy   : BOOL;
    bErr    : BOOL;
    iErrId  : UDINT;
END_VAR
```

Name	Type	Description
bBusy	BOOL	Becomes TRUE with a rising edge at bExecute, and remains TRUE until the block has executed the command.
bErr	BOOL	Becomes TRUE if an error occurs while executing the command
iErrId	UDINT	Error number (ADS or NC error number)

Requirements

Development environment	Target platform	PLC libraries to be linked
TwinCAT V3.1.0	PC or CX (x86 or x64)	Tc2_NcFifoAxes

3.8 FiFoSetChannelOverride

The function block FiFoSetChannelOverride sets the channel override by means of which the processing speed of the FIFO channel can be affected. The channel override should not be confused with the axis overrides for the individual axes.

Inputs

```
VAR_INPUT
    iChannelId   : UDINT;
    iOverride    : UDINT;
    bExecute     : BOOL;
    tTimeout     : TIME;
END_VAR
```

Name	Type	Description
iChannelId	UDINT	Channel ID of the FIFO channel
iOverride	UDINT	Channel override for the speed of the FIFO channel.
bExecute	BOOL	Edge-triggered signal for execution of the command
tTimeout	TIME	ADS timeout (about 1 second)

Outputs

```
VAR_OUTPUT
    bBusy   : BOOL;
    bErr    : BOOL;
    iErrId  : UDINT;
END_VAR
```

Name	Type	Description
bBusy	BOOL	Becomes TRUE with a rising edge at bExecute, and remains TRUE until the block has executed the command.
bErr	BOOL	Becomes TRUE if an error occurs while executing the command
iErrId	UDINT	Error number (ADS or NC error number)

Requirements

Development environment	Target platform	PLC libraries to be linked
TwinCAT V3.1.0	PC or CX (x86 or x64)	Tc2_NcFifoAxes

4 Appendix

4.1 Samples

Use of FIFO Axes

This example shows the basic use of the FIFO axis functionality under TwinCAT 3. Among other things, the project contains a file "ReadMe.txt", which explains to which locations some files have to be copied.

Download: https://infosys.beckhoff.com/content/1033/tf5060_tc3_nc_fifo_axes/Resources/13632521867/.zip

More Information:
www.beckhoff.com/tf5060

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