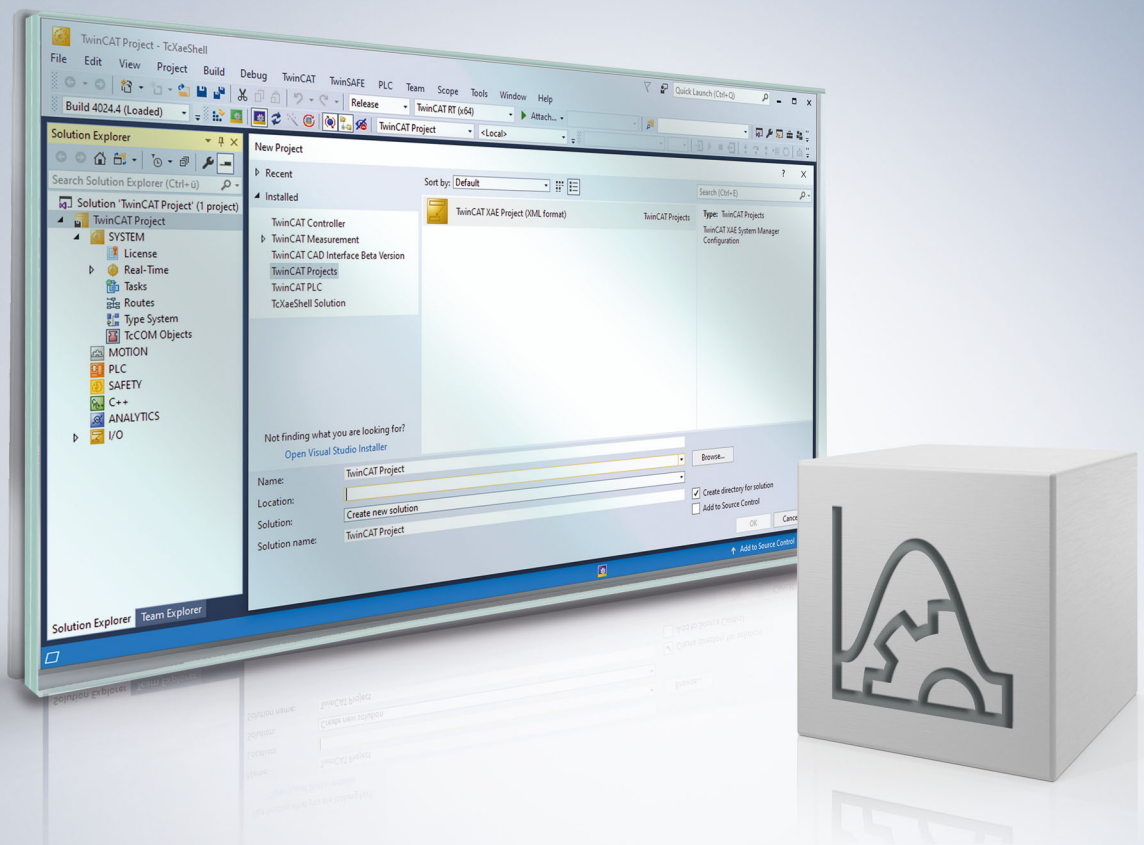
BECKHOFF New Automation Technology

Manual | EN

TF5065

TwinCAT 3 | Motion Control XFC/XFC NC I



2023-12-06 | Version: 2.2.0

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1 Foreword

1.1 Notes on the documentation

This description is intended exclusively for trained specialists in control and automation technology who are familiar with the applicable national standards.
For installation and commissioning of the components, it is absolutely necessary to observe the documentation and the following notes and explanations.
The qualified personnel is obliged to always use the currently valid documentation.

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

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The documentation has been prepared with care. The products described are, however, constantly under development.
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EP1590927, EP1789857, EP1456722, EP2137893, DE102015105702
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Always observe and follow product-specific safety instructions, which you may find at the appropriate places in this document.

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All the components are supplied in particular hardware and software configurations which are 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 technology who are familiar with the applicable national standards.

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The signal words used in the documentation are classified below. In order to prevent injury and damage to persons and property, read and follow the safety and warning notices.

Personal injury warnings

⚠ DANGER

Hazard with high risk of death or serious injury.

⚠ WARNING

Hazard with medium risk of death or serious injury.

⚠ CAUTION

There is a low-risk hazard that could result in medium or minor injury.

Warning of damage to property or environment

NOTICE

The environment, equipment, or data may be damaged.

Information on handling the product

This information includes, for example:
recommendations for action, assistance or further information on the product.

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2 Introduction

eXtreme Fast Control (XFC) is the name given to a technique that enables very fast, temporally high-precision reactions using EtherCAT, special I/O terminals and TwinCAT on the PC. Using EtherCAT Distributed Clocks (DC) and appropriate terminals, distributed latches or cam controllers can be implemented simply in this way.

- Function blocks for the high-precision acquisition and switching of digital signals related to axis positions
- EtherCAT Distributed Clocks with the timestamp-based EtherCAT, as for example EL1252, EL2252 or EL2262 input and output terminals
- Blocks for the conversion of DC time to position and vice versa
- Convenient PLCopen-compliant TouchProbe function block
- Digital cam controller as PLCopen-compliant function block

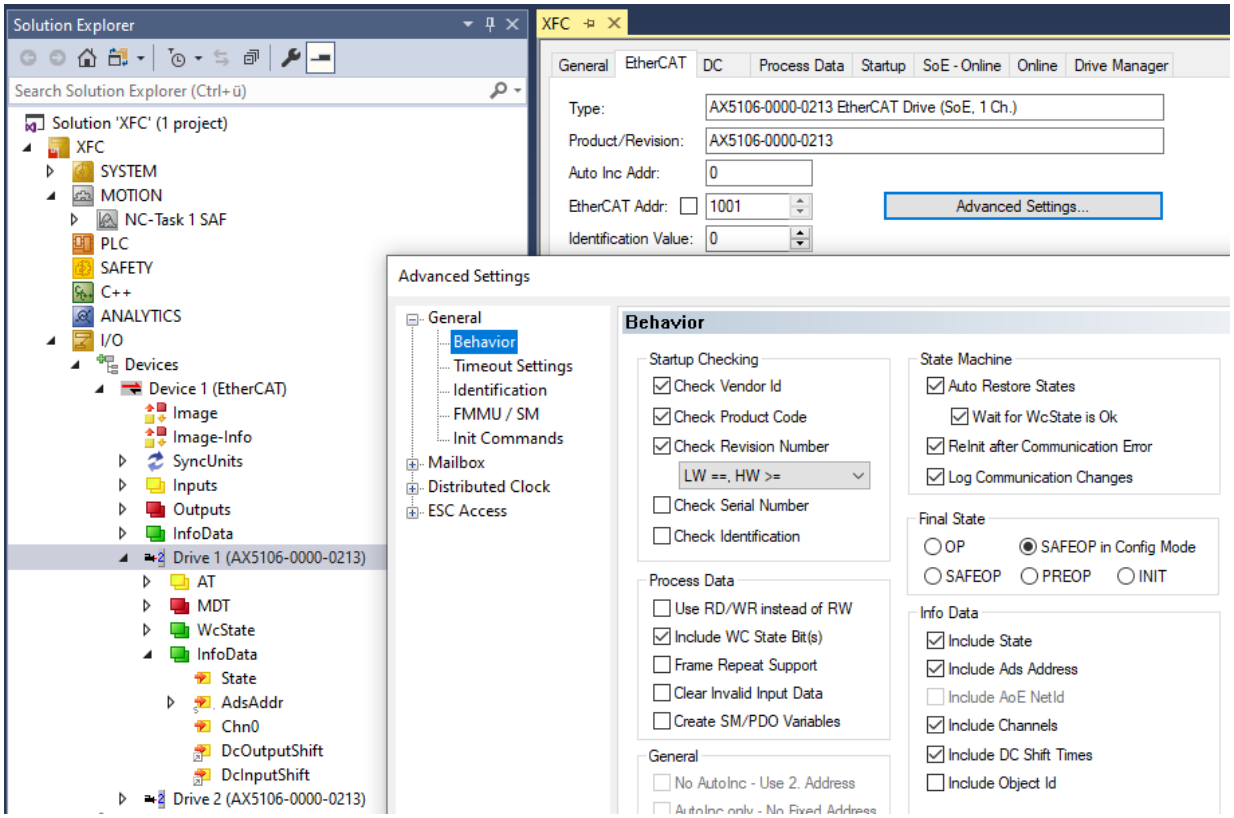
3 Dead time compensation

A prerequisite for high-precision conversion of positions into times and vice versa is precise dead time compensation of the axes. In TwinCAT 3 such a dead time compensation function is available for EtherCAT and Sercos axes. It operates largely automatically. Nevertheless, a manual configuration can be necessary, for example to compensate the drive's internal dead times.

Support of distributed clocks

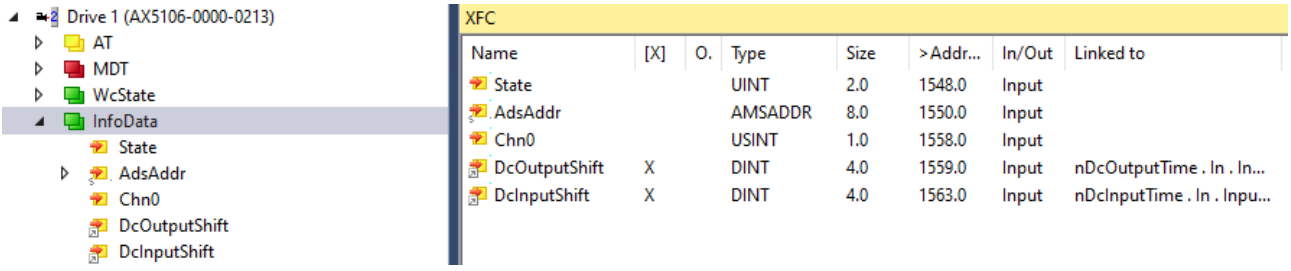
Support for distributed clocks must initially be activated in EtherCAT drives as follows:

1. Call the drive's EtherCAT **Advanced Settings** dialog.



2. Activate the switch **Include DC Shift Times**.

⇨ The time information is made available in the info data (**InfoData**) of the drive and later linked with the NC axis.

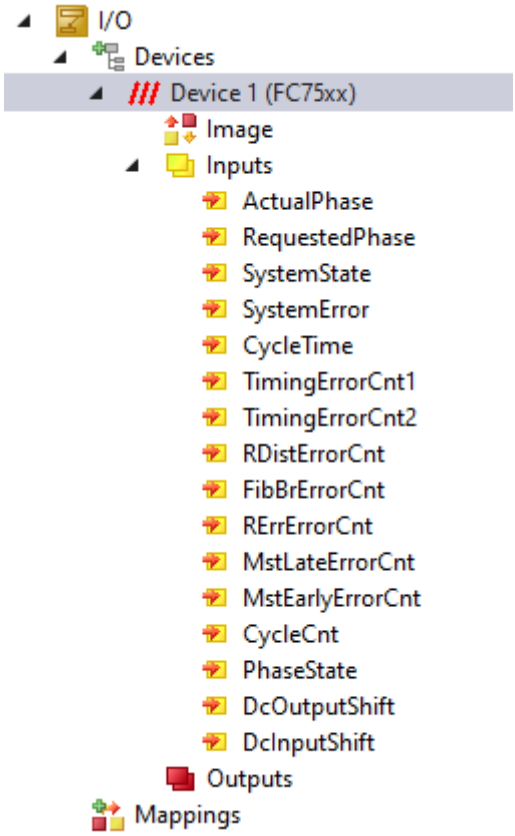


DcInputShift is the time required to transmit status information, such as the actual position of a drive, to the controller. In other words, it is the time between the acquisition and the evaluation of these data.

DcOutputShift is the time for the output of the process data to the drive, i.e. for the time delay between the calculation and the effect of these data.

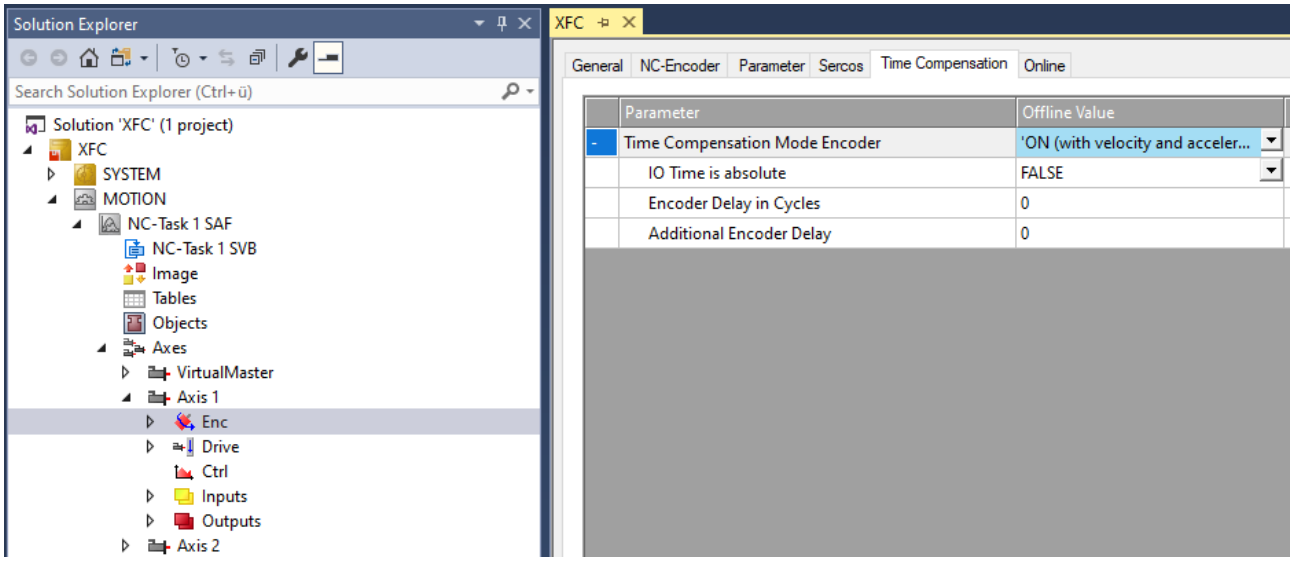
The time information is provided dynamically by the system and is used by the NC for dead time compensation of an axis.

For Sercos axes the times **DcInputShift** and **DcOutputShift** are provided by the Sercos card and do not have to be configured. If a drive is linked to an NC axis these times are also linked.



Compensation of the encoder dead time

The dead time compensation for the data acquisition side is activated on the **Time Compensation** tab of the axis encoder. The dead time from **DcInputShift** provided by the system is used for calculating the compensation.



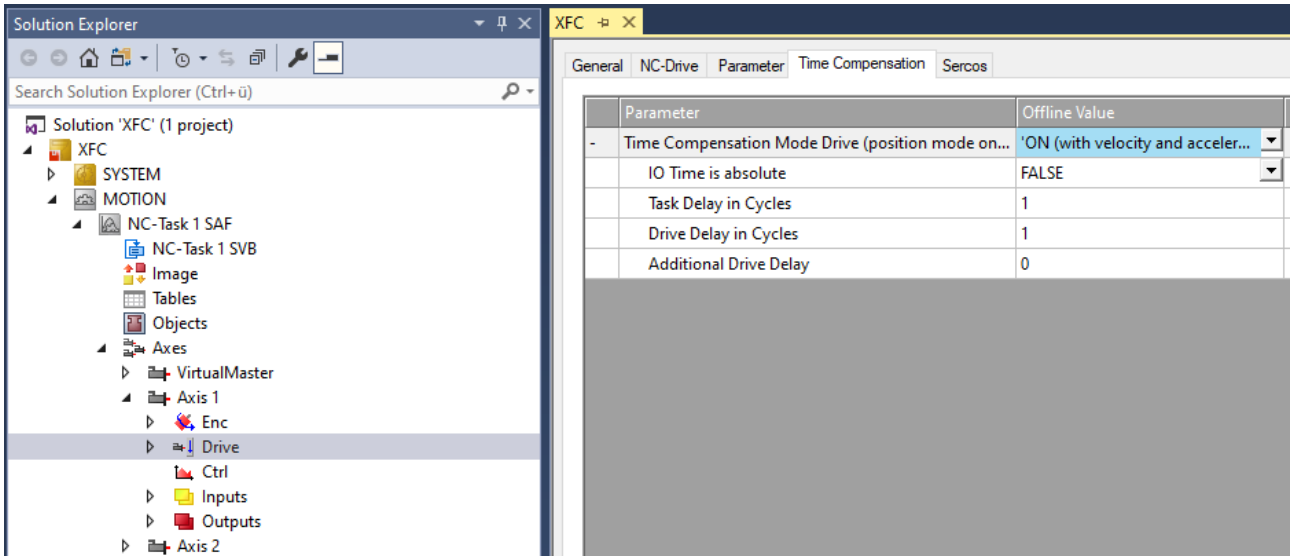
In special cases, for example in the event of additional dead times due to the hardware used, it may be necessary to configure further times.

The value **Encoder Delay** in Cycles indicates additional delays (whole I/O cycles). This time is therefore not a fixed value, but changes with the cycle time.

The value **Additional Encoder Delay** is a fixed time value in µs caused by the hardware used.

Compensation of the drive dead time

The dead time compensation in the output direction is activated on the **Time Compensation** tab of the NC axis drive. As a result the time from **DcOutputShift** provided by the system is used for calculating the compensation.



In special cases further times can be configured.

The value **Task Delay** in Cycles is based on the setting in the task configuration. Depending on the set task timing the dead time may be extended by one cycle.

The value **Drive Delay in Cycles** indicates additional delays by entire I/O cycles caused by the drive (e.g. depending on the interpolation type of the drive).

The value **Additional Drive Delay** is a fixed time value in µs caused by the hardware used.

Effect of dead time compensation

Dead time compensation is used for conversion of all NC data that are cyclically exchanged with the PLC (NcToPlc) to the current time. The actual position, set position and following error of the axis in particular refer to the current time and reflect the physical axis position at this time. The PLC can use these values for further high-precision time and position calculations. (See basic functions XFC_GetCurDcTaskTime [▶ 40], XFC_TimeOfPosition [▶ 13] and XFC_PositionAtTime [▶ 12].)

4 PLC libraries

4.1 Tc2_MC2_XFC

The library Tc2_Mc2_XFC facilitates precisely timed acquisition of axis positions and output of digital signals at precise positions in conjunction with EtherCAT XFC terminals (timestamp terminals and oversampling terminals).

A precise correlation between time and position can thus be established at any time.

Important applications include the acquisition of latch positions (touch probe or measuring probe function) and the realization of digital cam controllers. The library provides various function blocks for this.

4.1.1 Function blocks

4.1.1.1 Basic blocks

4.1.1.1.1 XFC_PositionAtTime

The function block XFC_PositionAtTime calculates an axis position, which will be or was valid at a given time.

The function extrapolates the position in relation to the current position and dynamics. Precise extrapolation is only possible over a short interval, since the axis dynamics may change.

The function block requires precisely one call in order to provide the result. It can therefore be used similar to a function, although as well as the position it may also return an error. This error must be analyzed in order to ensure that the calculated position is valid.

Inputs

```
VAR_INPUT
    DcTime  : T_DCTIME32;
    Options : ST_NcTimeConversionOptions;
END_VAR
```

Name	Type	Description
DcTime	T_DCTIME32	Distributed Clock System Time. Contains the lower 32 bits of the complete DcTime, thus covering a time range of +/- 2 seconds around the current time. In order to optimize the calculation of the position value, the time should be close to the current time, i.e. only a few PLC or NC cycles in the future or the past.
Options	ST_NcTimeConversionOptions [▶ 47]	Data structure with options for position extrapolation.

/ Inputs/Outputs

```
VAR_IN_OUT
    Axis    : AXIS_REF;
END_VAR
```

Name	Type	Description
Axis	AXIS_REF	The axis data structure of type AXIS_REF addresses an axis unambiguously within the system. Among other parameters, it contains the current axis status, including position, velocity or error state.

Outputs

```
VAR_OUTPUT
    Position : LREAL;
    Error    : BOOL;
    ErrorID  : UDINT;
END_VAR
```

Name	Type	Description
Position	LREAL	Extrapolated position that will be or was reached at the specified time DcTime.
Error	BOOL	Becomes TRUE if an error occurs.
ErrorID	UDINT	If the error output is set, this parameter supplies the error number.

4.1.1.1.2 XFC_TimeOfPosition

The function block XFC_TimeOfPosition calculates the time at which the axis will be or was at a specified position.

The function block extrapolates the time in relation to the current position and dynamics. Precise extrapolation is only possible over a short interval, since the axis dynamics may change.

It needs exactly one call to provide the result. It can therefore be used similar to a function, although as well as the time it may also return an error. This error must be analyzed in order to ensure that the calculated time DcTime is valid.

Inputs

```
VAR_INPUT
    Position : LREAL;
    Options  : ST_NcTimeConversionOptions;
END_VAR
```

Name	Type	Description
Position	LREAL	Absolute axis position
Options	ST_NcTimeConversionOptions [▶ 47]	Data structure with options for position extrapolation.

/ Inputs/Outputs

```
VAR_IN_OUT
    Axis     : AXIS_REF;
END_VAR
```

Name	Type	Description
Axis	AXIS_REF	The axis data structure of type AXIS_REF addresses an axis unambiguously within the system. Among other parameters, it contains the current axis status, including position, velocity or error state.

Outputs

```
VAR_OUTPUT
    DcTime  : T_DCTIME32;
    Error   : BOOL;
    ErrorID : UDINT;
END_VAR
```

Name	Type	Description
DcTime	T_DCTIME32	Distributed clock system time at which the position will be reached or was reached. DcTime contains the lower 32 bits of the complete DcTime and covers a time range of +/- 2 seconds around the current time.
Error	BOOL	Becomes TRUE if an error occurs.
ErrorID	UDINT	If the error output is set, this parameter supplies the error number.

4.1.1.1.3 XFC_TimeToPosition

The function block XFC_TimeToPosition calculates the time period within which an axis will reach a position, or the time that has elapsed since the axis passed this position.

The function block extrapolates the time in relation to the current position and dynamics. Precise extrapolation is only possible over a short interval, since the axis dynamics may change.

It needs exactly one call to provide the result. It can therefore be used similar to a function, although as well as the time it may also return an error. This error must be analyzed in order to ensure that the calculated time duration is valid.

Inputs

```
VAR_INPUT
    Position    : LREAL;
    Options     : ST_NcTimeConversionOptions;
END_VAR
```

Name	Type	Description
Position	LREAL	Absolute axis position
Options	ST_NcTimeConversionOptions [▶ 47]	Data structure with options for position extrapolation.

/ Inputs/Outputs

```
VAR_IN_OUT
    Axis     : AXIS_REF;
END_VAR
```

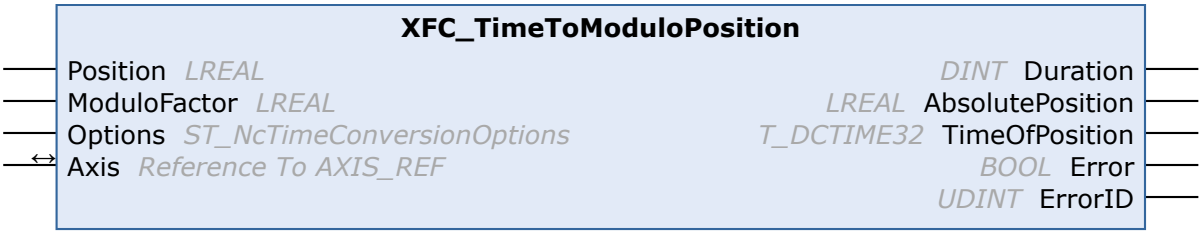
Name	Type	Description
Axis	AXIS_REF	The axis data structure of type AXIS_REF addresses an axis unambiguously within the system. Among other parameters, it contains the current axis status, including position, velocity or error state.

Outputs

```
VAR_OUTPUT
    Duration       : DINT;
    TimeOfPosition : T_DCTIME32;
    Error          : BOOL;
    ErrorID        : UDINT;
END_VAR
```

Name	Type	Description
Duration	DINT	Time duration in nanoseconds after which the position will be reached (> 0) or since the position was passed (< 0). Duration is a differential value from two variables of the type T_DCTIME32 Distributed Clock System Time.
TimeOfPosition	T_DCTIME32	Distributed clock system time at which the position will be reached or was reached. DcTime contains the lower 32 bits of the complete DcTime and covers a time range of +/- 2 seconds around the current time.
Error	BOOL	Becomes TRUE if an error occurs.
ErrorID	UDINT	If the error output is set, this parameter supplies the error number.

4.1.1.1.4 XFC_TimeToModuloPosition



The function block XFC_TimeToModuloPosition calculates the time period within which an axis will reach a position, or the time that has elapsed since the axis passed this position. In this case the position is the nearest modulo position in the direction of travel.

The function extrapolates the time in relation to the current position and dynamics. Precise extrapolation is only possible over a short interval, since the axis dynamics may change.

The function block requires precisely one call in order to provide the result. It can therefore be used similar to a function, although as well as the time it may also return an error. This error must be analyzed in order to ensure that the calculated time duration is valid.

Inputs

```
VAR_INPUT
    Position     : LREAL;
    ModuloFactor : LREAL;
    Options      : ST_NcTimeConversionOptions;
END_VAR
```

Name	Type	Description
Position	LREAL	Absolute axis position
ModuloFactor	LREAL	Modulo divider to be used for the calculation. ModuloFactor can be identical to the modulo factor of the axis, e.g. 360. However, a factor deviating from that can also be used.
Options	ST_NcTimeConversionOptions [▶ 47]	Data structure with options for position extrapolation.

/ Inputs/Outputs

```
VAR_IN_OUT
    Axis     : AXIS_REF;
END_VAR
```

Name	Type	Description
Axis	AXIS_REF	The axis data structure of type AXIS_REF addresses an axis unambiguously within the system. Among other parameters, it contains the current axis status, including position, velocity or error state.

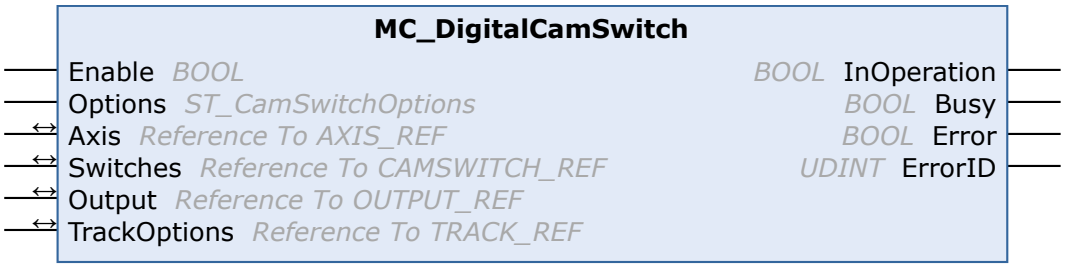
Outputs

```
VAR_OUTPUT
    Duration         : DINT;
    AbsolutePosition : LREAL;
    TimeOfPosition   : T_DCTIME32;
    Error            : BOOL;
    ErrorID          : UDINT;
END_VAR
```

Name	Type	Description
Duration	DINT	Time duration in nanoseconds after which the position will be reached. Duration is a differential value from two variables of the type T_DCTIME32 Distributed Clock System Time.
AbsolutePosition	LREAL	Absolute position (not modulo) corresponding to the modulo position and the determined time.
TimeOfPosition	T_DCTIME32	Distributed clock system time at which the Position will be reached or was reached. DcTime contains the lower 32 bits of the complete DcTime and covers a time range of +/- 2 seconds around the current time.
Error	BOOL	Becomes TRUE if an error occurs.
ErrorID	UDINT	If the error output is set, this parameter supplies the error number.

4.1.1.2 Cam controller

4.1.1.2.1 MC_DigitalCamSwitch



The function block MC_DigitalCamSwitch is a digital cam controller with one or several cams on a digital output track.

Position, time and brake cams can be realized through suitable parameterization. Further output tracks can be realized with independent instances of the function block.

In addition to the switching state of the digital output the output data structure contains precise time information for the next switching operations. This information is used for the actual output at an XFC output terminal with a downstream function block (XFC_EL2252_V2 [▶ 34] or XFC_EL2262 [▶ 37]).

Inputs

```
VAR_INPUT
    Enable  : BOOL;
    Options : ST_CamSwitchOptions;
END_VAR
```

Name	Type	Description
Enable	BOOL	The cam controller is activated via the Enable input. The initial state remains unchanged, as long as Enable=FALSE.
Options	ST_CamSwitchOptions [▶ 48]	Optional parameter

/ Inputs/Outputs

```
VAR_IN_OUT
    Axis         : AXIS_REF;
    Switches     : CAMSWITCH_REF;
    Output       : OUTPUT_REF;
    TrackOptions : TRACK_REF;
END_VAR
```

Name	Type	Description
Axis	AXIS_REF	The axis data structure of type AXIS_REF addresses an axis unambiguously within the system. Among other parameters, it contains the current axis status, including position, velocity or error state.
Switches	CAMSWITCH_REF [▶ 42]	The data structure Switches contains a reference to the parameterization of all cams on the cam track.
Output	OUTPUT_REF [▶ 42]	The data structure Output contains the calculated state of the digital output and the associated timestamp for the output at a digital XFC output terminal.
TrackOptions	TRACK_REF [▶ 43]	The data structure TrackOptions contains the parameterization for the cam track.

Outputs

```
VAR_OUTPUT
    InOperation : BOOL;
    Busy        : BOOL;
    Error       : BOOL;
    ErrorID     : UDINT;
END_VAR
```

Name	Type	Description
InOperation	BOOL	InOperation is TRUE, as long as the cam controller is active and the cam track is calculated according to the cam parameterization.
Busy	BOOL	Busy is TRUE as long as the block function is not completed.
Error	BOOL	Becomes TRUE if an error occurs.
ErrorID	UDINT	If the error output is set, this parameter supplies the Overview of NC Errors.

Example for two digital cam tracks

CamSwitchRefTrack1 : CAMSWITCH_REF	
	Value
NumberOfSwitches	3
pSwitches	ADR(CamSwitchArrayTrack1)
SizeOfSwitches	SIZEOF(CamSwitchArrayTrack1)

CamSwitchArrayTrack1 : Array [1..n] OF MC_CamSwitch

	Switch 1	**Switch 2**	**Switch 3**	**...**	**Switch n**
FirstOnPosition	2000	2500	4000		
LastOnPosition	3000	3000	1000		
AxisDirection	POSITIVE	NEGATIVE	BOTH		
CamSwitchMode	POSITION	POSITION	POSITION		
Duration [s]	—	—	—		

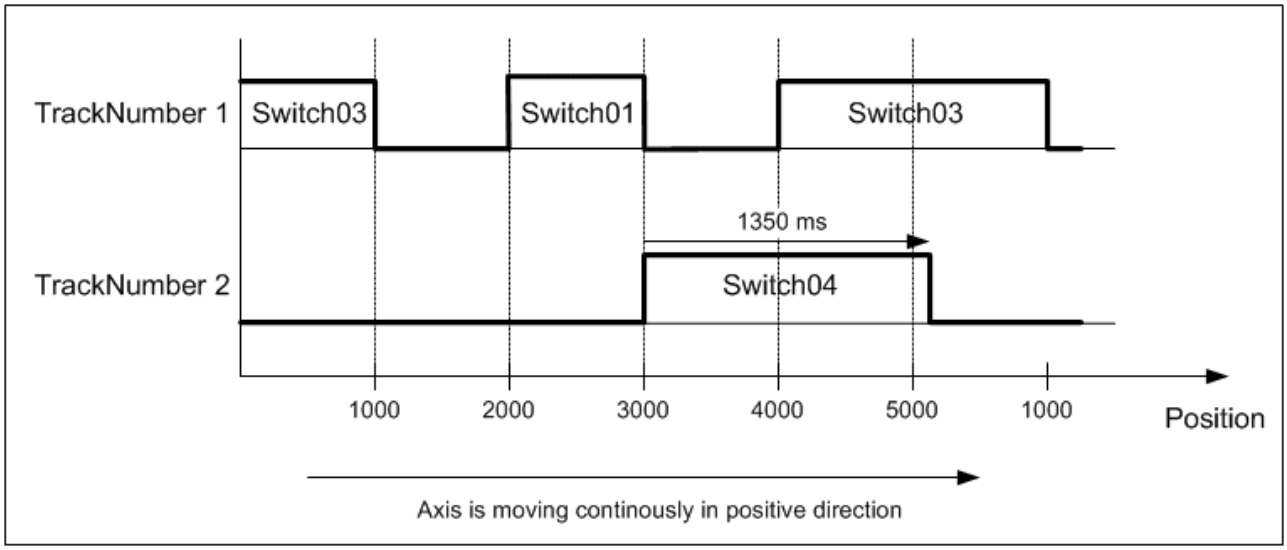
CamSwitchRefTrack2 : CAMSWITCH_REF	
	Value
NumberOfSwitches	1
pSwitches	ADR(CamSwitchArrayTrack2)
SizeOfSwitches	SIZEOF(CamSwitchArrayTrack2)

CamSwitchArrayTrack2 : Array [1..m] OF MC_CamSwitch

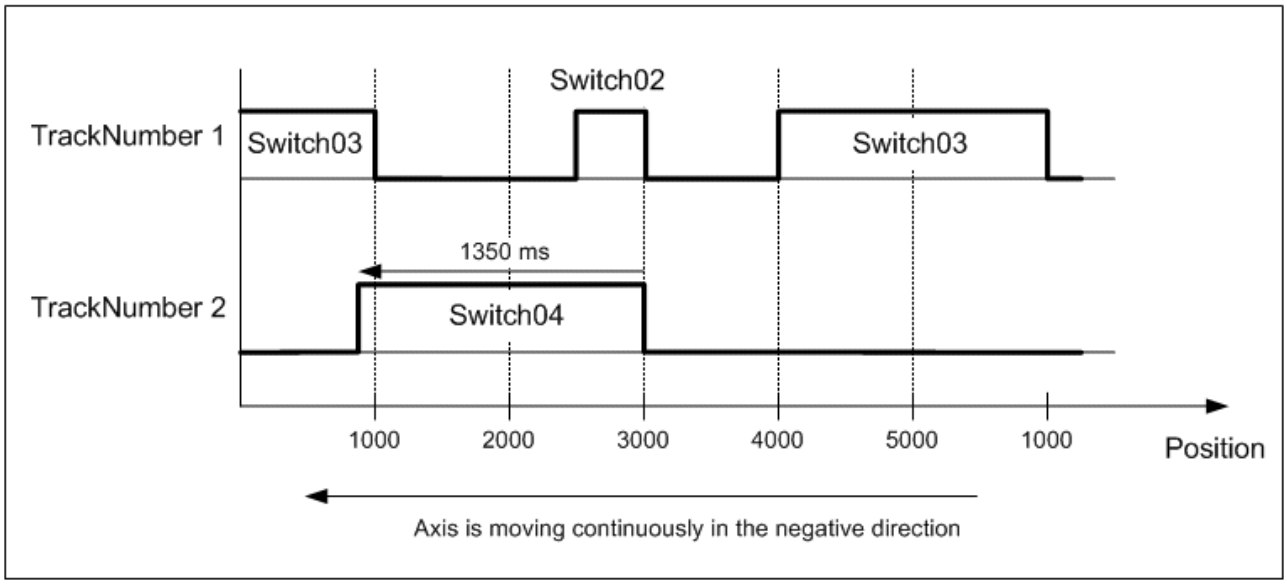
	Switch 1	**...**	**Switch m**
FirstOnPosition	3000		
LastOnPosition	—		
AxisDirection	BOTH		
CamSwitchMode	TIME		
Duration [s]	1,350		

The following switching diagrams result from the cam data. The switching sequence is represented without any time compensation and hysteresis and varies for both directions of travel due to the cam data.

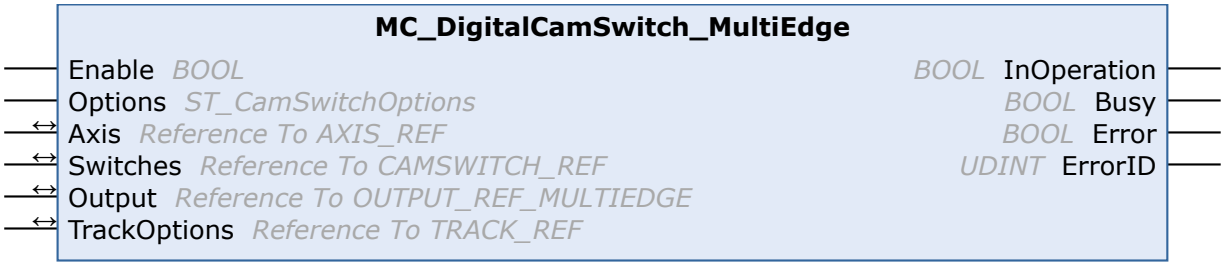
Switching sequence for positive direction of travel



Switching sequence for negative direction of travel



4.1.1.2.2 MC_DigitalCamSwitch_MultiEdge



The function block MC_DigitalCamSwitch_MultiEdge is a digital cam controller with one or several cams on a digital output track. The function block supplements the function block MC_DigitalCamSwitch by the capability of being able to perform multiple switching operations during a PLC cycle. The switching operations are defined by position cams. Further output tracks can be realized with independent instances of the function block.

In addition to the switching state of the digital output the output data structure contains precise time information for the next switching operations. With this information, the actual output can take place on an XFC multi-timestamp output terminal with a downstream function block (XFC_EL1259_MultiEdge, XFC_EL2212_MultiEdge [▶ 32], XFC_EL2258_MultiEdge [▶ 36] or XFC_EL2262_MultiEdge [▶ 38]).

Time cams and brake cams cannot be used with the function block MC_DigitalCamSwitch_MultiEdge. Terminals without multi-timestamp functionality are not suitable for use with this function block.

Inputs

```
VAR_INPUT
    Enable  : BOOL;
    Options : ST_CamSwitchOptions;
END_VAR
```

Name	Type	Description
Enable	BOOL	The cam controller is activated via the Enable input. The initial state remains unchanged, as long as Enable=FALSE.
Options	ST_CamSwitchOptions [▶ 48]	Optional parameters

Inputs/Outputs

```
VAR_IN_OUT
    Axis         : AXIS_REF;
    Switches     : CAMSWITCH_REF;
    Output       : OUTPUT_REF_MULTIEDGE;
    TrackOptions : TRACK_REF;
END_VAR
```

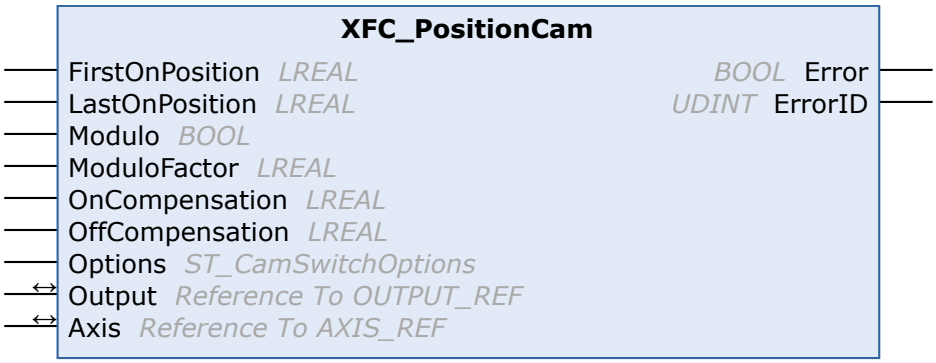
Name	Type	Description
Axis	AXIS_REF	The axis data structure of type AXIS_REF addresses an axis unambiguously within the system. Among other parameters, it contains the current axis status, including position, velocity or error state.
Switches	CAMSWITCH_REF [▶ 42]	The data structure Switches contains a reference to the parameterization of all cams on the cam track.
Output	OUTPUT_REF_MULTIEDGE [▶ 43]	The data structure Output contains the calculated state of the digital output and the associated timestamp for the output at a digital XFC output terminal.
TrackOptions	TRACK_REF [▶ 43]	The data structure TrackOptions contains the parameterization for the cam track.

Outputs

```
VAR_OUTPUT
    InOperation : BOOL;
    Busy        : BOOL;
    Error       : BOOL;
    ErrorID     : UDINT;
END_VAR
```

Name	Type	Description
InOperation	BOOL	InOperation is TRUE, as long as the cam controller is active and the cam track is calculated according to the cam parameterization.
Busy	BOOL	Busy is TRUE as long as the block function is not completed.
Error	BOOL	Becomes TRUE if an error occurs.
ErrorID	UDINT	If the error output is set, this parameter supplies the error number.

4.1.1.2.3 XFC_PositionCam



The function block XFC_PositionCam realizes a position cam that switches a digital output on or off, depending on the position.

In contrast to the digital cam controller MC_DigitalCamSwitch [▶ 16], the function block switches precisely one cam on a digital output track. This facilitates parameterization of the function block, although it cannot be used if several cams are required on an output track.

In addition to the switching state of the digital output the output data structure contains precise time information for the next switching operations. This information is used for the actual output at an XFC output terminal with a downstream function block (XFC_EL2252_V2 [▶ 34] or XFC_EL2262 [▶ 37]).

Inputs

```
VAR_INPUT
    FirstOnPosition : LREAL;
    LastOnPosition  : LREAL;
    Modulo          : BOOL;
    ModuloFactor    : LREAL := 360;
    OnCompensation  : LREAL;
    OffCompensation : LREAL;
    Options         : ST_CamSwitchOptions;
END_VAR
```

Name	Type	Description
FirstOnPosition	LREAL	First position from which the cam is switched on.
LastOnPosition	LREAL	Last position up to which the cam is switched on. The cam function is inverted, if LastOnPosition < FirstOnPosition
Modulo	BOOL	If Modulo TRUE, all positions are interpreted as modulo. The cam function is repeated cyclically. The parameter ModuloFactor is used for calculating the modulo cycle.

Name	Type	Description
ModuloFactor	LREAL	ModuloFactor indicates the length of a modulo cycle in the positioning unit of the axis and is only used if Modulo TRUE.
OnCompensation	LREAL	Compensation time for the rising edge of the cam in [s]. For negative values of OnCompensation the switching time is brought forward, otherwise it is delayed. The value OnCompensation parameterized here has priority over TRACK_REF. [▶ 43]
OffCompensation	LREAL	Compensation time for the falling edge of the cam in [s]. For negative values of OffCompensation the switching time is brought forward, otherwise it is delayed. The value OffCompensation parameterized here has priority over TRACK_REF [▶ 43].
Options	ST_CamSwitchOptions [▶ 48]	Optional parameters

/ Inputs/Outputs

```
VAR_IN_OUT
    Output : OUTPUT_REF;
    Axis   : AXIS_REF;
END_VAR
```

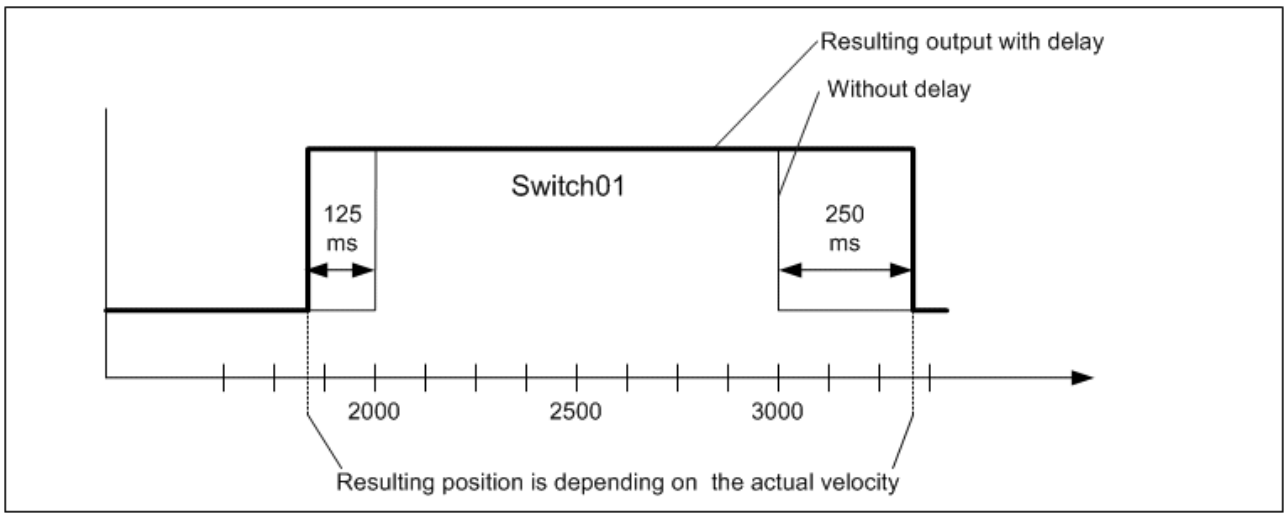
Name	Type	Description
Output	OUTPUT_REF [▶ 42]	The data structure Output contains the calculated state of the digital output and the associated timestamp for the output at a digital XFC output terminal
Axis	AXIS_REF	The axis data structure of type AXIS_REF addresses an axis unambiguously within the system. Among other parameters, it contains the current axis status, including position, velocity or error state.

Outputs

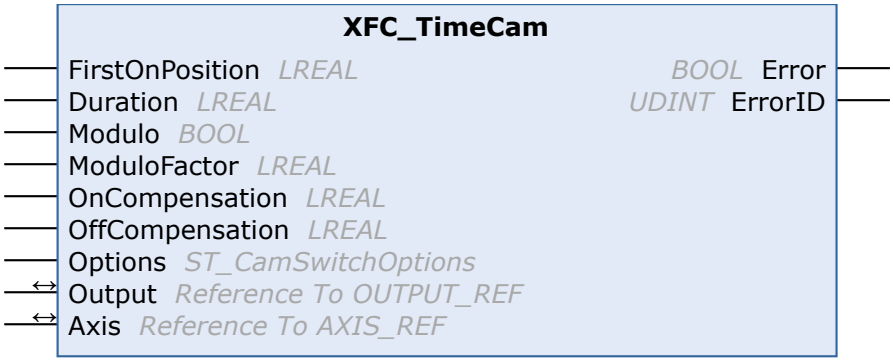
```
VAR_OUTPUT
    Error             : BOOL;
    ErrorID           : UDINT;
END_VAR
```

Name	Type	Description
Error	BOOL	Becomes TRUE if an error occurs.
ErrorID	UDINT	Returns a error number when the error output is set.

Method of function of the time compensation



4.1.1.2.4 XFC_TimeCam



The function block XFC_TimeCam realizes a time cam that activates a digital output depending on the position and switches it off after a certain time.

In contrast to the digital cam controller MC_DigitalCamSwitch [▶ 16], the function block switches precisely one cam on a digital output track. This facilitates parameterization of the function block, although it cannot be used if several cams are required on an output track.

In addition to the switching state of the digital output the output data structure contains precise time information for the next switching operations. This information is used for the actual output at an XFC output terminal with a downstream function block (XFC_EL2252_V2 [▶ 34] or XFC_EL2262 [▶ 37]).

Inputs

```
VAR_INPUT
    FirstOnPosition : LREAL;
    Duration        : LREAL;
    Modulo          : BOOL;
    ModuloFactor    : LREAL := 360;
    OnCompensation  : LREAL;
    OffCompensation : LREAL;
    Options         : ST_CamSwitchOptions;
END_VAR
```

Name	Type	Description
FirstOnPosition	LREAL	First position from which the cam is switched on.
Duration	LREAL	Switch-on duration of the cam in [s].
Modulo	BOOL	If Modulo TRUE, all positions are interpreted as modulo. The cam function is repeated cyclically. The parameter ModuloFactor is used for calculating the modulo cycle.

Name	Type	Description
ModuloFactor	LREAL	ModuloFactor indicates the length of a modulo cycle in the positioning unit of the axis and is only used if Modulo TRUE.
OnCompensation	LREAL	Compensation time for the rising edge of the cam in [s]. For negative values of OnCompensation the switching time is brought forward, otherwise it is delayed. The value OnCompensation parameterized here has priority over TRACK_REF [▶ 43].
OffCompensation	LREAL	Compensation time for the falling edge of the cam in [s]. For negative values of OffCompensation the switching time is brought forward, otherwise it is delayed. The value OffCompensation parameterized here has priority over TRACK_REF [▶ 43].
Options	ST_CamSwitchOptions [▶ 48]	Optional parameters

/ Inputs/Outputs

```
VAR_IN_OUT
    Output : OUTPUT_REF;
    Axis   : AXIS_REF;
END_VAR
```

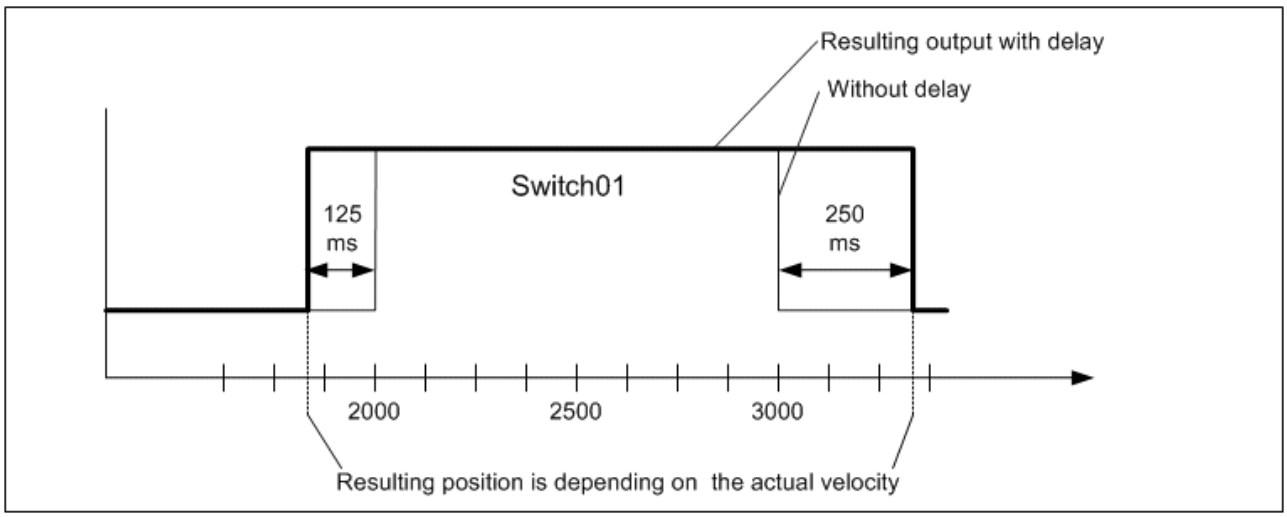
Name	Type	Description
Output	OUTPUT_REF [▶ 42]	The data structure Output contains the calculated state of the digital output and the associated timestamp for the output at a digital XFC output terminal
Axis	AXIS_REF	The axis data structure of type AXIS_REF addresses an axis unambiguously within the system. Among other parameters, it contains the current axis status, including position, velocity or error state.

Outputs

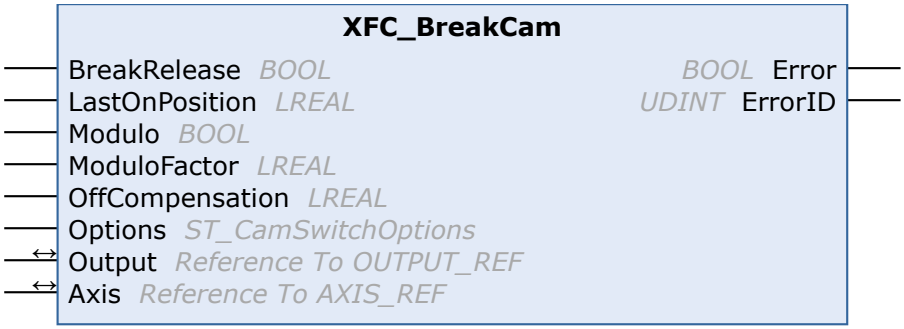
```
VAR_OUTPUT
    Error             : BOOL;
    ErrorID           : UDINT;
END_VAR
```

Name	Type	Description
Error	BOOL	Becomes TRUE if an error occurs.
ErrorID	UDINT	Returns a error number when the error output is set.

Method of function of the time compensation



4.1.1.2.5 XFC_BreakCam



The function block XFC_BreakCam realizes a brake cam, which deactivates a digital output depending on the position as soon as BreakRelease is withdrawn.

In addition to the switching state of the digital output the output data structure contains precise time information for the next switching operations. This information is used for the actual output at an XFC output terminal with a downstream function block (XFC_EL2252_V2 [▶ 34] or XFC_EL2262 [▶ 37]).

Inputs

```
VAR_INPUT
    BreakRelease    : LREAL;
    LastOnPosition  : LREAL;
    Modulo          : BOOL;
    ModuloFactor    : LREAL := 360;
    OffCompensation : LREAL;
    Options         : ST_CamSwitchOptions;
END_VAR
```

Name	Type	Description
BreakRelease	LREAL	Brake enable. The cam remains active as long as BreakRelease is TRUE. When BreakRelease becomes FALSE, the cam is switched off at position LastOnPosition.
LastOnPosition	LREAL	Last position up to which the cam is switched on.
Modulo	BOOL	If Modulo TRUE, all positions are interpreted as modulo. The cam function is repeated cyclically. The parameter ModuloFactor is used for calculating the modulo cycle.
ModuloFactor	LREAL	ModuloFactor indicates the length of a modulo cycle in the positioning unit of the axis and is only used if Modulo=TRUE.

Name	Type	Description
OffCompensation	LREAL	Compensation time for the falling edge of the cam in [s]. For negative values of OffCompensation the switching time is brought forward, otherwise it is delayed. The value OffCompensation parameterized here has priority over TRACK_REF [▶ 43].
Options	ST_CamSwitchOptions [▶ 48]	Optional parameters

/ Inputs/Outputs

```
VAR_IN_OUT
    Output : OUTPUT_REF;
    Axis   : AXIS_REF;
END_VAR
```

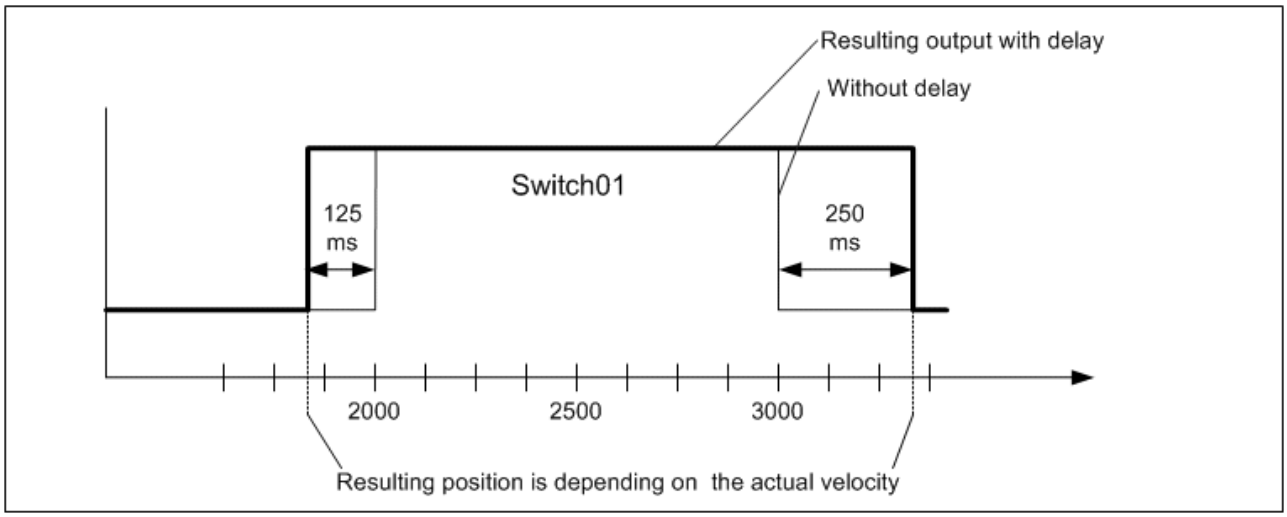
Name	Type	Description
Output	OUTPUT_REF [▶ 42]	The data structure Output contains the calculated state of the digital output and the associated timestamp for the output at a digital XFC output terminal.
Axis	AXIS_REF	The axis data structure of type AXIS_REF addresses an axis unambiguously within the system. Among other parameters, it contains the current axis status, including position, velocity or error state.

Outputs

```
VAR_OUTPUT
    Error             : BOOL;
    ErrorID           : UDINT;
END_VAR
```

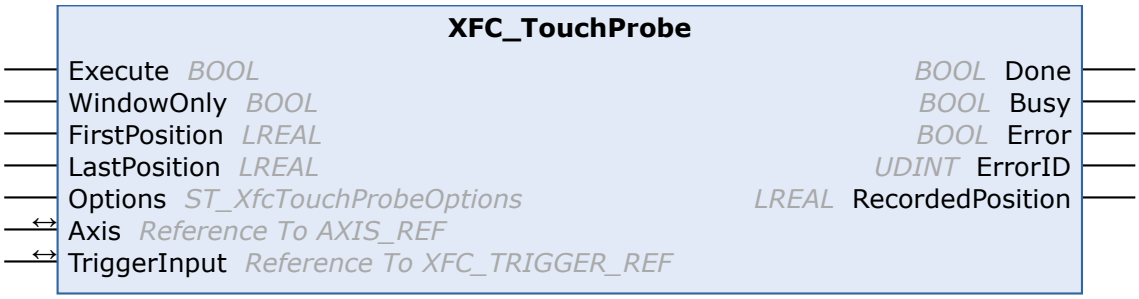
Name	Type	Description
Error	BOOL	Becomes TRUE if an error occurs.
ErrorID	UDINT	Returns a error number when the error output is set.

Method of function of the time compensation



4.1.1.3 TouchProbe

4.1.1.3.1 XFC_TouchProbe



The function block XFC_TouchProbe records an axis position at the time of the edge of a digital input signal (measuring probe function).

The digital input signal is recorded with an XFC input terminal (e.g. EL1252) with timestamps for the falling and rising signal edge. The function block determines the axis position at which the edge change occurred and issues it as RecordedPosition.

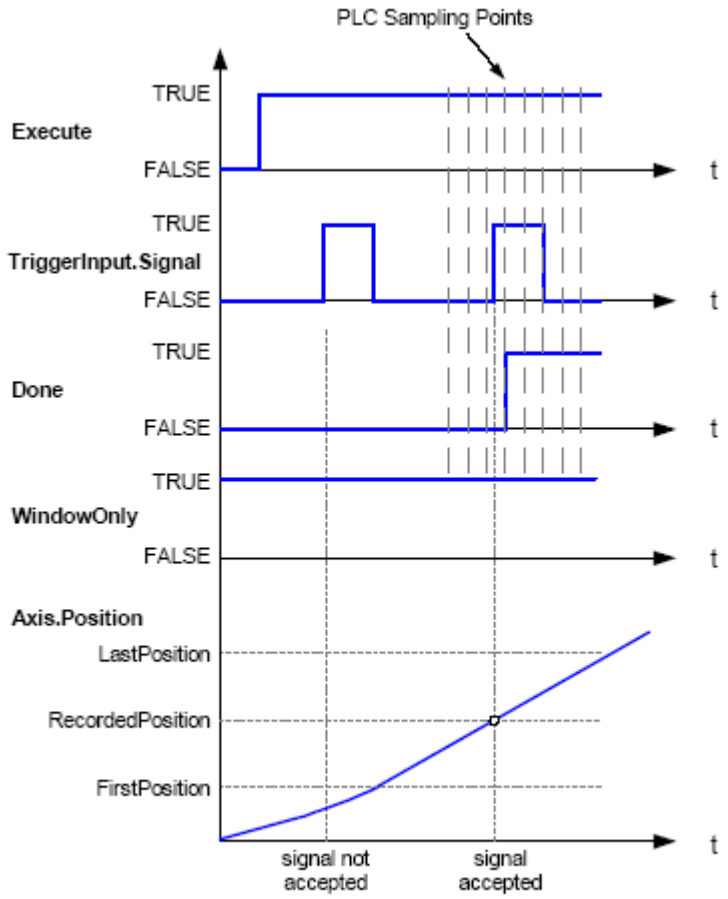
In contrast to the conventional TouchProbe function MC_TouchProbe the digital input is not directly linked to the drive hardware. The position of each EtherCAT or Sercos axis in the system can be recorded via the timestamp of the input. This axis is exactly synchronized via Dead time compensation [▶ 9].

The function block can be used in free-running or single-shot mode. In free-running mode each edge of the input signal is recorded (maximum one edge per PLC cycle). In single-shot mode the next edge is only recorded once until the function block is triggered again.

The optional window function can be used to ignore signal edges outside the defined position filter.

The sample [▶ 77] shows how the function block can be used in free-running (`FreeRun = TRUE`) or in single-shot mode (`FreeRun = FALSE`).

Signal curve



Timing example TouchProbe

Inputs

```
VAR_INPUT
    Execute       : BOOL;
    WindowOnly    : BOOL;
    FirstPosition : LREAL;
    LastPosition  : LREAL;
    Options       : ST_XfcTouchProbeOptions;
END_VAR
```

Name	Type	Description
Execute	BOOL	If Execute is active, the axis position is recorded at the defined signal edge of the input signal. A falling edge at Execute terminates the process immediately. Depending on the configuration in TriggerInput.FreeRun the next signal edge is recorded and evaluated once. If FreeRun is TRUE, a new position value is recorded continuously with each defined edge of the input signal, while Execute remains TRUE.
WindowOnly	BOOL	If this option is active, only one position inside the window between FirstPosition and LastPosition is recorded. Positions outside the window are discarded. Only if the recorded position lies inside the window does Done become TRUE. The recording window can be interpreted in terms of absolute or modulo values. In this connection the flag ModuloPositions [▶ 44]in the structure TriggerInput [▶ 44]is to be set accordingly. In the case of absolute value positions there is exactly one window. In the case of

Name	Type	Description
		modulo value positions the window repeats itself within the modulo cycle defined in the axis parameters (e.g. 0 to 360 degrees).
FirstPosition	LREAL	Initial position of the recording window, if WindowOnly is TRUE. This position can be interpreted as an absolute or modulo value. In this connection the flag ModuloPositions [▶ 44] is to be set appropriately in the structure TriggerInput (see below).
LastPosition	LREAL	Final position of the recording window, if WindowOnly is TRUE. This position can be interpreted as an absolute or modulo value. In this connection the flag ModuloPositions [▶ 44] is to be set appropriately in the structure TriggerInput (see below).
Options	ST_XfcTouchProbeOptions [▶ 48]	Optional parameters

/ Inputs/Outputs

```
VAR_IN_OUT
    Axis         : AXIS_REF;
    TriggerInput : XFC_TRIGGER_REF;
END_VAR
```

Name	Type	Description
Axis	AXIS_REF	The axis data structure of type AXIS_REF addresses an axis unambiguously within the system. Among other parameters, it contains the current axis status, including position, velocity or error state.
TriggerInput	XFC_TRIGGER_REF [▶ 44]	TriggerInput is a data structure for describing the trigger source and for feeding the state and timestamp of a digital input signal. This data structure is filled by the user.

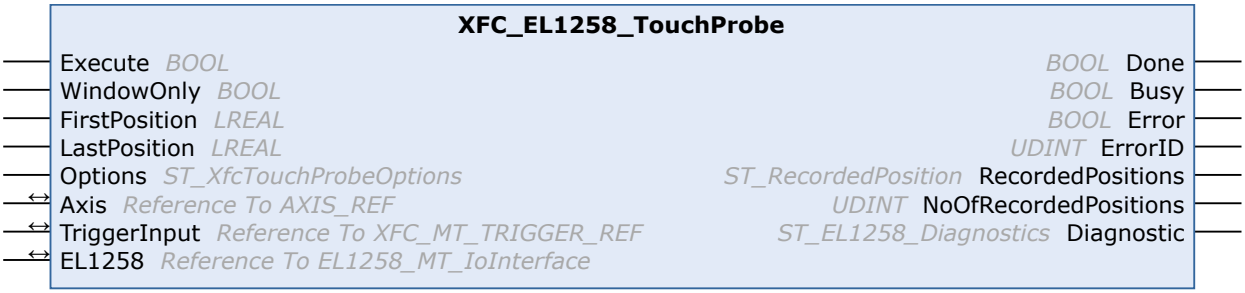
Outputs

```
VAR_OUTPUT
    Done             : BOOL;
    Busy             : BOOL;
    Error            : BOOL;
    ErrorID          : UDINT;
    RecordedPosition : LREAL;
END_VAR
```

Name	Type	Description
Done	BOOL	The value RecordedPosition is valid. If TriggerInput.FreeRun is TRUE, Done only remains TRUE only for one PLC cycle and is then reset automatically, since TouchProbe is automatically reactivated.
Busy	BOOL	Becomes TRUE as soon as the function block is active, and becomes FALSE when it has returned to its initial state. If TriggerInput.FreeRun is TRUE, Busy remains TRUE continuously, even if Done or Error become TRUE, since TouchProbe is automatically reactivated.
Error	BOOL	Becomes TRUE if an error occurs.
ErrorID	UDINT	If the error output is set, this parameter supplies the error number

Name	Type	Description
RecordedPosition	LREAL	Axis position recorded at the point in time of the trigger signal. If TriggerInput.FreeRun is TRUE, the function block operates in free-running mode, so that each valid change in the input signal leads to a new RecordedPosition. The position can be analyzed, if Done becomes TRUE.

4.1.1.3.2 XFC_EL1258_TouchProbe



The function block XFC_EL1258_TouchProbe records the axis positions at the time of the edges of a digital input signal (touch probe function).

The digital input signal is recorded with an EL1258 XFC input terminal with timestamps for falling and rising signal edges. The function block determines the axis positions at which an edge change occurred and issues it as RecordedPosition.

In contrast to the conventional TouchProbe function MC_TouchProbe the digital input is not directly linked to the drive hardware. The position of each EtherCAT or Sercos axis in the system can be recorded via the timestamps of the input. This axis is exactly synchronized via Dead time compensation.

The function block can be used in free-running or single-shot mode. In free-running mode, each edge of the input signal is recorded (including several edges per PLC cycle). In single-shot mode the next edges are only recorded once until the function block is triggered again.

The optional window function can be used to ignore signal edges outside the defined position filter.

Inputs

```
VAR_INPUT
    Execute       : BOOL;
    WindowOnly    : BOOL;
    FirstPosition : LREAL;
    LastPosition  : LREAL;
    Options       : ST_XfcTouchProbeOptions;
    EL1258        : EL1258_MT_IoInterface;
END_VAR
```

Name	Type	Description
Execute	BOOL	If Execute is active, the axis position is recorded at the defined signal edge of the input signal. A falling edge at Execute terminates the process immediately. Depending on the configuration in TriggerInput.FreeRun the next signal edge is recorded and evaluated once. If FreeRun is TRUE, a new position value is recorded continuously with each defined edge of the input signal, while Execute remains TRUE.
WindowOnly	BOOL	If this option is active, only one position inside the window between FirstPosition and LastPosition is recorded. Positions outside the window are discarded. Only when the recorded position is within the window, Done becomes TRUE. The recording window can be interpreted in terms of absolute or modulo values. In this connection the flag

Name	Type	Description
		ModuloPositions [▶ 44] is to be set appropriately in the structure TriggerInput [▶ 44]. In the case of absolute value positions there is exactly one window. In the case of modulo value positions the window repeats itself within the modulo cycle defined in the axis parameters (e.g. 0 to 360 degrees).
FirstPosition	LREAL	Initial position of the recording window, if WindowOnly is TRUE. This position can be interpreted as an absolute or modulo value. In this connection the flag ModuloPositions [▶ 44] is to be set appropriately in the structure TriggerInput (see below).
LastPosition	LREAL	Final position of the recording window, if WindowOnly is TRUE. This position can be interpreted as an absolute or modulo value. In this connection the flag ModuloPositions [▶ 44] is to be set appropriately in the structure TriggerInput (see below).
Options	ST_XfcTouchProbeOptions [▶ 48]	Optional parameters
EL1258	EL1258_MT_IoInterface [▶ 48]	Process image of the terminal

/ Inputs/Outputs

```
VAR_IN_OUT
    Axis         : AXIS_REF;
    TriggerInput : XFC_TRIGGER_REF;
END_VAR
```

Name	Type	Description
Axis	AXIS_REF	The axis data structure of type AXIS_REF addresses an axis unambiguously within the system. Among other parameters, it contains the current axis status, including position, velocity or error state.
TriggerInput	XFC_MT_TRIGGER_REF	TriggerInput is a data structure for describing the trigger source and for feeding the state and timestamp of a digital input signal. This data structure is filled by the user.

Outputs

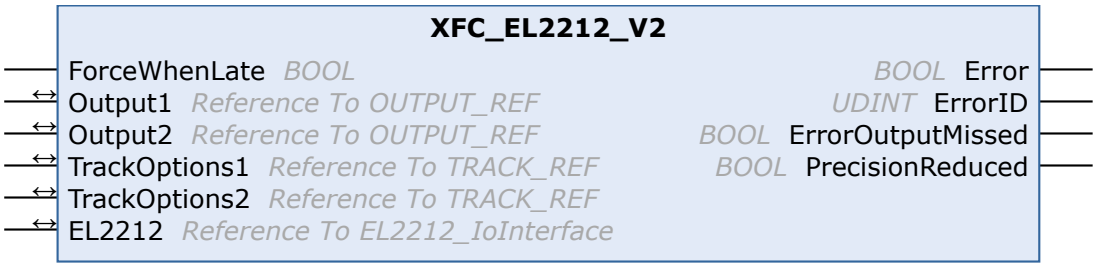
```
VAR_OUTPUT
    Done                 : BOOL;
    Busy                 : BOOL;
    Error                : BOOL;
    ErrorID              : UDINT;
    RecordedPositions    : ARRAY[1..10];
    NoOfRecordedPositions : UDINT;
    Diagnostic           : ST_EL1258_Diagnostics
END_VAR
```

Name	Type	Description
Done	BOOL	The value RecordedPosition is valid. If TriggerInput.FreeRun is TRUE, Done only remains TRUE for one PLC cycle and is then reset automatically, since TouchProbe is automatically reactivated.
Busy	BOOL	Becomes TRUE as soon as the function block is active, and becomes FALSE when it has returned to its initial state. If TriggerInput.FreeRun is TRUE, Busy remains TRUE continuously, even if Done or Error become TRUE, since TouchProbe is automatically reactivated.
Error	BOOL	Becomes TRUE if an error occurs.

Name	Type	Description
ErrorID	UDINT	If the error output is set, this parameter supplies the error number.
RecordedPositions	ARRAY[1..10]	One or more detected axis positions at the time of the trigger event. If TriggerInput.FreeRun is TRUE, the function block operates in free-running mode, so that each valid change in the input signal leads to a new RecordedPosition. The positions can be evaluated if Done is TRUE.
NoOfRecordedPositions	UDINT	Number of positions recorded.
Diagnostic	ST_EL1258_Diagnostics [▶ 45]	Data structure containing diagnostic data that can be used for error analysis.

4.1.1.4 Output routines for digital terminals

4.1.1.4.1 XFC_EL2212_V2



The function block XFC_EL2212_V2 handles the output of a digital cam with the EL2212 XFC timestamp terminal.

The output of the data to the terminal takes place only shortly before reaching the timestamp of one of the outputs. Four PLC cycles are required for activation and acknowledgement of the outputs. Only then can a further edge change take place. The minimum time between two edge changes of the output signal is therefore four PLC cycles, in order to prevent errors or loss of precision. If the output signal is generated by a cam controller, a minimum cam width can be calculated from the maximum velocity and the PLC cycle time.

The outputs Output1 and Output2 cannot be used completely independently of each other since the activation takes place with only one timestamp. As a prerequisite, the switching edges of both channels must be sufficiently far apart. In this case, the respectively nearest timestamp is applied to the block.

Inputs

```
VAR_INPUT
    ForceWhenLate : BOOL;
END_VAR
```

Name	Type	Description
ForceWhenLate	BOOL	If ForceWhenLate is TRUE, the output is activated even if the time stamp is already exceeded. It is recommended to set ForceWhenLate to prevent the loss of a switching edge in case of fluctuations of the time signal.

Inputs/outputs

```
VAR_IN_OUT
    Output1       : OUTPUT_REF;
    Output2       : OUTPUT_REF;
    TrackOptions1 : TRACK_REF;
```

```
    TrackOptions2 : TRACK_REF;
    EL2212        : EL2212_IoInterface;
END_VAR
```

Name	Type	Description
Output1	OUTPUT_REF [▶ 42]	Output state for channel 1 of the Terminal. The data structure Output contains the calculated state of the digital output and the associated time stamp for the output at a digital XFC output terminal
Output2	OUTPUT_REF [▶ 42]	Output state for channel 2 of the Terminal. The data structure Output contains the calculated state of the digital output and the associated time stamp for the output at a digital XFC output terminal.
TrackOptions1	TRACK_REF [▶ 43]	The TrackOptions1 data structure contains the parameterization of Cam Track 1 for Output1.
TrackOptions2	TRACK_REF [▶ 43]	The TrackOptions2 data structure contains the parameterization of Cam Track 2 for Output2.
EL2212	EL2212_IoInterface [▶ 49]	Process image of the terminal

Outputs

```
VAR_OUTPUT
    Error             : BOOL;
    ErrorID           : UDINT;
    ErrorOutputMissed : BOOL;
    PrecisionReduced  : BOOL;
END_VAR
```

Name	Type	Description
Error	BOOL	Becomes TRUE if an error occurs.
ErrorID	UDINT	If an error output is set, this parameter supplies an error number
ErrorOutputMissed	BOOL	The exact switching point transferred in the Output1 or Output2 structures could not be maintained and the output state remains unchanged. If ForceWhenLate is TRUE, the initial state is always output and ErrorOutputMissed does not become TRUE.
PrecisionReduced	BOOL	The exact switching point transferred in the Output1 or Output2 structures could not be maintained, but the output status was output with a delay. PrecisionReduced should be regarded as a warning. It can only become TRUE if ForceWhenLate is TRUE.

4.1.1.4.2 XFC_EL2212_MultiEdge

The function block XFC_EL2212_MultiEdge handles the output of a multi-edge cam controller MC_DigitalCamSwitch_MultiEdge [▶ 19] via the EL2212 XFC timestamp terminal.

Inputs

```
VAR_INPUT
    ForceWhenLate : BOOL;
    Reset         : BOOL;
END_VAR
```

Name	Type	Description
ForceWhenLate	BOOL	If ForceWhenLate is TRUE, the output is activated even if the time stamp is already exceeded. It is recommended to set ForceWhenLate to prevent the loss of a switching edge in case of fluctuations of the time signal.
Reset	BOOL	Reset initiates a reset of the terminal

Inputs/outputs

```
VAR_IN_OUT
    Output       : OUTPUT_REF_MULTIEDGE;
    TrackOptions : TRACK_REF;
    EL2212       : EL2212_IoInterface;
END_VAR
```

Name	Type	Description
Output	OUTPUT_REF_MULTIEDGE [▶ 43]	Output state for a channel of the Terminal. The data structure Output contains the next calculated states of the digital output and the associated timestamp for output on a digital XFC output terminal.
TrackOptions	TRACK_REF [▶ 43]	The data structure TrackOptions contains the parameterization for the cam track.
EL2212	EL2212_IoInterface [▶ 49]	Process image of the terminal

Outputs

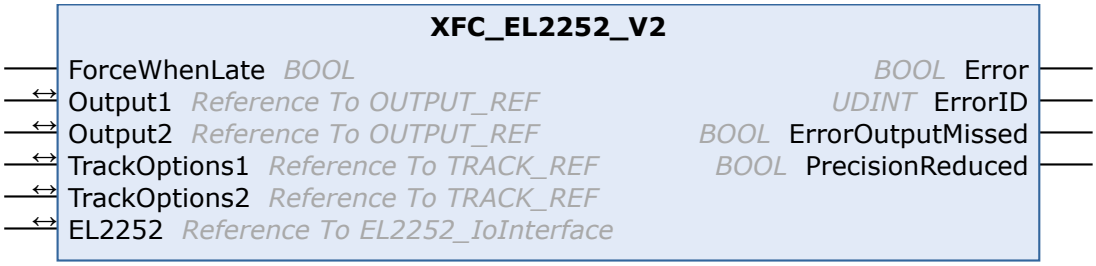
```
VAR_OUTPUT
    Error             : BOOL;
    ErrorID           : UDINT;
    ErrorOutputMissed : BOOL;
    PrecisionReduced  : BOOL;
    Diagnostics       : ST_EL2258_Diagnostics;
END_VAR
```

Name	Type	Description
Error	BOOL	Becomes TRUE if an error occurs.
ErrorID	UDINT	Returns a error number when the error output is set.
ErrorOutputMissed	BOOL	One of the switching points passed in the Output structure could not be met and the output state remains unchanged. If ForceWhenLate is TRUE, the output state is always output and ErrorOutputMissed does not become TRUE.
PrecisionReduced	BOOL	One of the switching points passed in the Output structure could not be kept, but the output state was delayed. PrecisionReduced is to be understood as a warning and can only become TRUE if ForceWhenLate is TRUE.
Diagnostics	ST_EL2258_Diagnostics [▶ 46]	Data structure containing diagnostic data that can be used for error analysis.

Process image

The terminal is inserted in the process image with up to 10 timestamps for operation with this function block in the multi-timestamp mode and the DC mode must be activated.

4.1.1.4.3 XFC_EL2252_V2



The function block XFC_EL2252_V2 handles the output of a digital cam with the EL2252 XFC timestamp terminal.

The output of the data to the terminal takes place only shortly before reaching the timestamp of one of the outputs. Four PLC cycles are required for activation and acknowledgement of the outputs. Only then can a further edge change take place. The minimum time between two edge changes of the output signal is therefore four PLC cycles, in order to prevent errors or loss of precision. If the output signal is generated by a cam controller, a minimum cam width can be calculated from the maximum velocity and the PLC cycle time.

The outputs Output1 and Output2 cannot be used completely independently of each other since the activation takes place with only one timestamp. As a prerequisite, the switching edges of both channels must be sufficiently far apart. In this case, the respectively nearest timestamp is applied to the block.

Inputs

```
VAR_INPUT
    ForceWhenLate : BOOL;
END_VAR
```

Name	Type	Description
ForceWhenLate	BOOL	If ForceWhenLate is TRUE, the output is activated even if the time stamp is already exceeded. It is recommended to set ForceWhenLate to prevent the loss of a switching edge in case of fluctuations of the time signal.

Inputs/outputs

```
VAR_IN_OUT
    Output1       : OUTPUT_REF;
    Output2       : OUTPUT_REF;
    TrackOptions1 : TRACK_REF;
    TrackOptions2 : TRACK_REF;
    EL2252        : EL2252_IoInterface;
END_VAR
```

Name	Type	Description
Output1	OUTPUT_REF [▶ 42]	Output state for channel 1 of the Terminal. The data structure Output contains the calculated state of the digital output and the associated time stamp for the output at a digital XFC output terminal.
Output2	OUTPUT_REF [▶ 42]	Output state for channel 2 of the Terminal. The data structure Output contains the calculated state of the digital output and the associated time stamp for the output at a digital XFC output terminal.
TrackOptions1	TRACK_REF [▶ 43]	The TrackOptions1 data structure contains the parameterization of Cam Track 1 for Output1.
TrackOptions2	TRACK_REF [▶ 43]	The TrackOptions2 data structure contains the parameterization of Cam Track 2 for Output2.
EL2252	EL2252_IoInterface [▶ 49]	Process image of the terminal

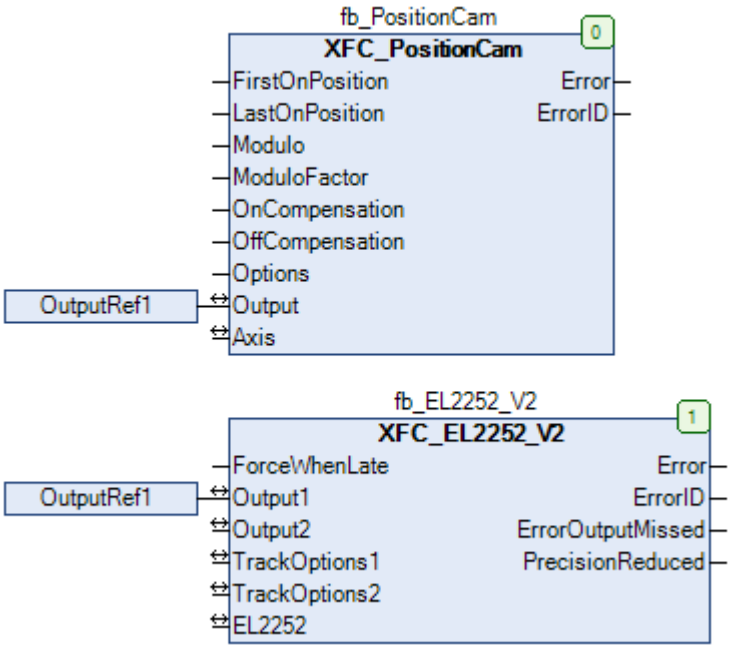
Outputs

```
VAR_OUTPUT
    Error             : BOOL;
    ErrorID           : UDINT;
    ErrorOutputMissed : BOOL;
    PrecisionReduced  : BOOL;
END_VAR
```

Name	Type	Description
Error	BOOL	Becomes TRUE if an error occurs.
ErrorID	UDINT	If an error output is set, this parameter supplies an error number
ErrorOutputMissed	BOOL	The exact switching point transferred in the Output1 or Output2 structures could not be maintained and the output state remains unchanged. If ForceWhenLate is TRUE, the initial state is always output and ErrorOutputMissed does not become TRUE.
PrecisionReduced	BOOL	The exact switching point transferred in the Output1 or Output2 structures could not be maintained, but the output status was output with a delay. PrecisionReduced should be regarded as a warning. It can only become TRUE if ForceWhenLate is TRUE.

Example for a position cam output

The function block XFC_PositionCam [▶ 20] is hardware-independent and transfers the necessary switching information for output to the function block XFC_EL2252_V2 in the OutputRef1 data structure. The data structure is used for data transfer on both function blocks.



Output of two position cams on one output terminal

The outputs Output1 and Output2 cannot be used completely independently of each other with the EL2252 because activation occurs with only one timestamp. As a prerequisite, the switching edges of both channels must be sufficiently far apart (4 PLC cycles). As soon as the switching edges are closer together, they are output inaccurately.

4.1.1.4.4 XFC_EL2258_MultiEdge

The function block XFC_EL2258_MultiEdge handles the output of a multi-edge cam controller MC_DigitalCamSwitch_MultiEdge [▶ 19] via the EL2258 XFC timestamp terminal.

Inputs

```
VAR_INPUT
    ForceWhenLate : BOOL;
    Reset         : BOOL;
END_VAR
```

Name	Type	Description
ForceWhenLate	BOOL	If ForceWhenLate is TRUE, the output is activated even if the time stamp is already exceeded.
Reset	BOOL	It is recommended to set ForceWhenLate to prevent the loss of a switching edge in case of fluctuations of the time signal.

Inputs/outputs

```
VAR_IN_OUT
    Output       : OUTPUT_REF_MULTIEDGE;
    TrackOptions : TRACK_REF;
    EL2258       : EL2258_IoInterface;
END_VAR
```

Name	Type	Description
Output	OUTPUT_REF_MULTIEDGE [▶ 43]	Output state for a channel of the Terminal. The data structure Output contains the next calculated states of the digital output and the associated timestamp for output on a digital XFC output terminal.
TrackOptions	TRACK_REF [▶ 43]	The data structure TrackOptions contains the parameterization for the cam track.
EL2258	EL2258_IoInterface [▶ 50]	Process image of the terminal

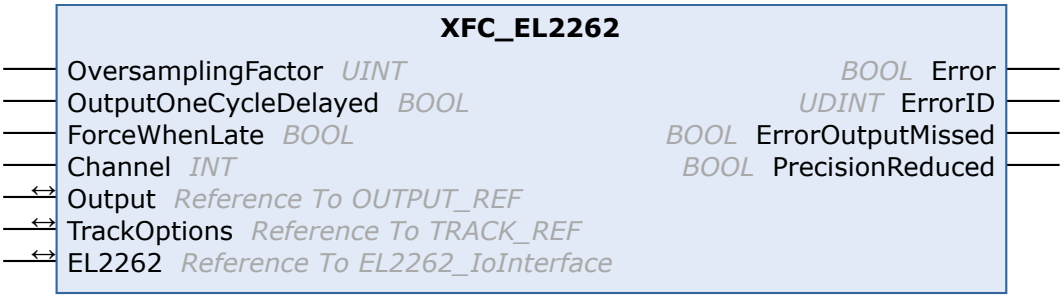
Outputs

```
VAR_OUTPUT
    Error            : BOOL;
    ErrorID          : UDINT;
    ErrorOutputMissed : BOOL;
    PrecisionReduced  : BOOL;
    Diagnostics      : ST_EL2258_Diagnostics;
END_VAR
```

Name	Type	Description
Error	BOOL	Becomes TRUE if an error occurs.
ErrorID	UDINT	If an error output is set, this parameter supplies an error number

Name	Type	Description
ErrorOutputMissed	BOOL	One of the switching points transferred in the Output structure could not be maintained and the output state remains unchanged. If ForceWhenLate is TRUE, the initial state is always output and ErrorOutputMissed does not become TRUE.
PrecisionReduced	BOOL	One of the switching points transferred in the Output structure could not be maintained, but the output state was output with a delay. PrecisionReduced should be regarded as a warning. It can only become TRUE if ForceWhenLate is TRUE.
Diagnostics	ST_EL2258_Diagnostics [▶ 46]	Data structure containing diagnostic data that can be used for error analysis.

4.1.1.4.5 XFC_EL2262



The function block XFC_EL2262 handles the output of a digital cam with the EL2262 XFC oversampling terminal.

The maximum frequency depends on the cycle time. The minimum distance between two rising signal edges is two PLC cycles. The minimum distance between rising and falling edge can be smaller than a PLC cycle. The switching accuracy is determined by the set oversampling factor of the terminal.

The two channels of the terminal are independent of each other and are served by two instances of the XFC_EL2262 function block.

Inputs

```
VAR_INPUT
    OversamplingFactor    : UINT;
    OutputOneCycleDelayed : BOOL; (* TRUE if EL2262 is updated with the NC SAF task at the beginning
 of the next cycle *)
    ForceWhenLate         : BOOL;
    Channel               : INT;
END_VAR
```

Name	Type	Description
OversamplingFactor	UINT	Oversampling factor for the EL2262 terminal
OutputOneCycleDelayed	BOOL	OutputOneCycleDelayed is TRUE, if the output of the process image is delayed by a cycle due to the set timing. OutputOneCycleDelayed depends on the timing of the output task to which the EL2262 is linked.
ForceWhenLate	BOOL	If the time information changes slightly from cycle to cycle, it might not be possible for a switching edge to be output. In such a situation ForceWhenLate forces the best possible switching. In this case the PrecisionReduced output goes TRUE and can be used for diagnosis. (Can be used in the case of increased jitter in an axis position where the output of a switching edge cannot be determined to an exact output cycle).
Channel	INT	Channel number 0 or 1 of the EL2262 Terminal

Inputs/outputs

```
VAR_IN_OUT
    Output       : OUTPUT_REF;
    TrackOptions : TRACK_REF;
    EL2262       : EL2262_IoInterface;
END_VAR
```

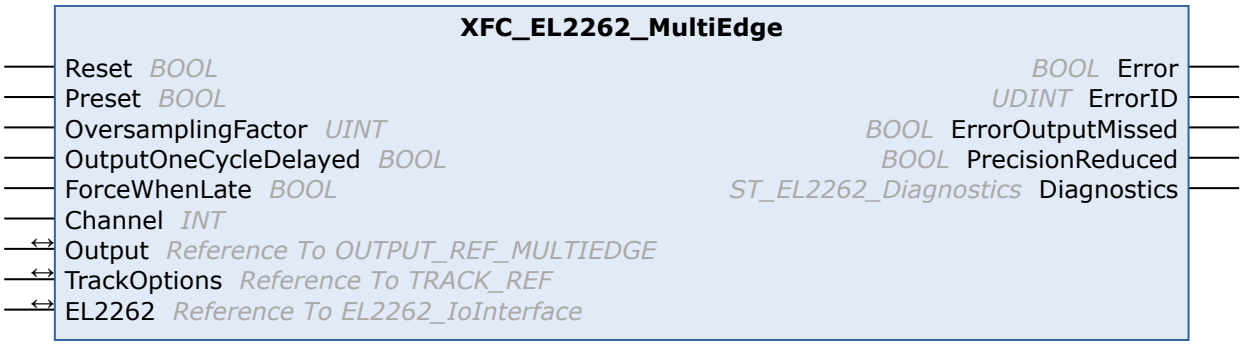
Name	Type	Description
Output	OUTPUT_REF [▶ 42]	The data structure Output contains the calculated state of the digital output and the associated time stamp for the output at a digital XFC output terminal
TrackOptions	TRACK_REF [▶ 43]	The data structure TrackOptions contains the parameterization for the cam track.
EL2262	EL2262_IoInterface [▶ 49]	Process image of the terminal

Outputs

```
VAR_OUTPUT
    Error             : BOOL;
    ErrorID           : UDINT;
    ErrorOutputMissed : BOOL;
    PrecisionReduced  : BOOL;
END_VAR
```

Name	Type	Description
Error	BOOL	Becomes TRUE if an error occurs.
ErrorID	UDINT	If an error output is set, this parameter supplies an error number
ErrorOutputMissed	BOOL	Indicates that a switching edge cannot be determined to an exact cycle and therefore cannot be output. The ForceWhenLate input can be set in order to output the switching edge as well as possible.
PrecisionReduced	BOOL	indicates that a switching edge cannot be determined to an exact cycle. However, the switching edge was output as well as possible.

4.1.1.4.6 XFC_EL2262_MultiEdge



The function block XFC_EL2262_Multiedge handles the output of a digital cam with the EL2262 XFC oversampling terminal.

The maximum frequency depends on the cycle time. The minimum distance between two rising signal edges = (2*PLC cycle time) / oversampling factor. The minimum distance between a rising and falling edge = PLC cycle time / oversampling factor. The switching accuracy is determined by the set oversampling factor of the terminal.

Inputs

```
VAR_INPUT
    Reset                   : BOOL;
    Preset                  : BOOL;
    OversamplingFactor      : UINT;
    OutputOneCycleDelayed   : BOOL; (* TRUE if EL2262 is updated with the NC SAF task at the begi
nning of the next cycle *)
    ForceWhenLate           : BOOL; (* forces the output even when the timestamp is missed *)
    Channel                 : INT;  (* select 0 or 1 for Output0 or Output1 *)
END_VAR
```

Name	Type	Description
Reset	BOOL	The terminal output is deactivated.
Preset	BOOL	The terminal output is activated.
OversamplingFactor	UINT	Oversampling factor for the EL2262 terminal
OutputOneCycleDelayed	BOOL	OutputOneCycleDelayed is TRUE, if the output of the process image is delayed by a cycle due to the set timing. OutputOneCycleDelayed depends on the timing of the output task to which the EL2262 is linked.
ForceWhenLate	BOOL	If the time information changes slightly from cycle to cycle, it might not be possible for a switching edge to be output. In such a situation ForceWhenLate forces the best possible switching. In this case the PrecisionReduced output goes TRUE and can be used for diagnosis. (Can be used in the case of increased jitter in an axis position where the output of a switching edge cannot be determined to an exact output cycle).
Channel	INT	Defines the output channel of the EL2262, where 0 = Output0 and 1 = Output1.

Inputs/outputs

```
VAR_IN_OUT
    Output       : OUTPUT_REF_MULTIEDGE;
    TrackOptions : TRACK_REF;
    EL2262       : EL2262_IoInterface;
END_VAR
```

Name	Type	Description
Output	OUTPUT_REF_MULTIEDGE [▶ 43]	The data structure Output contains an array of calculated states of the digital output and the associated timestamp for output on a digital XFC output terminal
TrackOptions	TRACK_REF [▶ 43]	The data structure TrackOptions contains the parameterization for the cam track.
EL2262	EL2262_IoInterface [▶ 49]	Process image of the terminal

Outputs

```
VAR_OUTPUT
    Error             : BOOL;
    ErrorID           : UDINT;
    ErrorOutputMissed : BOOL;
    PrecisionReduced  : BOOL;
    Diagnostics       : ST_EL2262_Diagnostics;
END_VAR
```

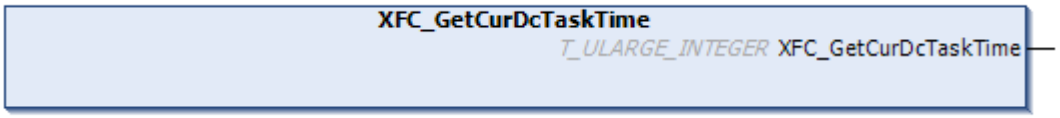
Name	Type	Description
Error	BOOL	Becomes TRUE if an error occurs.
ErrorID	UDINT	If an error output is set, this parameter supplies an error number

Name	Type	Description
ErrorOutputMissed	BOOL	One of the switching points transferred in the Output structure could not be maintained and the output state remains unchanged. If ForceWhenLate is TRUE, the initial state is always output and ErrorOutputMissed does not become TRUE.
PrecisionReduced	BOOL	One of the switching points transferred in the Output structure could not be maintained, but the output state was output with a delay. PrecisionReduced should be regarded as a warning. It can only become TRUE if ForceWhenLate is TRUE.
Diagnostics	ST_EL2262_Diagnostics [▶ 47]	Data structure containing diagnostic data that can be used for error analysis.

4.1.2 Functions

4.1.2.1 Basic functions

4.1.2.1.1 XFC_GetCurDcTaskTime



The function XFC_GetCurDcTaskTime determines the start time of the current PLC cycle.

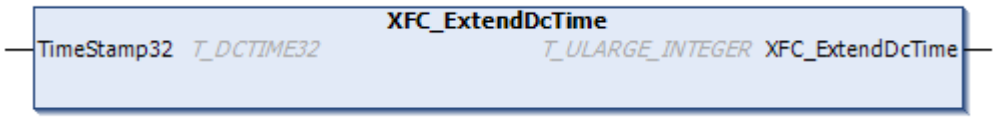
The function optimizes the calls of the system function F_GetCurDcTaskTime by answering several queries within a PLC task cycle with the same time, without calling the system function repeatedly.

Return value

```
FUNCTION XFCF_GetCurDcTaskTime : T_DCTIME
```

Name	Type	Description
XFCF_GetCurDcTaskTime	T_DCTIME	Return value of the function. Complete 64-bit distributed clock system time. Start time of the current PLC cycle (cycle of the task that calls this function.)

4.1.2.1.2 XFC_ExtendDcTime



The function XFC_ExtendDcTime extends a 32-bit time stamp to 64 bit.

A prerequisite for the extension to a complete time stamp is that the 32-bit time stamp is valid for the current time range. It is not possible to guarantee error-free extension of a time stamp that applies more than approx. +/- 2 seconds before or after the current time.

Inputs

```
VAR_INPUT
    TimeStamp32 : T_DCTIME32;
END_VAR
```

Name	Type	Description
TimeStamp32	T_DCTIME32	Distributed Clock System Time. Contains the lower 32 bits of the complete DcTime, thus covering a time range of +/- 2 seconds around the current time.

Return value

```
FUNCTION XFCF_ExtendDcTime : T_DCTIME
```

Name	Type	Description
XFCF_ExtendDcTime	T_DCTIME	Return value of the function. Complete 64-bit distributed clock system time.

4.1.3 Data types

4.1.3.1 MC_CamSwitch

The data type MC_CamSwitch contains all parameters of a digital cam for a digital cam controller MC_DigitalCamSwitch [▶ 16].

```
TYPE MC_CamSwitch :
STRUCT
    FirstOnPosition : LREAL;
    LastOnPosition  : LREAL;
    AxisDirection   : E_CamSwitchDirection;
    CamSwitchMode   : E_CamSwitchMode;
    Duration        : LREAL;
END_STRUCT
END_TYPE
```

The data structure for parameterization of a digital cam controller is usually an ARRAY OF MC_CamSwitch. A further structure CAMSWITCH_REF [▶ 42] refers to this structure.

Name	Type	Description
FirstOnPosition	LREAL	First position from which the cam is switched on.
LastOnPosition	LREAL	Last position up to which the cam is switched on. The cam function is inverted, if LastOnPosition < FirstOnPosition. LastOnPositionis is not used for time cams.
AxisDirection	E_CamSwitchDirection [▶ 50]	AxisDirection defines in which axis travel direction the digital cam is active (positive, negative or both directions).
CamSwitchMode	E_CamSwitchMode [▶ 50]	Digital cam type (position cam, time cam or brake cam).
Duration	LREAL	Duration defines the switch-on time of the cam in [s] and is only used for time cams.

```
TYPE E_CamSwitchDirection :
(
    CAMSWITCHDIRECTION_BOTH,     (* digital cam will work in both directions *)
    CAMSWITCHDIRECTION_POSITIVE, (* digital cam is just working in positive direction *)
    CAMSWITCHDIRECTION_NEGATIVE  (* digital cam is just working in negative direction *)
);
END_TYPE
```

```
TYPE E_CamSwitchMode :
(
    CAMSWITCHMODE_POSITION, (* position cam *)
    CAMSWITCHMODE_TIME,     (* time cam *)
    CAMSWITCHMODE_BREAK     (* break cam *)
);
END_TYPE
```

4.1.3.2 CAMSWITCH_REF

The data type CAMSWITCH_REF refers to a data structure with cam parameters for a digital cam controller MC_DigitalCamSwitch [▶ 16].

```
TYPE CAMSWITCH_REF :
STRUCT
    NumberOfSwitches : UDINT;
    pSwitches        : POINTER TO MC_CamSwitch;
    SizeOfSwitches   : UDINT;
END_STRUCT
END_TYPE
```

Name	Type	Description
NumberOfSwitches	UDINT	Number of array elements used. Can be less than the maximum number.
pSwitches	POINTER TO MC_CamSwitch	Pointer to the digital cam array.
SizeOfSwitches	UDINT	Maximum size of the digital cam array.

The actual data structure for parameterization of a digital cam controller is usually an ARRAY OF MC_CamSwitch [▶ 41]. CAMSWITCH_REF [▶ 42] refers to this structure via a pointer and clearly defines the size of the structure and the number of actual cams.

A variable of type CAMSWITCH_REF is initialized as illustrated in the following example:

```
VAR
    CamSwitchArray : ARRAY[1..3] OF MC_CamSwitch;
    CamSwitchRef   : CAMSWITCH_REF;
END_VAR
```

```
(* real number of defined digital cams *)
CamSwitchRef.NumberOfSwitches := 1; (* 1..3 *)
(* pointer to the digital cam data array *)
CamSwitchRef.pSwitches        := ADR(CamSwitchArray);
(* maximum size of the digital cam data array *)
CamSwitchRef.SizeOfSwitches   := SIZEOF(CamSwitchArray);
```

Example with two cam tracks

CamSwitchRefTrack1 : CAMSWITCH_REF	
	Value
NumberOfSwitches	3
pSwitches	ADR(CamSwitchArrayTrack1)
SizeOfSwitches	SIZEOF(CamSwitchArrayTrack1)

CamSwitchArrayTrack1 : Array [1..n] OF MC_CamSwitch

	Switch 1	Switch 2	Switch 3	...	Switch n
FirstOnPosition	2000	2500	4000		
LastOnPosition	3000	3000	1000		
AxisDirection	POSITIVE	NEGATIVE	BOTH		
CamSwitchMode	POSITION	POSITION	POSITION		
Duration [s]	—	—	—		

CamSwitchRefTrack2 : CAMSWITCH_REF	
	Value
NumberOfSwitches	1
pSwitches	ADR(CamSwitchArrayTrack2)
SizeOfSwitches	SIZEOF(CamSwitchArrayTrack2)

CamSwitchArrayTrack2 : Array [1..m] OF MC_CamSwitch

	Switch 1	...	Switch m
FirstOnPosition	3000		
LastOnPosition	—		
AxisDirection	BOTH		
CamSwitchMode	TIME		
Duration [s]	1,350		

4.1.3.3 OUTPUT_REF

The data type OUTPUT_REF contains data describing the state of a digital output. In addition to the switching state it contains time stamps for state changes.

```
TYPE OUTPUT_REF :
STRUCT
    Level                : BOOL;       (* current level of the digital output *)

    NextStateChangeValid : BOOL;       (* time value NextStateChange is valid *)
    NextStateChange      : T_DCTIME32; (* time of next state change -
```

```
 current level will be inverted *)

    NextOnTimeValid      : BOOL;       (* time value NextOnTime is valid *)
    NextOnTime           : T_DCTIME32; (* time when the digital output is turned ON next time *)

    NextOffTimeValid     : BOOL;       (* time value NextOffTime is valid *)
    NextOffTime          : T_DCTIME32; (* time when the digital output is turned OFF next time *)
END_STRUCT
END_TYPE
```

Name	Type	Description
Level	BOOL	Current switching state of the digital output
NextStateChangeValid	BOOL	NextStateChangeValid is TRUE, if the time stamp NextStateChange is valid.
NextStateChange	T_DCTIME32	Time of the next change of state (distributed clock TimeStamp)
NextOnTimeValid	BOOL	NextOnTimeValid is TRUE, if the time stamp NextOnTime is valid.
NextOnTime	T_DCTIME32	Time of the next positive switching edge (distributed clock TimeStamp)
NextOffTimeValid	BOOL	NextOffTimeValid is TRUE, if the time stamp NextOffTime is valid.
NextOffTime	T_DCTIME32	Time of the next negative switching edge (distributed clock TimeStamp)

4.1.3.4 OUTPUT_REF_MULTIEDGE

The data type OUTPUT_REF_MULTIEDGE contains data describing the state of a digital output. In addition to the switching state it contains time stamps for state changes. The data type is used in conjunction with terminals that allow multiple switching operations per PLC cycle by means of multi-timestamp.

```
TYPE OUTPUT_REF_MULTIEDGE :
STRUCT
    SwitchEvent : ARRAY [0..TCMC2_XFC_MAXINDEXOFMULTIEDGEOUTPUTEVENTS] OF ST_SwitchEvent;
END_STRUCT
END_TYPE

TYPE ST_SwitchEvent :
STRUCT
    ID       : UDINT;
    Valid    : BOOL;       (* time value is valid *)
    Level    : BOOL;       (* next level of the digital signal *)
    Position : LREAL;
    DcTime   : T_DCTIME32; (* time when the digital output changes *)
    Duration : DINT;
END_STRUCT
END_TYPE
```

Name	Type	Description
ID	UDINT	Internal ID of the switching edge
Valid	BOOL	Valid is TRUE if the DcTime timestamp is valid.
Level	BOOL	Current switching state of the digital output
Position	LREAL	Switching position of the switching operation
DcTime	T_DCTIME32	Time of the next change of state (distributed clock TimeStamp)
Duration	DINT	Not used

4.1.3.5 TRACK_REF

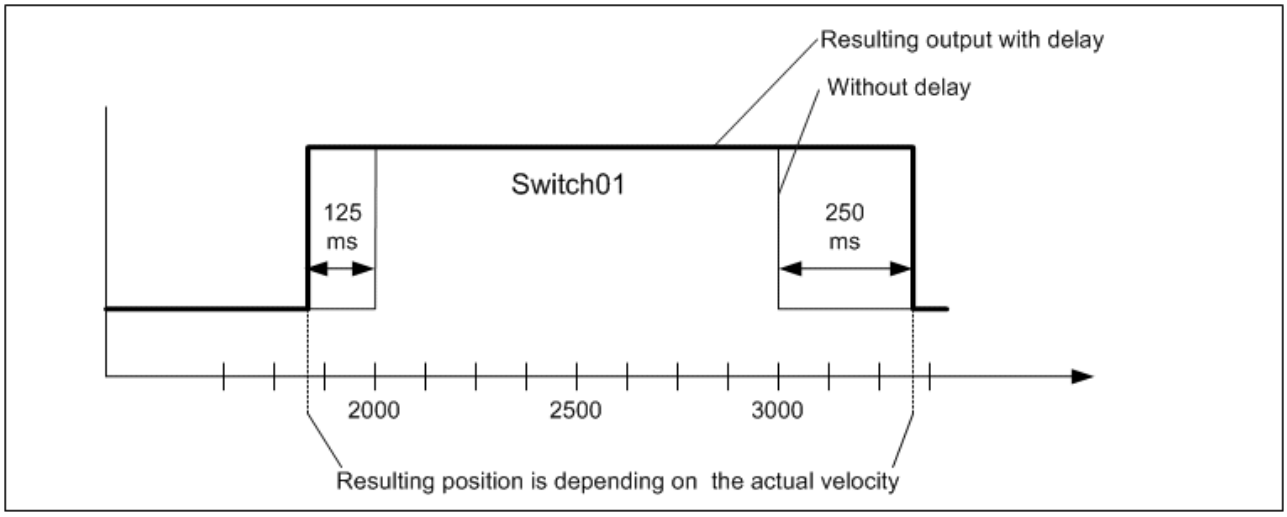
The data type TRACK_REF contains the parameters of a digital cam track for a digital cam controller MC_DigitalCamSwitch [▶ 16].

```
TYPE TRACK_REF :
STRUCT
    ModuloPositions : BOOL := TRUE; (* all cam positions are interpreted as modulo positions when TR
```

```
UE *)
    ModuloFactor    : LREAL := 360; (* e. g. 360 degrees *)
    OnCompensation  : LREAL;        (* compensation time [s] *)
    OffCompensation : LREAL;        (* compensation time [s] *)
    Hysteresis      : LREAL;        (* distance from last switch position (+ or -) *)
    BreakRelease    : BOOL;         (* allow break to be released when TRUE, break cams will be acti
vated when FALSE *)
    Force           : BOOL;         (* override all digital cams and set track ON *)
    Disable         : BOOL;         (* override all digital cams and set track OFF -
 overrides Force as well *)
END_STRUCT
END_TYPE
```

Name	Type	Description
ModuloPositions	BOOL	If Modulo TRUE, all positions are interpreted as modulo. The cam function is repeated cyclically. The parameter ModuloFactor is used for calculating the modulo cycle.
ModuloFactor	LREAL	ModuloFactor indicates the length of a modulo cycle in the positioning unit of the axis and is only used if Modulo TRUE.
OnCompensation	LREAL	Compensation time for the rising edge of the cam in [s]. For negative values of OnCompensation the switching time is brought forward, otherwise it is delayed.
OffCompensation	LREAL	Compensation time for the falling edge of the cam in [s]. For negative values of OffCompensation the switching time is brought forward, otherwise it is delayed.
Hysteresis	LREAL	not implemented. Hysteresis of the switching operations for reversing the rotation direction. The hysteresis is specified in the position unit of the axis.
BreakRelease	BOOL	Brake enable for brake cams on this cam track
Force	BOOL	The digital output is activated independent of the cams on this track. Disable has priority over Force.
Disable	BOOL	The digital output is deactivated independent of the cams on this track. Disable has priority over Force.

Method of function of the time compensation



4.1.3.6 XFC_TRIGGER_REF

The data type XFC_TRIGGER_REF contains the status and parameters of a digital input that is used for the function block XFC_TouchProbe [▶ 26].

```
TYPE XFC_TRIGGER_REF :
STRUCT
    Signal               : BOOL;
    TimestampRisingEdge  : T_DCTIME32;
```

```
    TimestampFallingEdge : T_DCTIME32;
    Edge                 : E_SignalEdge;
    FreeRun              : BOOL;
    EncoderIndex         : UINT;
    ModuloPositions      : BOOL;
    ModuloFactor         : LREAL := 360.0;
END_STRUCT
END_TYPE
```

Name	Type	Description
Signal	BOOL	Current state of the digital input signal. The current state must be supplied here.
TimestampRisingEdge	T_DCTIME32	Time stamp of the last rising edge of the digital input signal. Only the time stamp of the edge defined via Edge has to be supplied. If the input signal supplies a 64-bit time stamp T_DCTIME, only the lower 32 bits are supplied. It is therefore important to ensure that the value at the time of the evaluation is not older than 2 seconds.
TimestampFallingEdge	T_DCTIME32	Time stamp of the last falling edge of the digital input signal. Only the time stamp of the edge defined via Edge has to be supplied. If the input signal supplies a 64-bit time stamp T_DCTIME, only the lower 32 bits are supplied. It is therefore important to ensure that the value at the time of the evaluation is not older than 2 seconds.
Edge	E_SignalEdge	Edge defines the signal edge to be used for the evaluation of the axis position. TYPE E_SignalEdge : (RisingEdge, FallingEdge); END_TYPE
FreeRun	BOOL	If FreeRun is TRUE, the input is latched continuously. In this case the input Execute must remain TRUE in function block XFC_TouchProbe [▶ 26]. No edge at Execute is required in order to record the next new position value.
EncoderIndex	UINT	If more than one encoder is connected to the axis, the encoder index [0 – 9] can be defined here. The first encoder has the index 0.
ModuloPositions	BOOL	If ModuloPositions is TRUE, all positions are interpreted as modulo. The parameter ModuloFactor is used for calculating the modulo cycle.
ModuloFactor	LREAL	ModuloFactor indicates the length of a modulo cycle in the positioning unit of the axis and is only used if ModuloPositions is TRUE.

4.1.3.7 ST_EL1258_Diagnostics

The data type ST_EL1258_Diagnostics contains diagnostic data that can be used for error analysis.

```
TYPE ST_EL1258_Diagnostics :
STRUCT
    EventsInInputBuffer:       UDINT;
    NoOfReceiveEvents:         UDINT;
    NoOfReceiveEventsRising:   UDINT;
    NoOfReceiveEventsFalling:  UDINT;
    NoOfRecordedEventsRising:  UDINT;
    NoOfRecordedEventsFalling: UDINT;
    ErrorBufferOverflow:       BOOL;
    ErrorModuloInput:          BOOL;
END_STRUCT
END_TYPE
```

Name	Type	Description
EventsInInputBuffer	UDINT	Counts the events as long as ErrorBufferOverflow is FALSE.
NoOfReceiveEvents	UDINT	Number of input events of EL1258.
NoOfReceiveEventsRising	UDINT	Number of rising edges of EL1258.
NoOfReceiveEventsFalling	UDINT	Number of falling edges of EL1258.
NoOfRecordedEventsRising	UDINT	Number of rising edges in the recorded events as long as WindowOnly is FALSE and NoOfReceiveEventsRising = NoOfRecordedEventsRising.
NoOfRecordedEventsFalling	UDINT	Number of falling edges in the recorded events as long as WindowOnly is FALSE and NoOfReceiveEventsFalling = NoOfRecordedEventsFalling.
ErrorBufferOverflow	BOOL	Indicates that the output buffer of the EL1258 is full.
ErrorModuloInput	BOOL	NoOfRecordedEventsRising + NoOfRecordedEvents-Falling = NoOfRecordedEvents.

4.1.3.8 ST_EL2258_Diagnostics

The data type ST_EL2258_Diagnostics contains diagnostic data that can be used for error analysis.

```
TYPE ST_EL2258_Diagnostics :
STRUCT
    ErrorOnOutputMissed     : BOOL;
    ErrorOffOutputMissed    : BOOL;
    ErrorNoOfEventsExceeded : BOOL;
    ErrorBufferOverflow     : BOOL;
    ErrorEventDistance      : BOOL;
    OnPrecisionReduced      : BOOL;
    OffPrecisionReduced     : BOOL;
    LastOutputLevel         : BOOL;
    ActivatedOnValues       : INT;
    ActivatedOffValues      : INT;
END_STRUCT
END_TYPE
```

Name	Type	Description
ErrorOnOutputMissed	BOOL	Indicates that a rising switching edge could not be determined to an exact cycle and therefore could not be output. The ForceWhenLate input can be set in order to output the switching edge as well as possible.
ErrorOffOutputMissed	BOOL	Indicates that a falling switching edge could not be determined to an exact cycle and therefore could not be output. The ForceWhenLate input can be set in order to output the switching edge as well as possible.
ErrorNoOfEventsExceeded	BOOL	Indicates that too many edges were delivered for a cycle and that therefore not all of them can be output.
ErrorBufferOverflow	BOOL	Indicates that the output buffer of the EL2258 is full.
ErrorEventDistance	BOOL	Indicates that the distance between two consecutive edges is too small.
OnPrecisionReduced	BOOL	Indicates that a rising switching edge could not be determined to an exact cycle. However, the switching edge was output as well as possible.
OffPrecisionReduced	BOOL	Indicates that a falling switching edge could not be determined to an exact cycle. However, the switching edge was output as well as possible.
LastOutputLevel	BOOL	Indicates which signal state the channel of the EL2262 will have after the following update.
ActivatedOnValues	INT	Number of rising edges activated in this cycle.
ActivatedOffValues	INT	Number of falling edges activated in this cycle.

4.1.3.9 ST_EL2262_Diagnostics

The data type ST_EL2262_Diagnostics contains diagnostic data that can be used for error analysis.

```
TYPE ST_EL2262_Diagnostics :
STRUCT
    ErrorOnOutputMissed     : BOOL;
    ErrorOffOutputMissed    : BOOL;
    OnPrecisionReduced      : BOOL;
    OffPrecisionReduced     : BOOL;
    LastOutputLevel         : BOOL;
    ActivatedOnValues       : INT;
    ActivatedOffValues      : INT;
END_STRUCT
END_TYPE
```

Name	Type	Description
ErrorOnOutputMissed	BOOL	Indicates that a rising switching edge could not be determined to an exact cycle and therefore could not be output. The ForceWhenLate input can be set in order to output the switching edge as well as possible.
ErrorOffOutputMissed	BOOL	Indicates that a falling switching edge could not be determined to an exact cycle and therefore could not be output. The ForceWhenLate input can be set in order to output the switching edge as well as possible.
OnPrecisionReduced	BOOL	Indicates that a rising switching edge could not be determined to an exact cycle. However, the switching edge was output as well as possible.
OffPrecisionReduced	BOOL	Indicates that a falling switching edge could not be determined to an exact cycle. However, the switching edge was output as well as possible.
LastOutputLevel	BOOL	Indicates which signal state the channel of the EL2262 will have after the following update.
ActivatedOnValues	INT	Number of rising edges activated in this cycle
ActivatedOffValues	INT	Number of falling edges activated in this cycle

4.1.3.10 ST_NcTimeConversionOptions

```
TYPE ST_NcTimeConversionOptions :
STRUCT
    SubIndex :             UINT;
    InterpolationOptions : UINT;
    CompensationTime :     DINT;
END_STRUCT
END_TYPE
```

Name	Type	Description
SubIndex	UINT	For axes with more than one encoder the index (0..9) of the encoder to which the position refers can be specified in SubIndex. No subindex can be specified for Path function blocks that refer to multiple interpolated axes.
InterpolationOptions	UINT	Bit mask for special options: InterpolationOptions.0 = FALSE: The position extrapolation is carried out with the current velocity, without taking into account the current acceleration. InterpolationOptions.0 = TRUE: The axis acceleration is included in the position extrapolation. InterpolationOptions.12 = TRUE: The position buffer is ignored. InterpolationOptions.15 = TRUE: a logger message is forced.
CompensationTime	DINT	Additional compensation time

4.1.3.11 XFC_MT_TRIGGER_REF

```
TYPE XFC_MT_TRIGGER_REF :
STRUCT
    Signal          : BOOL;
    FreeRun         : BOOL;
    EncoderIndex    : UINT;
    ModuloPositions : BOOL;
    ModuloFactor    : LREAL := 360.0;
END_STRUCT
END_TYPE
```

Name	Type	Description
Signal	BOOL	Current state of the digital input signal. The current state must be supplied here.
FreeRun	BOOL	If FreeRun is TRUE, the input is latched continuously. In the case of the function block XFC_EL1258_TouchProbe, the input Execute must then remain TRUE. No edge at Execute is required in order to record the next new position value.
EncoderIndex	UINT	If more than one encoder is connected to the axis, the encoder index [0 – 9] can be defined here. The first encoder has the index 0.
ModuloPositions	BOOL	If ModuloPositions is TRUE, all positions are interpreted as modulo. The parameter ModuloFactor is used for calculating the modulo cycle.
ModuloFactor	LREAL	ModuloFactor indicates the length of a modulo cycle in the positioning unit of the axis and is only used if ModuloPositions is TRUE.

4.1.3.12 ST_CamSwitchOptions

Name	Type	Description
EncoderIndex	UINT	If more than one encoder is connected to the axis, the encoder index [0 – 9] can be defined here. The first encoder has the index 0. No subindex can be specified for Path function blocks that refer to multiple interpolated axes.
UseAcceleration	BOOL	UseAcceleration can be set to TRUE in order to incorporate the acceleration of the axis into the position calculation. UseAcceleration can be advantageous if the setpoint values of the acceleration can be used. UseAcceleration may be disadvantageous with encoder axes that supply a noisy position signal, because the acceleration is also erroneous.

4.1.3.13 ST_XFCTouchProbeOptions

Name	Type	Description
UseAcceleration	BOOL	UseAcceleration can be set to TRUE in order to incorporate the acceleration of the axis into the position calculation. UseAcceleration can be advantageous if the setpoint values of the acceleration can be used. UseAcceleration may be disadvantageous with encoder axes that supply a noisy position signal, because the acceleration is also erroneous.

4.1.3.14 EL1258_MT_IoInterface

Name	Type	Description
Status	_EL1258_Status	
InputEventState	_EL1258_InputEvents	MTI inputs

Name	Type	Description
InputEventTime	ARRAY [1..10] OF T_DCTIME32	MTI input of the Event time 1..10
Ctrl	_EL1258_Ctrl	

4.1.3.15 EL2252_IoInterface

Name	Type	Description
SysTime	T_ULARGE_INTEGER	Not used
Feedback	BYTE	Not used
WcStateOut	BOOL	Not used
WcStateIn	BOOL	Not used
State	UINT	Not used
Activate	BYTE	Activates the output
StartTime	T_ULARGE_INTEGER	Activates the output
Output1	BOOL	Signal of output channel 1
TriState1	BOOL	Channel 1
Output1	BOOL	Signal of output channel 2
TriState1	BOOL	Channel 2

4.1.3.16 EL2212_IoInterface

Name	Type	Description
Status1	WORD	Status channel 1
Status1	WORD	Status channel 2
Feedback	BYTE	Not used
WcState	BOOL	Not used
State	UINT	Not used
Output1	BOOL	Signal output channel 1
TriState1	BOOL	Channel 1
Reset1	BOOL	Channel 1
Output2	BOOL	Signal output channel 2
TriState2	BOOL	Channel 2
Reset2	BOOL	Channel 2
Activate	BYTE	PDO 0x1602, activates the output
StartTime	T_ULARGE_INTEGER	PDO 0x1602, activates the output

4.1.3.17 EL2262_IoInterface

Name	Type	Description
StartTimeNextOutput	T_DCTIME32	Time stamp of the next signal output of the EL2262 terminal.
WcState	BOOL	
State	UINT	
CycleCounter0	WORD	
Output0	ARRAY [0..31] OF DWORD	Array with 1024 to 10000x oversampling – Channel 1
CycleCounter1	WORD	
Output1	ARRAY [0..31] OF DWORD	Array with 1024 to 10000x oversampling – Channel 1

4.1.3.18 EL2258_MT_IoInterface

Name	Type	Description
Status	_EL2258_Status	MTO status
Ctrl	_EL2258_Ctrl	MTO Ctrl
Outputs	DWORD	MTO outputs
OutputEventTime	ARRAY [1..10] OF T_DCTIME32	MTO output event time

4.1.3.19 E_CamSwitchDirection

Name	Description
CAMSWITCHDIRECTION_BOTH	The digital cam works in both directions.
CAMSWITCHDIRECTION_POSITIVE	The digital cam works in the positive direction.
CAMSWITCHDIRECTION_NEGATIVE	The digital cam works in the negative direction.

4.1.3.20 E_CamSwitchMode

Name	Description
CAMSWITCHMODE_POSITION	Position cam
CAMSWITCHMODE_TIME	Time cam
CAMSWITCHMODE_BREAK	Brake cam

4.2 Tc2_NciXFC

The Tc2_NciXFC library facilitates the precisely timed recording of relative path distances and the path-precise output of digital signals in connection with the EtherCAT XFC terminals. The required output function blocks are included in the Tc2_MC2_XFC library.

A precise correlation between time and relative path position can thus be established at any time.

The library provides various function blocks for the calculation of the timestamps or positions.

4.2.1 Function blocks

4.2.1.1 Basic blocks

4.2.1.1.1 XFC_PathPositionAtTime

The function block XFC_PathPositionAtTime calculates a relative path at a given time in relation to the current path position.

The function extrapolates the path distance in relation to the current dynamics. Precise extrapolation is only possible over a short interval, since the group dynamics may change.

The function block requires precisely one call in order to provide the result. Therefore it can be used in a similar way to a function, but may return an error in addition to the relative path distance. This error must be evaluated to ensure that the calculated path distance is valid.

Inputs

```
VAR_INPUT
    GrpId   : UDINT;
    DcTime  : T_DCTIME32;
    Options : ST_NcTimeConversionOptions;
END_VAR
```

Name	Type	Description
GrpId	UDINT	Group ID of the Nci group. This clearly identifies the requested Nci group in the system.
DcTime	T_DCTIME32	Distributed Clock System Time. DcTime contains the lower 32 bits of the complete DcTime and covers a time range of +/- 2 seconds around the current time. In order to optimize the calculation of the path value, the time should be close to the current time, i.e. only a few PLC or NC cycles in the future or the past.
Options	ST_NcTimeConversionOptions [▶ 47]	Data structure with options for the extrapolation of the relative path.

Outputs

```
VAR_OUTPUT
    PathPosition : LREAL;
    Error        : BOOL;
    ErrorID      : UDINT;
END_VAR
```

Name	Type	Description
PathPosition	LREAL	Extrapolated relative path up to the preset time DcTime.
Error	BOOL	Becomes TRUE if an error occurs
ErrorID	UDINT	If the error output is set, this parameter supplies the error number.

4.2.1.1.2 XFC_TimeOfPathPosition

The function block XFC_TimeOfPathPosition calculates the time at which an Nci group has traveled or will have traveled a preset relative path.

The function extrapolates the time in relation to the current path position and dynamics. Precise extrapolation is only possible over a short interval, since the Nci group dynamics may change.

The function block requires precisely one call in order to provide the result. It can therefore be used similar to a function, although as well as the time it may also return an error. This error must be analyzed in order to ensure that the calculated time DcTime is valid.

Inputs

```
VAR_INPUT
    GrpId        : UDINT;
    PathPosition : LREAL;
    Options      : ST_NcTimeConversionOptions;
END_VAR
```

Name	Type	Description
GrpId	UDINT	Group ID of the Nci group. This clearly identifies the requested Nci group in the system.
PathPosition	LREAL	Relative path
Options	ST_NcTimeConversionOptions [▶ 47]	Data structure with options for the extrapolation of the relative path.

Outputs

```
VAR_OUTPUT
    DcTime  : T_DCTIME32;
    Error   : BOOL;
    ErrorID : UDINT;
END_VAR
```

Name	Type	Description
DcTime	T_DCTIME32	Distributed clock system time at which the relative path PathPosition will have been travelled or at which this was passed. DcTime contains the lower 32 bits of the complete DcTime and covers a time range of +/- 2 seconds around the current time.
Error	BOOL	Becomes TRUE if an error occurs.
ErrorID	UDINT	If the error output is set, this parameter supplies the error number.

4.2.1.1.3 XFC_TimeToPathPosition

The function block XFC_TimeToPathPosition calculates the time period within which an Nci group has traveled a relative path or which has elapsed since then.

The function extrapolates the time in relation to the current path position and dynamics. Precise extrapolation is only possible over a short interval, since the group dynamics may change.

The function block requires precisely one call in order to provide the result. It can therefore be used similar to a function, although as well as the time it may also return an error. This error must be analyzed in order to ensure that the calculated time duration is valid.

Inputs

```
VAR_INPUT
    GrpId        : UDINT;
    PathId       : UDINT;
    PathPosition : LREAL;
    Options      : ST_NcTimeConversionOptions;
END_VAR
```

Name	Type	Description
GrpId	UDINT	Group ID of the Nci group. This clearly identifies the requested Nci group in the system.
PathId	UDINT	Unique ID that continually increases over the path course and belongs to the relative path.
PathPosition	LREAL	Relative path
Options	ST_NcTimeConversionOptions [▶ 47]	Data structure with options for the extrapolation of the relative path.

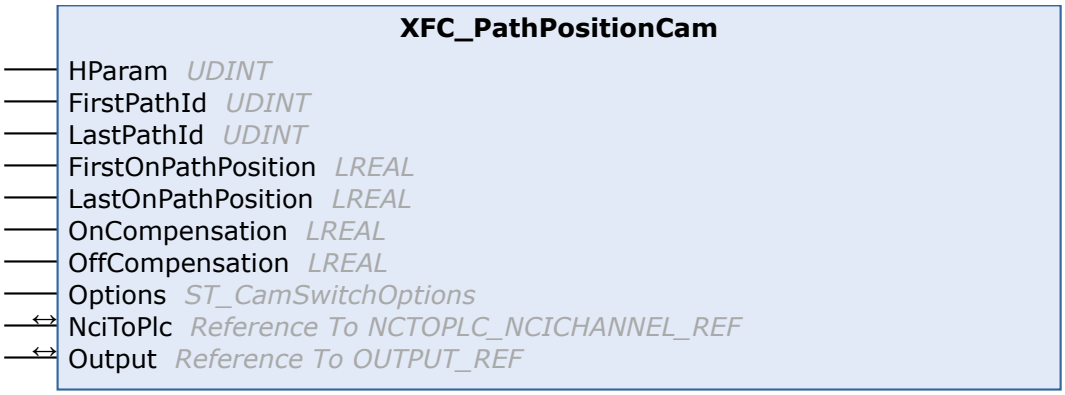
Outputs

```
VAR_OUTPUT
    Duration       : DINT;
    TimeOfPosition : T_DCTIME32;
    Error          : BOOL;
    ErrorID        : UDINT;
END_VAR
```

Name	Type	Description
Duration	DINT	Time period in nanoseconds after which the relative path will have been travelled (>0) or which has elapsed since then (<0). Duration is a differential value from two variables of the type T_DCTIME32
TimeOfPosition	T_DCTIME32	Distributed clock system time at which the relative path distance was or will have been be travelled. DcTime contains the lower 32 bits of the complete DcTime and covers a time range of +/- 2 seconds around the current time.
Error	BOOL	Becomes TRUE if an error occurs.
ErrorID	UDINT	If the error output is set, this parameter supplies the error number.

4.2.1.2 Cam controller

4.2.1.2.1 XFC_PathPositionCam



The function block XFC_PathPositionCam realizes a path cam that switches a digital output on and off depending on the path.

In contrast to the digital cam controller MC_PathDigitalCamSwitch_MultiEdge [▶ 55], the function block switches precisely one cam on a digital output track. This facilitates parameterization of the function block, although it cannot be used if several cams are required on an output track.

In addition to the switching state of the digital output the output data structure contains precise time information for the next switching operations.

This information is used for the actual output at an XFC output terminal with a downstream function block (XFC_EL2252_V2 [▶ 34] or XFC_EL2262 [▶ 37]).

Inputs

```
VAR_INPUT
    HParam              : UDINT;
    FirstPathId         : UDINT;
    LastPathId          : UDINT;
    FirstOnPathPosition : LREAL;
    LastOnPathPosition  : LREAL;
    OnCompensation      : LREAL;
    OffCompensation     : LREAL;
    Options             : ST_CamSwitchOptions;
END_VAR
```

Name	Type	Description
HParam	UDINT	H-parameter value that corresponds to the switching state.
FirstPathId	UDINT	Unique ID that continually increases over the path and belongs to the relative path until the cam switches on.
LastPathId	UDINT	Unique ID that continually increases over the path and belongs to the relative path until the cam switches off.
FirstOnPathPosition	LREAL	Relative path until the cam switches on.
LastOnPathPosition	LREAL	Relative path until the cam switches off.
OnCompensation	LREAL	Compensation time for the rising edge of the cam in [s]. For negative values of OnCompensation the switching time is brought forward, otherwise it is delayed. The value OnCompensation parameterized here has priority over TRACK_REF
OffCompensation	LREAL	Compensation time for the falling edge of the cam in [s]. For negative values of OffCompensation the switching time is brought forward, otherwise it is delayed. The value OffCompensation parameterized here has priority over TRACK_REF

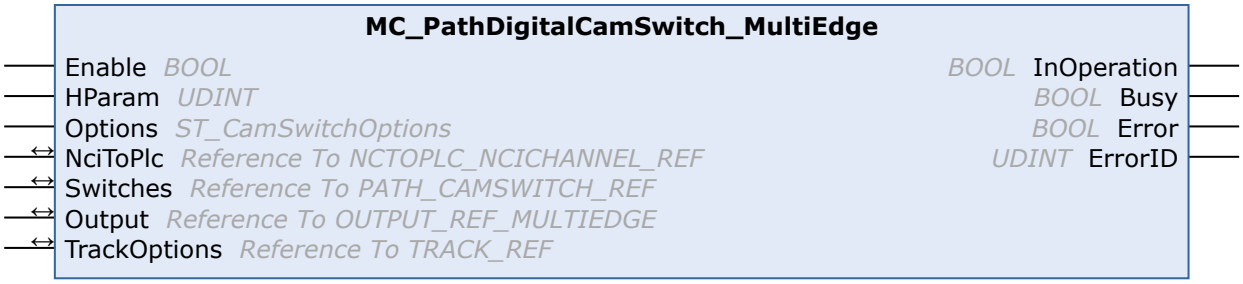
Name	Type	Description
Options	ST_CamSwitchOptions [▶ 48]	Optional parameters

Inputs/outputs

```
VAR_IN_OUT
    NciToPlc : NciChannelToPlc;
    Output   : OUTPUT_REF;
END_VAR
```

Name	Type	Description
NciToPlc	NciChannelToPlc	The structure of the cyclic channel interface from the NCI to the PLC. This structure is only accessed for reading
Output	OUTPUT_REF [▶ 42]	The data structure Output contains the calculated state of the digital output and the associated time stamp for the output at a digital XFC output terminal

4.2.1.2.2 MC_PathDigitalCamSwitch_MultiEdge



The function block MC_PathDigitalCamSwitch_MultiEdge is a digital cam controller with one or several cams on a digital output track. The function block is capable of performing several switching operations during a PLC cycle. The switching operations are defined by position cams. Further output tracks can be realized with independent instances of the function block.

In addition to the switching states of the digital output the output data structure contains precise time information for the next switching operations. With this information, the actual output can take place on an XFC multi-timestamp output terminal with a downstream function block (XFC_EL1259_MultiEdge, XFC_EL2212_MultiEdge [▶ 32], XFC_EL2262_MultiEdge [▶ 38] or XFC_EL2258_MultiEdge [▶ 36]).

Time cams and brake cams cannot be used with the function block MC_PathDigitalCamSwitch_MultiEdge. Terminals without multi-timestamp functionality are not suitable for use with this function block.

Inputs

```
VAR_INPUT
    Enable  : BOOL;
    HParam  : DINT;
    Options : ST_CamSwitchOptions;
END_VAR
```

Name	Type	Description
Enable	BOOL	The cam controller is activated via the Enable input. The initial state remains unchanged, as long as Enable=FALSE.
HParam	DINT	H-parameter value that corresponds to the switching state TRUE.
Options	ST_CamSwitchOptions [▶ 48]	Optional parameters

Inputs/outputs

```
VAR_IN_OUT
    NciToPlc     : NciChannelToPlc
    Switches     : PATH_CAMSWITCH_REF;
    Output       : OUTPUT_REF_MULTIEDGE;
    TrackOptions : TRACK_REF;
END_VAR
```

Name	Type	Description
NciToPlc	NciChannelToPlc	The structure of the cyclic channel interface from the NCI to the PLC. This structure is only accessed for reading.
Switches	PATH_CAMSWITCH_REF [▶ 57]	The data structure Switches contains a reference to the parameterization of all cams on the cam track.
Output	OUTPUT_REF_MULTIEDGE [▶ 43]	The data structure Output contains the calculated states of the digital output and the associated time stamps for the output at a digital XFC output terminal.
TrackOptions	TRACK_REF [▶ 43]	The data structure TrackOptions contains the parameterization for the cam track.

Outputs

```
VAR_OUTPUT
    InOperation : BOOL;
    Busy        : BOOL;
    Error       : BOOL;
    ErrorID     : UDINT;
END_VAR
```

Name	Type	Description
InOperation	BOOL	InOperation is TRUE, as long as the cam controller is active and the cam track is calculated according to the cam parameterization.
Busy	BOOL	Busy is TRUE as long as the block function is not completed.
Error	BOOL	Becomes TRUE if an error occurs.
ErrorID	UDINT	If the error output is set, this parameter supplies the error number

4.2.2 Data types

4.2.2.1 MC_PathCamSwitch

The data type MC_PathCamSwitch contains all parameters of a digital cam for a digital cam controller MC_PathDigitalCamSwitch_MultiEdge [▶ 55].

```
TYPE MC_PathCamSwitch :
STRUCT
    FirstOnPosition : LREAL;
    LastOnPosition  : LREAL;
    FirstPathId     : UDINT;
    LastPathId      : UDINT;
    CamSwitchMode   : E_CamSwitchMode;
    Duration        : LREAL;
END_STRUCT
END_TYPE
```

The data structure for parameterization of a digital cam controller is usually an ARRAY OF MC_PathCamSwitch. A further structure PATH_CAMSWITCH_REF [▶ 57] refers to this structure.

Name	Type	Description
FirstOnPosition	LREAL	First position from which the cam is switched on.

Name	Type	Description
LastOnPosition	LREAL	Last position up to which the cam is switched on. The cam function is inverted, if LastOnPosition < FirstOnPosition. LastOnPositionis is not used for time cams.
FirstPathId	UDINT	Unique ID that continually increases over the path and belongs to the relative path until the cam switches on.
LastPathId	UDINT	Unique ID that continually increases over the path and belongs to the relative path until the cam switches off.
CamSwitchMode	E_CamSwitchMode [▶ 50]	Digital cam type (position cam, time cam or brake cam).
Duration	LREAL	Duration defines the switch-on time of the cam in [s] and is only used for time cams.

```
TYPE E_CamSwitchMode :
(
    CAMSWITCHMODE_POSITION, (* position cam *)
    CAMSWITCHMODE_TIME,     (* time cam *)
    CAMSWITCHMODE_BREAK     (* break cam *)
);
END_TYPE
```

4.2.2.2 PATH_CAMSWITCH_REF

The data type PATH_CAMSWITCH_REF refers to a data structure with cam parameters for a digital cam controller MC_PathDigitalCamSwitch_MultiEdge.

```
TYPE PATH_CAMSWITCH_REF :
STRUCT
    NumberOfSwitches : UDINT;
    pSwitches        : POINTER TO MC_PathCamSwitch;
    SizeOfSwitches   : UDINT;
END_STRUCT
END_TYPE
```

Name	Type	Description
NumberOfSwitches	UDINT	Number of array elements used, can be less than the maximum number.
pSwitches	POINTER TO MC_PathCamSwitch [▶ 56]	Pointer to an array of switches, transferred with ADR.
SizeOfSwitches	UDINT	Maximum size of the array.

The actual data structure for parameterization of a digital cam controller is usually an ARRAY OF MC_PathCamSwitch [▶ 56]. PATH_CAMSWITCH_REF refers to this structure via a POINTER and clearly defines the size of the structure and the number of cams that were actually used.

A variable of type PATH_CAMSWITCH_REF is initialized as illustrated in the following example:

```
VAR
    CamSwitchArray   : ARRAY[1..3] OF MC_PathCamSwitch;
    CamSwitchRef     : PATH_CAMSWITCH_REF;
END_VAR

(* real number of defined digital cams *)
CamSwitchRef.NumberOfSwitches := 1; (* 1..3 *)
(* pointer to the digital cam data array *)
CamSwitchRef.pSwitches        := ADR(CamSwitchArray);
(* maximum size of the digital cam data array *)
CamSwitchRef.SizeOfSwitches   := SIZEOF(CamSwitchArray);
```

4.3 Tc3_MC2_AdvancedHoming_XFC

4.3.1 Overview

The TwinCAT Motion Control PLC library Tc3_MC2_AdvancedHoming_XFC includes function blocks for programming machine applications. The Tc3_MC2_AdvancedHoming_XFC is based on the similarly revised PLCopen specification for Motion Control function blocks V2.0. This library contains function blocks of Part 5 – Homing Procedures (www.PLCopen.org).

TwinCAT version

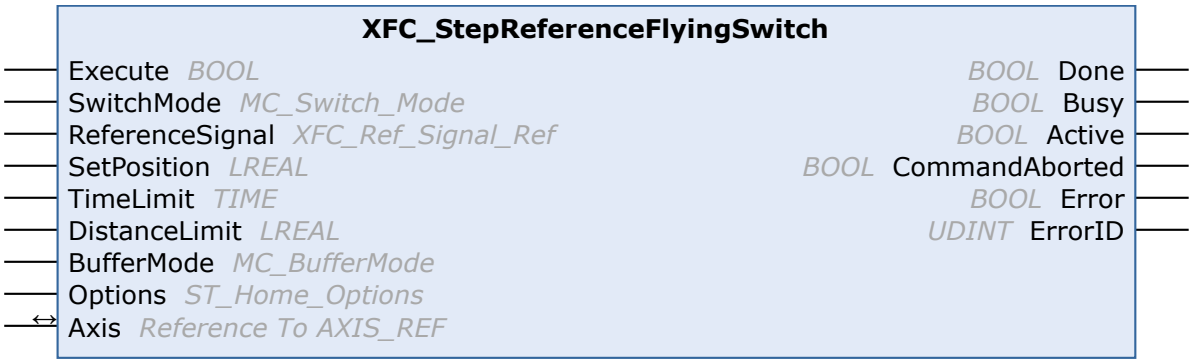
The Tc3_MC2_AdvancedHoming_XFC library can be used with TwinCAT version 3.1 Build 4020 or higher. With remote programmed controllers care must be taken that an appropriate version is installed on both the programmer PC and the control PC. In the case of control systems with the operating system Windows CE, the version of the installed image is decisive.

Further information, including referencing sequences, can be found in the Motion library Tc3_MC2_AdvancedHoming.

4.3.2 Function blocks

4.3.2.1 Referencing functions (passive)

4.3.2.1.1 XFC_StepReferenceFlyingSwitch



This function block MC_StepReferenceFlyingSwitch performs referencing during a running movement via an absolutely positioned external physical switch.

The execution does not start or modify any movement itself.

Inputs

```
VAR_INPUT
    Execute         : BOOL;
    SwitchMode      : BOOL;
    ReferenceSignal : XFC_Ref_Signal_Ref;
    SetPosition     : LREAL;
    TimeLimit       : TIME;
    DistanceLimit   : LREAL;
```

```
    BufferMode      : MC_BufferMode;
    Options         : ST_Home_Options;
END_VAR
```

Name	Type	Description
Execute	BOOL	The command is executed with a rising edge at the Execute input.
SwitchMode	BOOL	Enumeration that defines the final condition for the search procedure.
ReferenceSignal	XFC_Ref_Signal_Ref [▶ 76]	Configuration of the reference signal source.
SetPosition	LREAL	Position value to which the axis position is to be set.
TimeLimit	TIME	Exceeding this time leads to the search procedure being aborted.
DistanceLimit	LREAL	Exceeding this distance in relation to the start position leads to the search procedure being aborted.
BufferMode	MC_BufferMode	Currently not implemented.
Options	ST_Home_Options	Currently not used.

Inputs/Outputs

```
VAR_IN_OUT
    Axis : AXIS_REF;
END_VAR
```

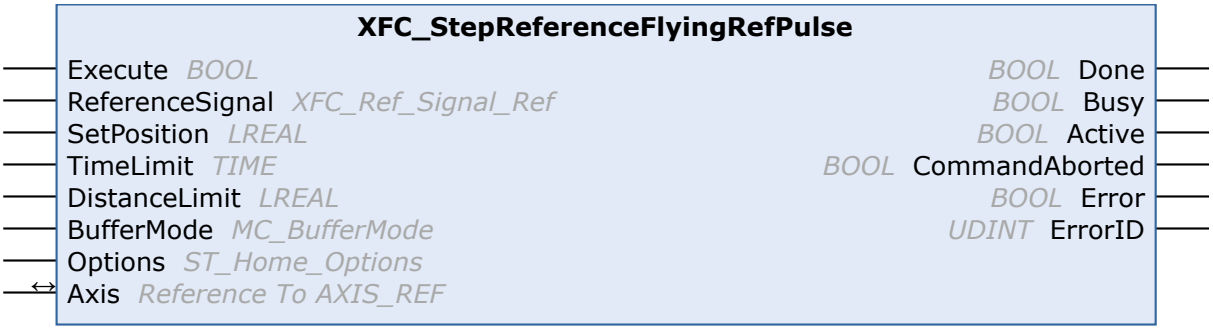
Name	Type	Description
Axis	AXIS_REF	Axis data structure of the type AXIS_REF, which uniquely addresses an axis in the system. Among other parameters it contains the current axis status, including position, velocity or error state.

Outputs

```
VAR_OUTPUT
    Done            : BOOL;
    Busy            : BOOL;
    Active          : BOOL;
    CommandAborted  : BOOL;
    Error           : BOOL;
    ErrorID         : UDINT;
END_VAR
```

Name	Type	Description
Done	BOOL	Becomes TRUE, if the command was completed successfully.
Busy	BOOL	The Busy output becomes TRUE when the command is started with Execute and remains TRUE as long as the command is processed. If Busy becomes FALSE again, the function block is ready for a new order. At the same time one of the outputs, Done, CommandAborted or Error, is set.
Active	BOOL	Indicates that the command is executed.
CommandAborted	BOOL	Becomes TRUE, if the command could not be fully executed.
Error	BOOL	Becomes TRUE, as soon as an error occurs.
ErrorID	UDINT	If the error output is set, this parameter supplies the error number.

4.3.2.1.2 XFC_StepReferenceFlyingRefPulse



This function block XFC_StepReferenceFlyingRefPulse performs referencing during a running movement to the zero pulse of an encoder.

The execution does not start or modify any movement itself.

Inputs

```
VAR_INPUT
    Execute         : BOOL;
    ReferenceSignal : XFC_Ref_Signal_Ref;
    SetPosition     : LREAL;
    TimeLimit       : TIME;
    DistanceLimit   : LREAL;
    BufferMode      : MC_BufferMode;
    Options         : ST_Home_Options;
END_VAR
```

Name	Type	Description
Execute	BOOL	The command is executed with a rising edge at the Execute input.
ReferenceSignal	XFC_Ref_Signal_Ref [▶ 76]	Configuration of the reference signal source.
SetPosition	LREAL	Position value to which the axis position is to be set.
TimeLimit	TIME	Exceeding this time leads to the search procedure being aborted.
DistanceLimit	LREAL	Exceeding this distance in relation to the start position leads to the search procedure being aborted.
BufferMode	MC_BufferMode	Currently not implemented.
Options	ST_Home_Options	Currently not used.

Inputs/Outputs

```
VAR_IN_OUT
    Axis : AXIS_REF;
END_VAR
```

Name	Type	Description
Axis	AXIS_REF	Axis data structure of the type AXIS_REF, which uniquely addresses an axis in the system. Among other parameters it contains the current axis status, including position, velocity or error state.

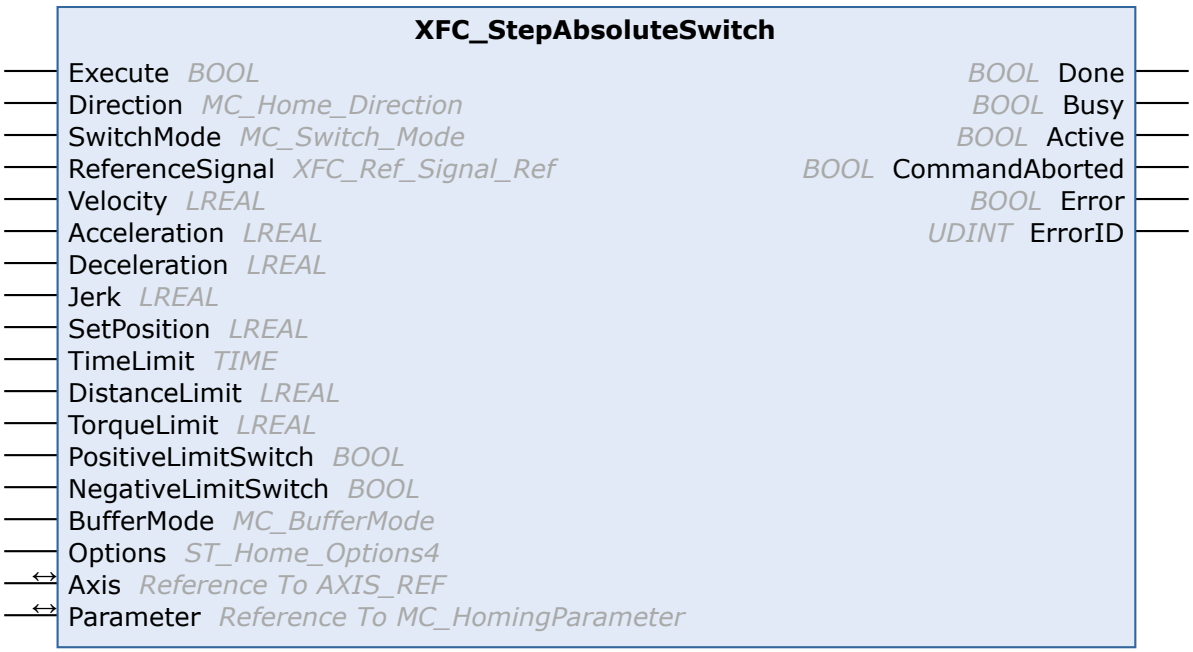
Outputs

```
VAR_OUTPUT
    Done           : BOOL;
    Busy           : BOOL;
    Active         : BOOL;
    CommandAborted : BOOL;
    Error          : BOOL;
    ErrorID        : UDINT;
END_VAR
```

Name	Type	Description
Done	BOOL	Becomes TRUE, if the command was completed successfully.
Busy	BOOL	The Busy output becomes TRUE when the command is started with Execute and remains TRUE as long as the command is processed. If Busy becomes FALSE again, the function block is ready for a new order. At the same time one of the outputs, Done, CommandAborted or Error, is set.
Active	BOOL	Indicates that the command is executed.
CommandAborted	BOOL	Becomes TRUE, if the command could not be fully executed.
Error	BOOL	Becomes TRUE, as soon as an error occurs.
ErrorID	UDINT	If the error output is set, this parameter supplies the error number.

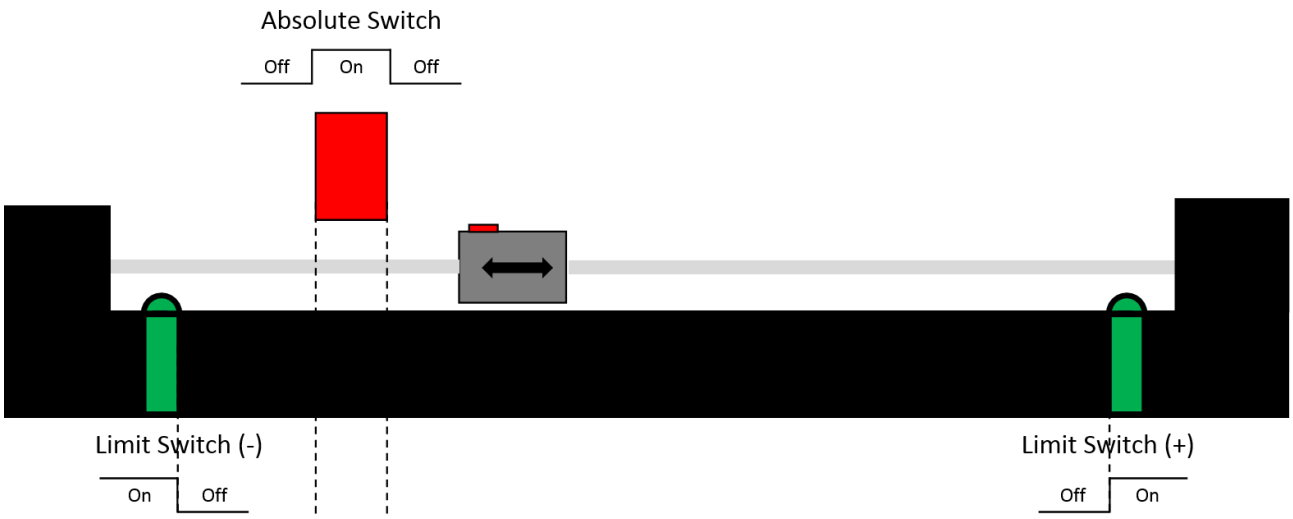
4.3.2.2 Step functions

4.3.2.2.1 XFC_StepAbsoluteSwitch

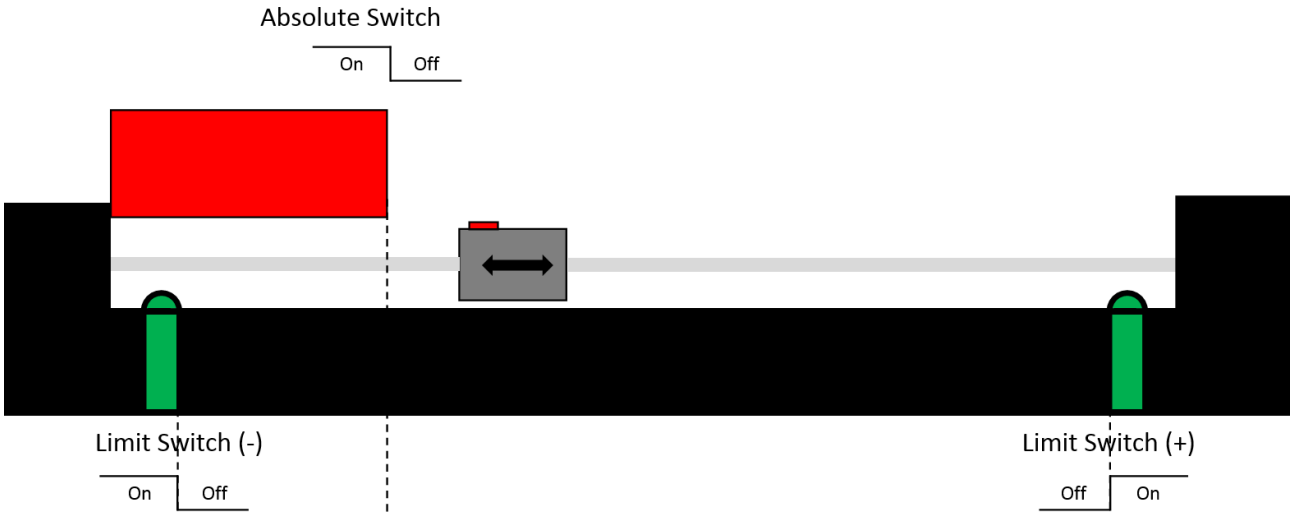


This function block searches for an absolutely positioned, external physical switch.

In general, an absolute switch has two "off" areas and one "on" area.



If the absolute switch cannot be overcrossed, then it has only one "off" area and one "on" area.



Inputs

```
VAR_INPUT
    Execute             : BOOL;
    Direction           : MC_Home_Direction;
    SwitchMode          : MC_Switch_Mode;
    ReferenceSignal     : XFC_Ref_Signal_Ref;
    Velocity            : LREAL;
    Acceleration        : LREAL;
    Deceleration        : LREAL;
    Jerk                : LREAL;
    SetPosition         : LREAL;
    TimeLimit           : TIME;
    DistanceLimit       : LREAL;
    TorqueLimit         : LREAL;
    PositiveLimitSwitch : BOOL;
    NegativeLimitSwitch : BOOL;
    BufferMode          : MC_BufferMode;
    Options             : ST_Home_Options4;
END_VAR
```

Name	Type	Description
Execute	BOOL	The command is executed with a rising edge at the Execute input.
Direction	MC_Home_Direction	Enumeration that defines the initial direction of movement for the search procedure.
SwitchMode	MC_Switch_Mode	Enumeration that defines the final condition for the search procedure.

Name	Type	Description
ReferenceSignal	XFC_Ref_Signal_Ref [▶ 76]	This structure defines the source of the reference cam signal.
Velocity	LREAL	Maximum travel velocity (>0).
Acceleration	LREAL	Acceleration (≥0). If the value is 0, the standard acceleration from the axis configuration in the System Manager is used.
Deceleration	LREAL	Deceleration (≥0). If the value is 0, the standard deceleration from the axis configuration in the System Manager is used.
Jerk	LREAL	Jerk (≥0). If the value is 0, the standard jerk from the axis configuration in the System Manager is used.
SetPosition	LREAL	Position value to which the axis position is to be set.
TimeLimit	TIME	Exceeding this time leads to the search procedure being aborted.
DistanceLimit	LREAL	Exceeding this distance in relation to the start position leads to the search procedure being aborted.
TorqueLimit	LREAL	The motor torque is limited to this value in order to avoid mechanical damage.
PositiveLimitSwitch	BOOL	Signal of the hardware limit switch in the logically positive direction of movement (PositiveLimitSwitch = FALSE within the permissible travel range).
NegativeLimitSwitch	BOOL	Signal of the hardware limit switch in the logically negative direction of movement (NegativeLimitSwitch = FALSE within the permissible travel range).
BufferMode	MC_BufferMode	Currently not implemented
Options	ST_Home_Options4	**DisableDriveAccess**: Set to FALSE for Beckhoff drives, usually to TRUE for third-party drives (see info). **EnableLagErrorDetection**: In the step functions, the lag error detection is switched off in order to ensure a smooth referencing process. If it would be purposeful to keep the lag error detection active in an application, this can be achieved by setting this flag.

If DisableDriveAccess = TRUE, the user is responsible for modifying and reconstructing required drive parameters. The parameters required for the intended homing sequence must be agreed with the manufacturer of the third-party drive.

Inputs/Outputs

```
VAR_IN_OUT
    Axis      : AXIS_REF;
    Parameter : MC_HomingParameter;
END_VAR
```

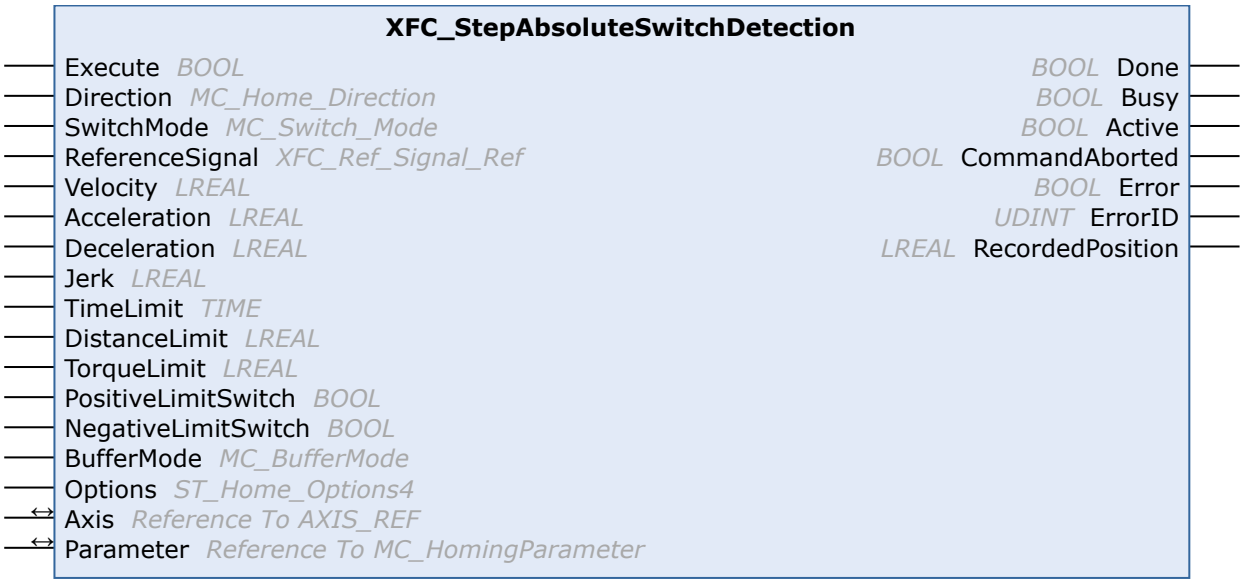
Name	Type	Description
Axis	AXIS_REF	Axis data structure of the type AXIS_REF, which uniquely addresses an axis in the system. Among other parameters it contains the current axis status, including position, velocity or error state.
Parameter	MC_HomingParameter	Data structure of the type MC_HomingParameter, which must be transferred from function block to function block over the entire homing sequence.

Outputs

```
VAR_OUTPUT
    Done            : BOOL;
    Busy            : BOOL;
    Active          : BOOL;
    CommandAborted  : BOOL;
    Error           : BOOL;
    ErrorID         : UDINT;
END_VAR
```

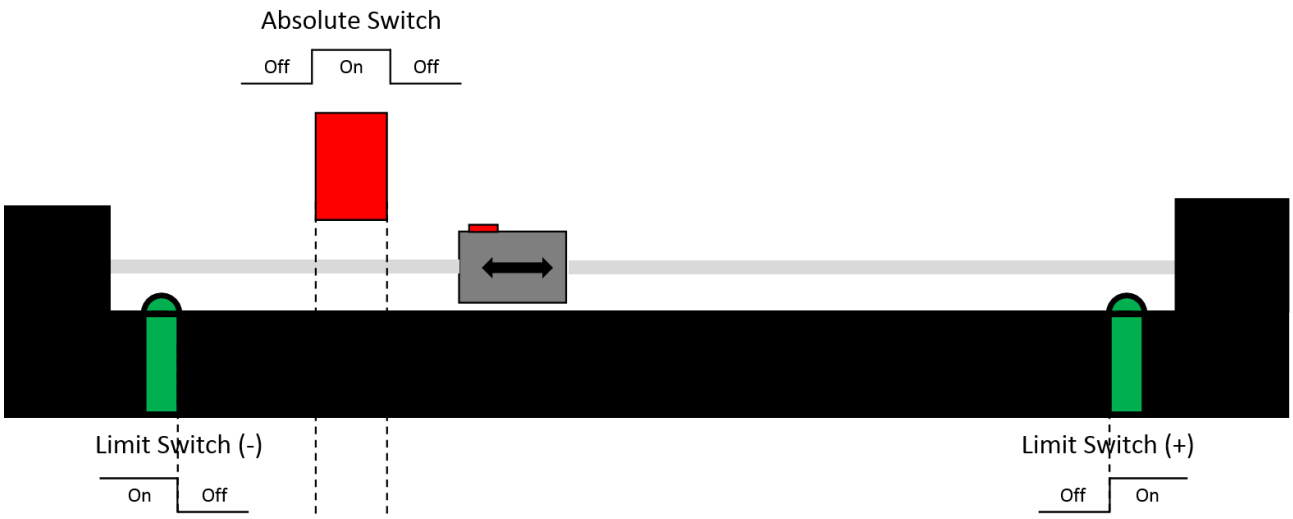
Name	Type	Description
Done	BOOL	Becomes TRUE, if the command was completed successfully.
Busy	BOOL	The Busy output becomes TRUE when the command is started with Execute and remains TRUE as long as the command is processed. If Busy becomes FALSE again, the function block is ready for a new order. At the same time one of the outputs, Done, CommandAborted or Error, is set.
Active	BOOL	Indicates that the command is executed.
CommandAborted	BOOL	Becomes TRUE, if the command could not be fully executed.
Error	BOOL	Becomes TRUE, as soon as an error occurs.
ErrorID	UDINT	If the error output is set, this parameter supplies the error number.

4.3.2.2.2 XFC_StepAbsoluteSwitchDetection

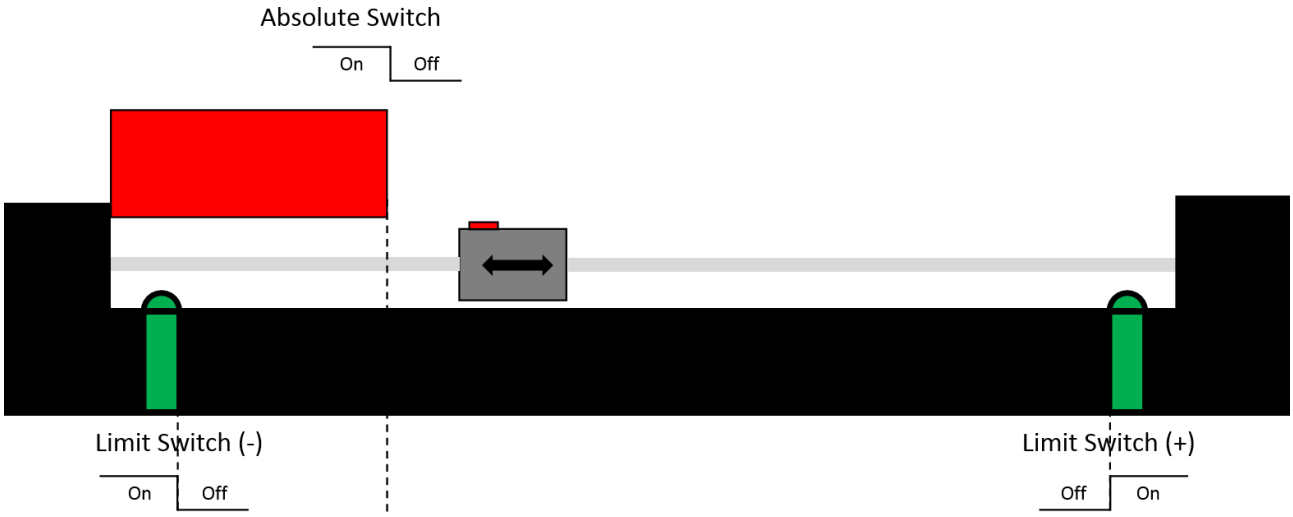


This function block searches for an absolutely positioned, external physical switch.

In general, an absolute switch has two "off" areas and one "on" area.



If the absolute switch cannot be overcrossed, then it has only one "off" area and one "on" area.



The "..Detection" version of this function block does not manipulate the current position of the axis at the end of the sequence, but instead returns the detected position to the user as "RecordedPosition".

Inputs

```
VAR_INPUT
    Execute             : BOOL;
    Direction           : MC_Home_Direction;
    SwitchMode          : MC_Switch_Mode;
    ReferenceSignal     : XFC_Ref_Signal_Ref;
    Velocity            : LREAL;
    Acceleration        : LREAL;
    Deceleration        : LREAL;
    Jerk                : LREAL;
    TimeLimit           : TIME;
    DistanceLimit       : LREAL;
    TorqueLimit         : LREAL;
    PositiveLimitSwitch : BOOL;
    NegativeLimitSwitch : BOOL;
    BufferMode          : MC_BufferMode;
    Options             : ST_Home_Options4;
END_VAR
```

Name	Type	Description
Execute	BOOL	The command is executed with a rising edge at the Execute input.
Direction	MC_Home_Direction	Enumeration that defines the initial direction of movement for the search procedure.
SwitchMode	MC_Switch_Mode	Enumeration that defines the final condition for the search procedure.

Name	Type	Description
ReferenceSignal	XFC_Ref_Signal_Ref [▶ 76]	This structure defines the source of the reference cam signal.
Velocity	LREAL	Maximum travel velocity (>0).
Acceleration	LREAL	Acceleration (≥0). If the value is 0, the standard acceleration from the axis configuration in the System Manager is used.
Deceleration	LREAL	Deceleration (≥0). If the value is 0, the standard deceleration from the axis configuration in the System Manager is used.
Jerk	LREAL	Jerk (≥0). If the value is 0, the standard jerk from the axis configuration in the System Manager is used.
TimeLimit	TIME	Exceeding this time leads to the search procedure being aborted.
DistanceLimit	LREAL	Exceeding this distance in relation to the start position leads to the search procedure being aborted.
TorqueLimit	LREAL	The motor torque is limited to this value in order to avoid mechanical damage.
PositiveLimitSwitch	BOOL	Signal of the hardware limit switch in the logically positive direction of movement (PositiveLimitSwitch = FALSE within the permissible travel range).
NegativeLimitSwitch	BOOL	Signal of the hardware limit switch in the logically negative direction of movement (NegativeLimitSwitch = FALSE within the permissible travel range).
BufferMode	MC_BufferMode	Currently not implemented
Options	ST_Home_Options4	**DisableDriveAccess**: Set to FALSE for Beckhoff drives, usually to TRUE for third-party drives (see info). **EnableLagErrorDetection**: In the step functions, the lag error detection is switched off in order to ensure a smooth referencing process. If it would be purposeful to keep the lag error detection active in an application, this can be achieved by setting this flag.

If DisableDriveAccess = TRUE, the user is responsible for modifying and reconstructing required drive parameters. The parameters required for the intended homing sequence must be agreed with the manufacturer of the third-party drive.

Inputs/Outputs

```
VAR_IN_OUT
    Axis      : AXIS_REF;
    Parameter : MC_HomingParameter;
END_VAR
```

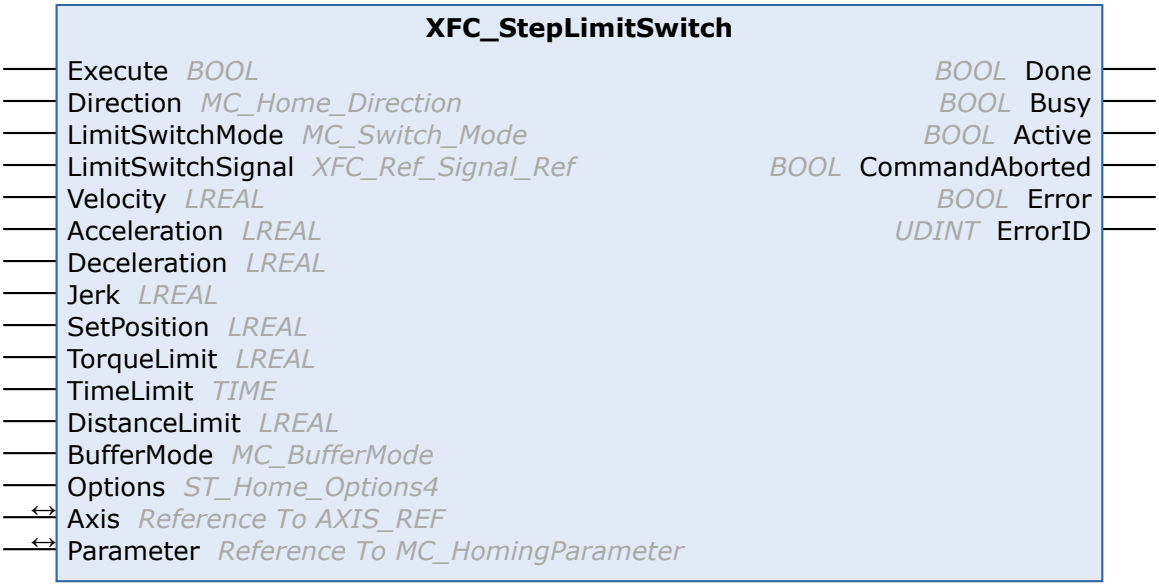
Name	Type	Description
Axis	AXIS_REF	Axis data structure of the type AXIS_REF, which uniquely addresses an axis in the system. Among other parameters it contains the current axis status, including position, velocity or error state.
Parameter	MC_HomingParameter	Data structure of the type MC_HomingParameter, which must be transferred from function block to function block over the entire homing sequence.

Outputs

```
VAR_OUTPUT
    Done              : BOOL;
    Busy              : BOOL;
    Active            : BOOL;
    CommandAborted    : BOOL;
    Error             : BOOL;
    ErrorID           : UDINT;
    RecordedPosition  : LREAL;
END_VAR
```

Name	Type	Description
Done	BOOL	Becomes TRUE, if the command was completed successfully.
Busy	BOOL	The Busy output becomes TRUE when the command is started with Execute and remains TRUE as long as the command is processed. When Busy becomes FALSE again, the function block is ready for a new order. At the same time one of the outputs, Done, CommandAborted or Error, is set.
Active	BOOL	Indicates that the command is executed.
CommandAborted	BOOL	Becomes TRUE, if the command could not be fully executed.
Error	BOOL	Becomes TRUE, as soon as an error occurs.
ErrorID	UDINT	If the error output is set, this parameter supplies the error number.
RecordedPosition	LREAL	Axis position at which the event was recorded.

4.3.2.2.3 XFC_StepLimitSwitch



This function block performs the search for a hardware limit switch.

Inputs

```
VAR_INPUT
    Execute           : BOOL;
    Direction         : MC_Home_Direction;
    LimitSwitchMode   : MC_Switch_Mode;
    LimitSwitchSignal : XFC_Ref_Signal_Ref;
    Velocity          : LREAL;
    Acceleration      : LREAL;
    Deceleration      : LREAL;
    Jerk              : LREAL;
    SetPosition       : LREAL;
    TimeLimit         : TIME;
    DistanceLimit     : LREAL;
    TorqueLimit       : LREAL;
```

```
    BufferMode          : MC_BufferMode;
    Options             : ST_Home_Options4;
END_VAR
```

Name	Type	Description
Execute	BOOL	The command is executed with a rising edge at the Execute input.
Direction	MC_Home_Direction	Enumeration that defines the initial direction of movement for the search procedure.
LimitSwitchMode	MC_Switch_Mode	Enumeration that defines the final condition for the search procedure.
LimitSwitchSignal	XFC_Ref_Signal_Ref [▶ 76]	This structure defines the source of the reference cam signal.
Velocity	LREAL	Maximum travel velocity (>0).
Acceleration	LREAL	Acceleration (≥0). If the value is 0, the standard acceleration from the axis configuration in the System Manager is used.
Deceleration	LREAL	Deceleration (≥0). If the value is 0, the standard deceleration from the axis configuration in the System Manager is used.
Jerk	LREAL	Jerk (≥0). If the value is 0, the standard jerk from the axis configuration in the System Manager is used.
SetPosition	LREAL	Position value to which the axis position is to be set.
TimeLimit	TIME	Exceeding this time leads to the search procedure being aborted.
DistanceLimit	LREAL	Exceeding this distance in relation to the start position leads to the search procedure being aborted.
TorqueLimit	LREAL	The motor torque is limited to this value in order to avoid mechanical damage.
BufferMode	MC_BufferMode	Currently not implemented.
Options	ST_Home_Options4	**DisableDriveAccess**: Set to FALSE for Beckhoff drives, usually to TRUE for third-party drives (see info). **EnableLagErrorDetection**: In the step functions, the lag error detection is switched off in order to ensure a smooth referencing process. If it would be purposeful to keep the lag error detection active in an application, this can be achieved by setting this flag.

If DisableDriveAccess = TRUE, the user is responsible for modifying and reconstructing required drive parameters. The parameters required for the intended homing sequence must be agreed with the manufacturer of the third-party drive.

/ Inputs/Outputs

```
VAR_IN_OUT
    Axis      : AXIS_REF;
    Parameter : MC_HomingParameter;
END_VAR
```

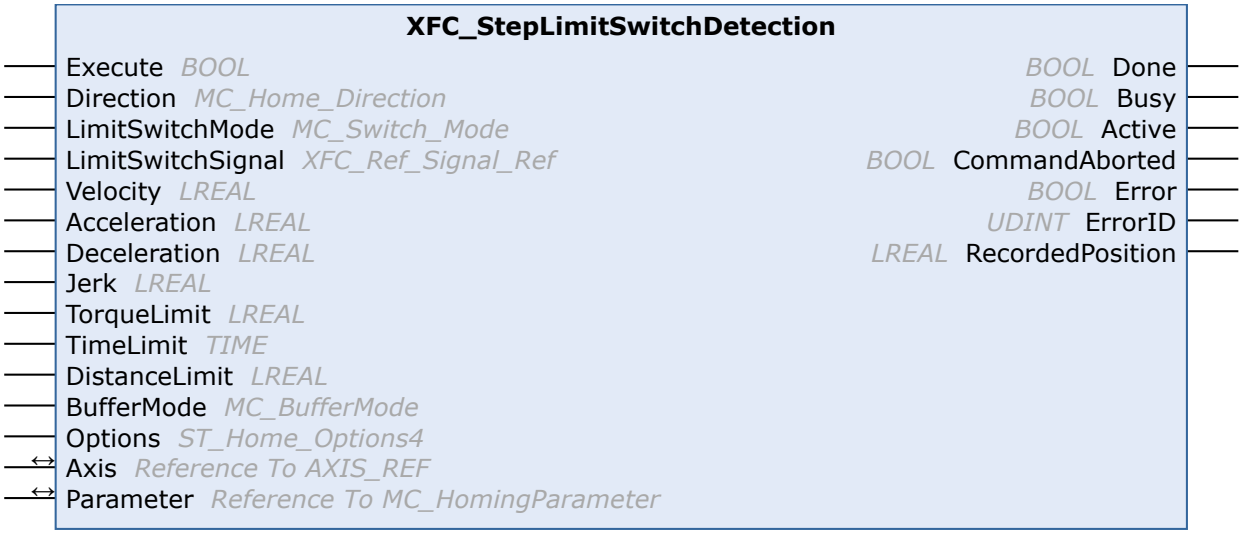
Name	Type	Description
Axis	AXIS_REF	Axis data structure of the type AXIS_REF, which uniquely addresses an axis in the system. Among other parameters it contains the current axis status, including position, velocity or error state.
Parameter	MC_HomingParameter	Data structure of the type MC_HomingParameter, which must be transferred from function block to function block over the entire homing sequence.

Outputs

```
VAR_OUTPUT
    Done           : BOOL;
    Busy           : BOOL;
    Active         : BOOL;
    CommandAborted : BOOL;
    Error          : BOOL;
    ErrorID        : UDINT;
END_VAR
```

Name	Type	Description
Done	BOOL	Becomes TRUE, if the command was completed successfully.
Busy	BOOL	The Busy output becomes TRUE when the command is started with Execute and remains TRUE as long as the command is processed. If Busy becomes FALSE again, the function block is ready for a new order. At the same time one of the outputs, Done, CommandAborted or Error, is set.
Active	BOOL	Indicates that the command is executed.
CommandAborted	BOOL	Becomes TRUE, if the command could not be fully executed.
Error	BOOL	Becomes TRUE, as soon as an error occurs.
ErrorID	UDINT	If the error output is set, this parameter supplies the error number.

4.3.2.2.4 XFC_StepLimitSwitchDetection



This function block performs the search for a hardware limit switch.

The "…Detection" version of this function block does not manipulate the current position of the axis at the end of the sequence, but instead returns the detected position to the user as "RecordedPosition".

Inputs

```
VAR_INPUT
    Execute           : BOOL;
    Direction         : MC_Home_Direction;
    LimitSwitchMode   : MC_Switch_Mode;
    LimitSwitchSignal : XFC_Ref_Signal_Ref;
    Velocity          : LREAL;
    Acceleration      : LREAL;
    Deceleration      : LREAL;
    Jerk              : LREAL;
    TimeLimit         : TIME;
    DistanceLimit     : LREAL;
    TorqueLimit       : LREAL;
    BufferMode        : MC_BufferMode;
    Options           : ST_Home_Options4;
END_VAR
```

Name	Type	Description
Execute	BOOL	The command is executed with a rising edge at the Execute input.
Direction	MC_Home_Direction	Enumeration that defines the initial direction of movement for the search procedure.
LimitSwitchMode	MC_Switch_Mode	Enumeration that defines the final condition for the search procedure.
LimitSwitchSignal	XFC_Ref_Signal_Ref [▶ 76]	This structure defines the source of the reference cam signal.
Velocity	LREAL	Maximum travel velocity (>0).
Acceleration	LREAL	Acceleration (≥0). If the value is 0, the standard acceleration from the axis configuration in the System Manager is used.
Deceleration	LREAL	Deceleration (≥0). If the value is 0, the standard deceleration from the axis configuration in the System Manager is used.
Jerk	LREAL	Jerk (≥0). If the value is 0, the standard jerk from the axis configuration in the System Manager is used.
TimeLimit	TIME	Exceeding this time leads to the search procedure being aborted.

Name	Type	Description
DistanceLimit	LREAL	Exceeding this distance in relation to the start position leads to the search procedure being aborted.
TorqueLimit	LREAL	The motor torque is limited to this value in order to avoid mechanical damage.
BufferMode	MC_BufferMode	Currently not implemented.
Options	ST_Home_Options4	**DisableDriveAccess**: Set to FALSE for Beckhoff drives, usually to TRUE for third-party drives (see info). **EnableLagErrorDetection**: In the step functions, the lag error detection is switched off in order to ensure a smooth referencing process. If it would be purposeful to keep the lag error detection active in an application, this can be achieved by setting this flag.

If DisableDriveAccess = TRUE, the user is responsible for modifying and reconstructing required drive parameters. The parameters required for the intended homing sequence must be agreed with the manufacturer of the third-party drive.

Inputs/Outputs

```
VAR_IN_OUT
    Axis      : AXIS_REF;
    Parameter : MC_HomingParameter;
END_VAR
```

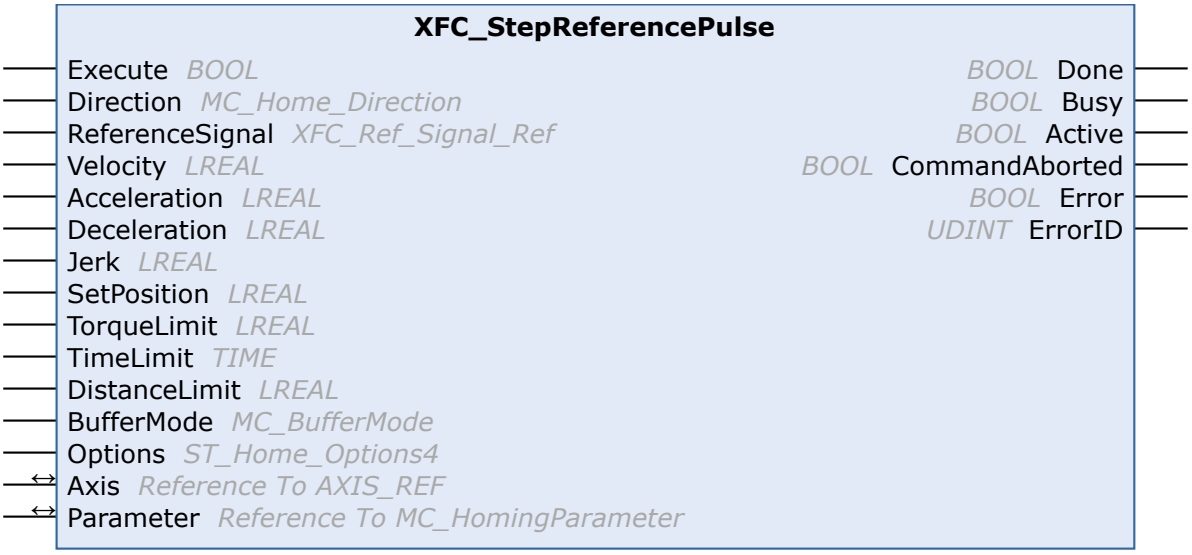
Name	Type	Description
Axis	AXIS_REF	Axis data structure of the type AXIS_REF, which uniquely addresses an axis in the system. Among other parameters it contains the current axis status, including position, velocity or error state.
Parameter	MC_HomingParameter	Data structure of the type MC_HomingParameter, which must be transferred from function block to function block over the entire homing sequence.

Outputs

```
VAR_OUTPUT
    Done             : BOOL;
    Busy             : BOOL;
    Active           : BOOL;
    CommandAborted   : BOOL;
    Error            : BOOL;
    ErrorID          : UDINT;
    RecordedPosition : LREAL;
END_VAR
```

Name	Type	Description
Done	BOOL	Becomes TRUE, if the command was completed successfully.
Busy	BOOL	The Busy output becomes TRUE when the command is started with Execute and remains TRUE as long as the command is processed. When Busy becomes FALSE again, the function block is ready for a new order. At the same time one of the outputs, Done, CommandAborted or Error, is set.
Active	BOOL	Indicates that the command is executed.
CommandAborted	BOOL	Becomes TRUE, if the command could not be fully executed.
Error	BOOL	Becomes TRUE, as soon as an error occurs.
ErrorID	UDINT	If the error output is set, this parameter supplies the error number.
RecordedPosition	LREAL	Axis position at which the event was recorded.

4.3.2.2.5 XFC_StepReferencePulse



This function block performs the search for a zero pulse of an encoder.

A zero pulse is not present in all encoders and occurs only once per encoder revolution. The advantage of using a zero pulse for referencing is the high accuracy of this signal compared to that of a standard sensor.

Inputs

```
VAR_INPUT
    Execute         : BOOL;
    Direction       : MC_Home_Direction;
    SwitchMode      : MC_Switch_Mode;
    ReferenceSignal : XFC_Ref_Signal_Ref;
    Velocity        : LREAL;
    Acceleration    : LREAL;
    Deceleration    : LREAL;
    Jerk            : LREAL;
    SetPosition     : LREAL;
    TimeLimit       : TIME;
    DistanceLimit   : LREAL;
    TorqueLimit     : LREAL;
    BufferMode      : MC_BufferMode;
    Options         : ST_Home_Options4;
END_VAR
```

Name	Type	Description
Execute	BOOL	The command is executed with a rising edge at the Execute input.
Direction	MC_Home_Direction	Enumeration that defines the initial direction of movement for the search procedure.
SwitchMode	MC_Switch_Mode	Enumeration that defines the final condition for the search procedure.
ReferenceSignal	XFC_Ref_Signal_Ref [▶ 76]	This structure defines the source of the reference cam signal.
Velocity	LREAL	Maximum travel velocity (>0).
Acceleration	LREAL	Acceleration (≥0). If the value is 0, the standard acceleration from the axis configuration in the System Manager is used.
Deceleration	LREAL	Deceleration (≥0). If the value is 0, the standard deceleration from the axis configuration in the System Manager is used.
Jerk	LREAL	Jerk (≥0). If the value is 0, the standard jerk from the axis configuration in the System Manager is used.
SetPosition	LREAL	Position value to which the axis position is to be set.

Name	Type	Description
TimeLimit	TIME	Exceeding this time leads to the search procedure being aborted.
DistanceLimit	LREAL	Exceeding this distance in relation to the start position leads to the search procedure being aborted.
TorqueLimit	LREAL	The motor torque is limited to this value in order to avoid mechanical damage.
BufferMode	MC_BufferMode	Currently not implemented.
Options	ST_Home_Options4	**DisableDriveAccess**: Set to FALSE for Beckhoff drives, usually to TRUE for third-party drives (see info). **EnableLagErrorDetection**: In the step functions the lag error detection is switched off in order to ensure a smooth referencing process. If it would be purposeful to keep the lag error detection active in an application, this can be achieved by setting this flag.

If DisableDriveAccess = TRUE, the user is responsible for modifying and reconstructing required drive parameters. The parameters required for the intended homing sequence must be agreed with the manufacturer of the third-party drive.

Inputs/Outputs

```
VAR_IN_OUT
    Axis      : AXIS_REF;
    Parameter : MC_HomingParameter;
END_VAR
```

Name	Type	Description
Axis	AXIS_REF	Axis data structure of the type AXIS_REF, which uniquely addresses an axis in the system. Among other parameters it contains the current axis status, including position, velocity or error state.
Parameter	MC_HomingParameter	Data structure of the type MC_HomingParameter, which must be transferred from function block to function block over the entire homing sequence.

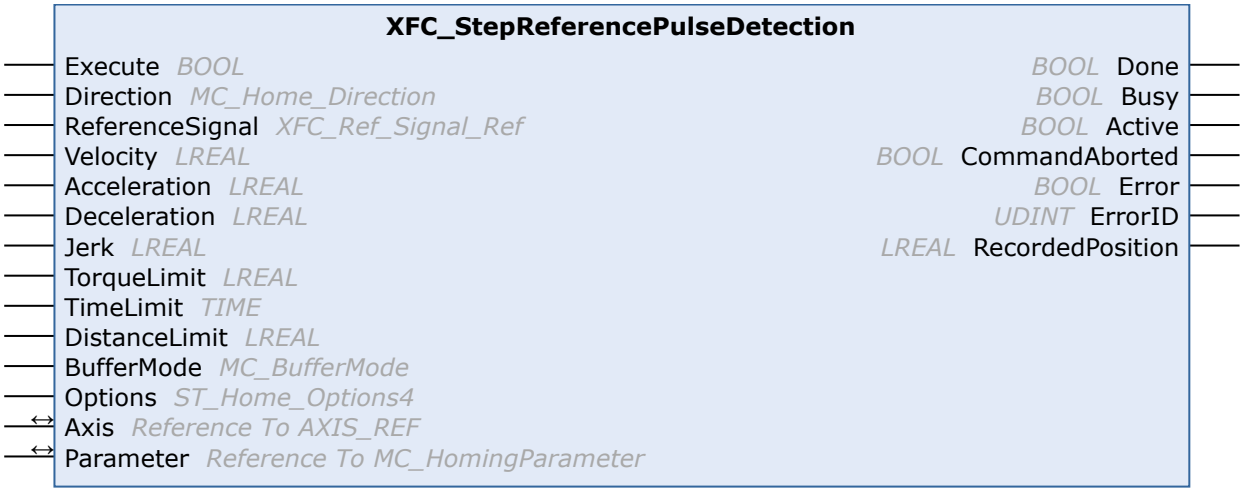
Outputs

```
VAR_OUTPUT
    Done           : BOOL;
    Busy           : BOOL;
    Active         : BOOL;
    CommandAborted : BOOL;
    Error          : BOOL;
    ErrorID        : UDINT;
END_VAR
```

Name	Type	Description
Done	BOOL	Becomes TRUE, if the command was completed successfully.
Busy	BOOL	The Busy output becomes TRUE when the command is started with Execute and remains TRUE as long as the command is processed. If Busy becomes FALSE again, the function block is ready for a new order. At the same time one of the outputs, Done, CommandAborted or Error, is set.
Active	BOOL	Indicates that the command is executed.

Name	Type	Description
CommandAborted	BOOL	Becomes TRUE, if the command could not be fully executed.
Error	BOOL	Becomes TRUE, as soon as an error occurs.
ErrorID	UDINT	If the error output is set, this parameter supplies the error number.

4.3.2.2.6 XFC_StepReferencePulseDetection



This function block performs the search for a zero pulse of an encoder.

A zero pulse is not present in all encoders and occurs only once per encoder revolution. The advantage of using a zero pulse for referencing is the high accuracy of this signal compared to that of a standard sensor.

The "…Detection" version of this function block does not manipulate the current position of the axis at the end of the sequence, but instead returns the detected position to the user as "RecordedPosition".

Inputs

```
VAR_INPUT
    Execute         : BOOL;
    Direction       : MC_Home_Direction;
    SwitchMode      : MC_Switch_Mode;
    ReferenceSignal : XFC_Ref_Signal_Ref;
    Velocity        : LREAL;
    Acceleration    : LREAL;
    Deceleration    : LREAL;
    Jerk            : LREAL;
    TimeLimit       : TIME;
    DistanceLimit   : LREAL;
    TorqueLimit     : LREAL;
    BufferMode      : MC_BufferMode;
    Options         : ST_Home_Options4;
END_VAR
```

Name	Type	Description
Execute	BOOL	The command is executed with a rising edge at the Execute input.
Direction	MC_Home_Direction	Enumeration that defines the initial direction of movement for the search procedure.
SwitchMode	MC_Switch_Mode	Enumeration that defines the final condition for the search procedure.
ReferenceSignal	XFC_Ref_Signal_Ref [▶ 76]	This structure defines the source of the reference cam signal.
Velocity	LREAL	Maximum travel velocity (>0).

Name	Type	Description
Acceleration	LREAL	Acceleration (≥0). If the value is 0, the standard acceleration from the axis configuration in the System Manager is used.
Deceleration	LREAL	Deceleration (≥0). If the value is 0, the standard deceleration from the axis configuration in the System Manager is used.
Jerk	LREAL	Jerk (≥0). If the value is 0, the standard jerk from the axis configuration in the System Manager is used.
TimeLimit	TIME	Exceeding this time leads to the search procedure being aborted.
DistanceLimit	LREAL	Exceeding this distance in relation to the start position leads to the search procedure being aborted.
TorqueLimit	LREAL	The motor torque is limited to this value in order to avoid mechanical damage.
BufferMode	MC_BufferMode	Currently not implemented.
Options	ST_Home_Options4	**DisableDriveAccess**: Set to FALSE for Beckhoff drives, usually to TRUE for third-party drives (see info). **EnableLagErrorDetection**: In the step functions, the lag error detection is switched off in order to ensure a smooth referencing process. If it would be purposeful to keep the lag error detection active in an application, this can be achieved by setting this flag.

If DisableDriveAccess = TRUE, the user is responsible for modifying and reconstructing required drive parameters. The parameters required for the intended homing sequence must be agreed with the manufacturer of the third-party drive.

Inputs/Outputs

```
VAR_IN_OUT
    Axis      : AXIS_REF;
    Parameter : MC_HomingParameter;
END_VAR
```

Name	Type	Description
Axis	AXIS_REF	Axis data structure of the type AXIS_REF, which uniquely addresses an axis in the system. Among other parameters it contains the current axis status, including position, velocity or error state.
Parameter	MC_HomingParameter	Data structure of the type MC_HomingParameter, which must be transferred from function block to function block over the entire homing sequence.

Outputs

```
VAR_OUTPUT
    Done             : BOOL;
    Busy             : BOOL;
    Active           : BOOL;
    CommandAborted   : BOOL;
    Error            : BOOL;
    ErrorID          : UDINT;
    RecordedPosition : LREAL;
END_VAR
```

Name	Type	Description
Done	BOOL	Becomes TRUE, if the command was completed successfully.

Name	Type	Description
Busy	BOOL	The Busy output becomes TRUE when the command is started with Execute and remains TRUE as long as the command is processed. When Busy becomes FALSE again, the function block is ready for a new order. At the same time one of the outputs, Done, CommandAborted or Error, is set.
Active	BOOL	Indicates that the command is executed.
CommandAborted	BOOL	Becomes TRUE, if the command could not be fully executed.
Error	BOOL	Becomes TRUE, as soon as an error occurs.
ErrorID	UDINT	If the error output is set, this parameter supplies the error number.
RecordedPosition	LREAL	Axis position at which the event was recorded.

4.3.3 Data types

4.3.3.1 General

4.3.3.1.1 XFC_Ref_Signal_Ref

```
TYPE XFC_Ref_Signal_Ref :
STRUCT
    Level                : BOOL;

    TimeStampRisingEdge  : UDINT;
    TimeStampFallingEdge : UDINT;
END_STRUCT
END_TYPE
```

Name	Type	Description
Level	BOOL	The current signal state of the sensor must be transferred here.
TimeStampRisingEdge	UDINT	Timestamp of the last rising edge of the digital input signal. If the input signal supplies a 64-bit timestamp T_DCTIME, only the lower 32 bits are supplied. It is therefore important to ensure that the value at the time of the evaluation is not older than 2 seconds.
TimeStampFallingEdge	UDINT	Timestamp of the last falling edge of the digital input signal. If the input signal supplies a 64-bit timestamp T_DCTIME, only the lower 32 bits are supplied. It is therefore important to ensure that the value at the time of the evaluation is not older than 2 seconds.

5 Samples

XFC TouchProbe

The XFC_TouchProbe [▶ 26] function block records an axis position at the time of the edge of a digital input signal (measuring probe function). The following example shows how the function block can be used in free-running (`FreeRun = TRUE`) or in single-shot mode (`FreeRun = FALSE`).

Download: https://infosys.beckhoff.com/content/1033/TF5065_TC3_PLC_Motion_Control_XFC/XFC_NCI/Resources/12595575307/.zip

NCI XFC Fast output switching

This example shows how an output can be switched using the XFC functionalities in conjunction with the NCI.

Download: https://infosys.beckhoff.com/content/1033/TF5065_TC3_PLC_Motion_Control_XFC/XFC_NCI/Resources/13632374795/.zip

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