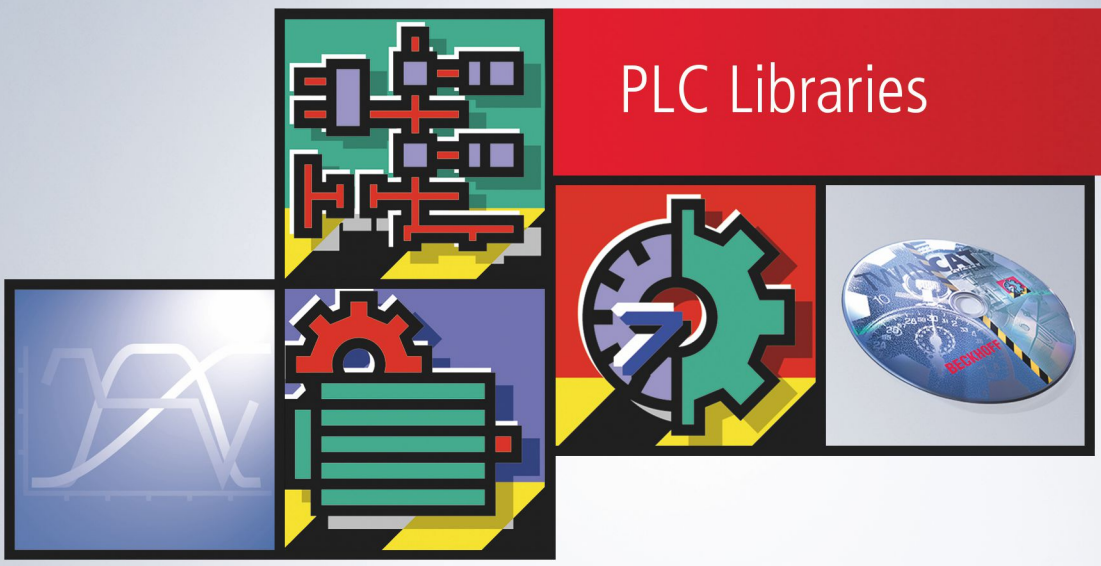
BECKHOFF New Automation Technology

Manual | EN

TX1200

TwinCAT 2 | PLC Library: TcMC2Drive



2023-07-20 | Version: 1.2

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1 Foreword

1.1 Notes on the documentation

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

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

Disclaimer

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

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EP1590927, EP1789857, EP1456722, EP2137893, DE102015105702
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1.2 For your safety

Safety regulations

Read the following explanations for your safety.
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.

Signal words

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 POUs of TcMc2Drive.lib

This library contains functions and functionblocks for SoE-drives. The access to the drive is done via MC2-Axis-Reference (AXIS_REF).

There are differences in the usage of the drive libs in combination with AX5000 and with Bosch Rexroth IndraDriveCS. See sample.

The TcMc2Drive.lib is a wrapper library around the FBs of the TcDrive.lib.

The TcMc2Drive.lib should be used, if the drive is used with the NC via FBs of the librariy TcMc2.lib. The FBs of the TcMc2Drive.lib use the information of the NC-Axis reference (AXIS_REF), that are also used by the FBs of the TcMc2.lib. The FBs determine via the Nc-AxisID of the AXIS_REF the access data to the drive (NetID, address and channel number). See samples of the FBs in the documentation of the TcMc2Drive.lib.

The function blocks FB_SoERead and FB_SoEWrite can be used to access any parameter in the drive, that have no special acces FB.

Functionblocks

Name	Description
FB_SoEReset [▶ 10]	Execute drive reset (S-0-0099)
FB_SoEWritePassword [▶ 11]	Set drive password (S-0-0267)
FB_SoEReadDiagMessage [▶ 16]	Read diagnostic message (S-0-0095)
FB_SoEReadDiagNumber [▶ 18]	Read diagnostic number (S-0-0390)
FB_SoEReadDiagNumberList [▶ 19]	Read diagnostic number list (up to 30 entries) (S-0-0375)
FB_SoEReadClassXDiag [▶ 20]	Read class 1 diag (S-0-0011) ... class 3 diag (S-0-0013)
FB_SoEExecuteCommand [▶ 12]	Execute command
FB_SoEWriteCommandControl [▶ 14]	Set command control
FB_SoEReadCommandState [▶ 15]	Read command state
FB_SoERead [▶ 22]	Read parameter
FB_SoEWrite [▶ 23]	Write parameter
FB_SoEReadAmplifierTemperature [▶ 25]	Read amplifier temperature (S-0-0384)
FB_SoEReadMotorTemperature [▶ 26]	Read motor temperature (S-0-0383)
FB_SoEReadDcBusCurrent [▶ 27]	Read Dc-Bus-current (S-0-0381)
FB_SoEReadDcBusVoltage [▶ 28]	Read Dc-Bus-Voltage (S-0-0380)
FB_SoEAX5000ReadActMainVoltage [▶ 30]	Read main voltage (P-0-0200)
FB_SoEAX5000SetMotorCtrlWord [▶ 31]	Set motor control word to override brake handling (P-0-0096)
FB_SoEAX5000FirmwareUpdate [▶ 32]	Automatic firmware update of AX5000

Sample project and configuration for AX5000 drive diagnose

See https://infosys.beckhoff.com/content/1033/tcplclibmc2_drive/Resources/10842618635/.zip,

Sample project and configuration for IndraDriveCS drive diagnose

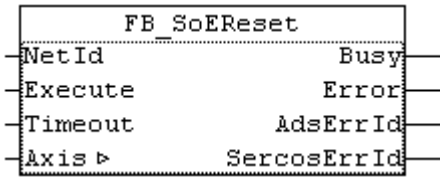
See https://infosys.beckhoff.com/content/1033/tcplclibmc2_drive/Resources/10842620043/.zip, https://infosys.beckhoff.com/content/1033/tcplclibmc2_drive/Resources/10842621451/.zip (TcMc2Drive.lib v0.0.25 or higher)

Requirements

Component	Version
TwinCAT on the development PC	2.10 Build 1335 or higher
TwinCAT on the Windows CE-Image	2.10 Build 1333 or higher
TwinCAT on the Windows XP-Image	2.10 Build 1333 or higher

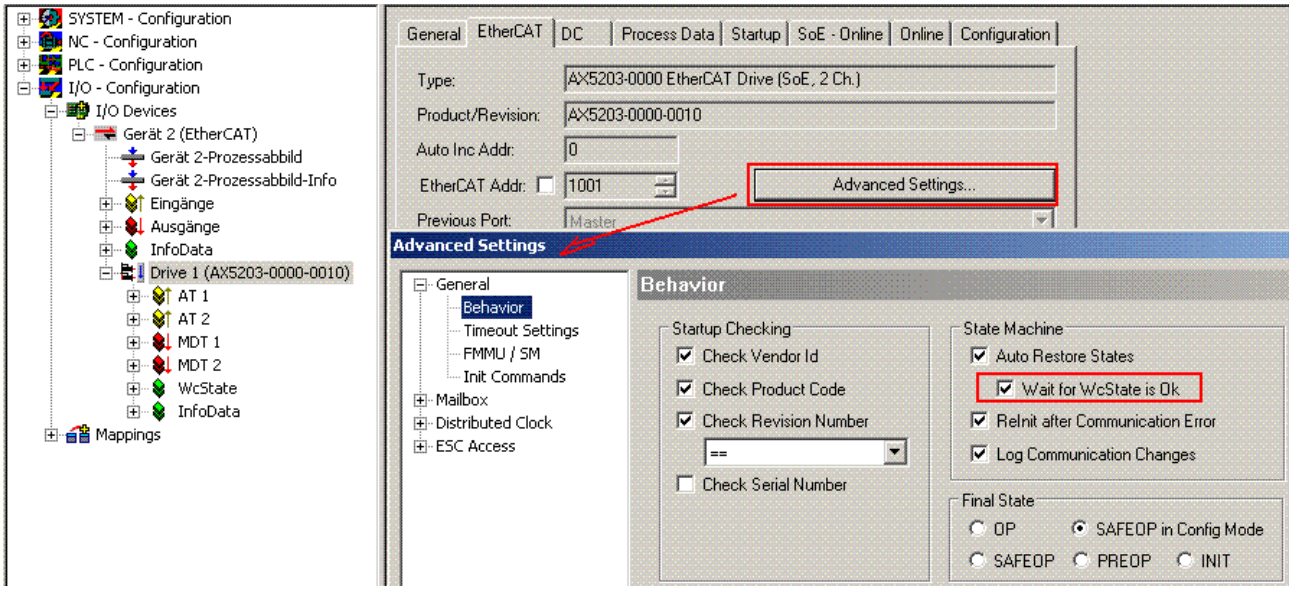
3 General SoE FB

3.1 FB_SoEReset



The functionblock FB_SoEReset can be used to execute a drive reset (S-0-0099). Drives with more than on channel may require a reset on all channels. The timeout time must be 10s, because the reset can take up to 10s.

For the AX5000 the flag "Wait For WcState is OK" in the Advanced EtherCAT Settings has to be active.



An NC-Reset is not executed.

If an NC-Reset is necessary, it can be executed via the MC_Reset block from the TcMc.lib

VAR_INPUT

```
VAR_INPUT
    NetId    : T_AmsNetId := '';
    Execute  : BOOL;
    Timeout  : TIME := T#10s;
END_VAR
```

NetId: A string containing the AMS network identifier of the PC.

Execute: The block is activated by a rising edge at this input.

Timeout: Maximum time allowed for the execution of the function block.

VAR_IN_OUT

```
VAR_IN_OUT
    Axis : AXIS_REF; (* Axis reference *)
END_VAR
```

Axis: Axis structure (see TcMC2.lib).

VAR_OUTPUT

```
VAR_OUTPUT
    Busy         : BOOL;
    Error        : BOOL;
    AdsErrId     : UINT;
    SercosErrId  : UINT;
END_VAR
```

Busy: This output is set when the function block is activated and remains set until an acknowledgement is received.

Error: This output is set up after the bBusy output has been reset if there has been an error in transmission of the command.

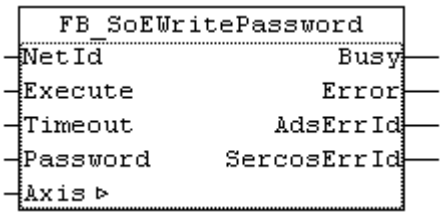
AdsErrId: Supplies the ADS error code associated with the most recently executed command if the Error output is set.

SercosErrId: Supplies the Sercos error code associated with the most recently executed command if the Error output is set.

Sample

```
fbSoEReset : FB_SoEReset;
SoEReset : BOOL;

(* NcAxis *)
Axis            : AXIS_REF;
IF SoEReset THEN
    fbSoEReset(
       Axis     := Axis,
        Execute := TRUE,
    );
    IF NOT fbSoEReset.Busy THEN
        fbSoEReset(Axis := Axis,Execute := FALSE);
        SoEReset := FALSE;
    END_IF
END_IF
```

3.2 FB_SoEWritePassword



The functionblock FB_SoEWritePassword can be used to set the drive password (S-0-0267).

VAR_INPUT

```
VAR_INPUT
    NetId           : T_AmsNetId := '';
    Execute         : BOOL;
    Timeout         : TIME := DEFAULT_ADS_TIMEOUT;
    Password        : ST_SoE_String;
END_VAR
```

NetId: A string containing the AMS network identifier of the PC.

Execute: The block is activated by a rising edge at this input.

Timeout: Maximum time allowed for the execution of the function block.

Password: Contains password as Sercos string

VAR_IN_OUT

```
VAR_IN_OUT
    Axis : AXIS_REF; (* Axis reference *)
END_VAR
```

Axis: Axis structure (see TcMC2.lib).

VAR_OUTPUT

```
VAR_OUTPUT
    Busy         : BOOL;
    Error        : BOOL;
    AdsErrId     : UINT;
    SercosErrId  : UINT;
END_VAR
```

Busy: This output is set when the function block is activated and remains set until an acknowledgement is received.

Error: This output is set up after the bBusy output has been reset if there has been an error in transmission of the command.

AdsErrId: Supplies the ADS error code associated with the most recently executed command if the Error output is set.

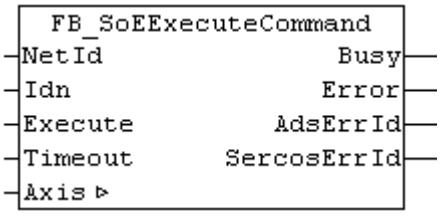
SercosErrId: Supplies the Sercos error code associated with the most recently executed command if the Error output is set.

Sample

```
fbWritePassword : FB_SoEWritePassword;
WritePassword   : BOOL;
Password        :
ST_SoE_String;

(* NcAxis *)
Axis            : AXIS_REF;
IF WritePassword THEN
    fbWritePassword(
        Axis     := Axis,
        Execute  := TRUE,
        Timeout  := DEFAULT_ADS_TIMEOUT,
        Password := Password
    );
    IF NOT fbWritePassword.Busy THEN
        fbWritePassword(Axis := Axis, Execute := FALSE);
        WritePassword := FALSE;
    END_IF
END_IF
```

3.3 Command FB

3.3.1 FB_SoEExecuteCommand



The functionblock FB_SoEExecuteCommand can be used to execute a command.

VAR_INPUT

```
VAR_INPUT
    NetId    : T_AmsNetId := '';
    Idn      : WORD;
```

```
    Execute  : BOOL;
    Timeout  : TIME := DEFAULT_ADS_TIMEOUT;
END_VAR
```

NetId: A string containing the AMS network identifier of the PC.

Idn: Parameter number for the command, i.e. "P_0_IDN + 160" for executing a P-0-0160 command

Execute: The block is activated by a rising edge at this input.

Timeout: Maximum time allowed for the execution of the function block.

VAR_IN_OUT

```
VAR_IN_OUT
    Axis : AXIS_REF; (* Axis reference *)
END_VAR
```

Axis: Axis structure (see TcMC2.lib).

VAR_OUTPUT

```
VAR_OUTPUT
    Busy         : BOOL;
    Error        : BOOL;
    AdsErrId     : UINT;
    SercosErrId  : UINT;
END_VAR
```

Busy: This output is set when the function block is activated and remains set until an acknowledgement is received.

Error: This output is set up after the bBusy output has been reset if there has been an error in transmission of the command.

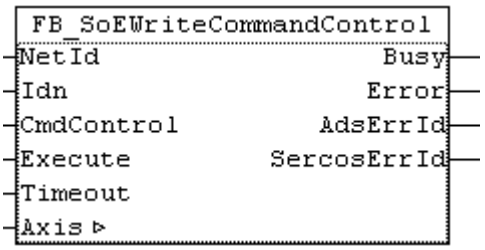
AdsErrId: Supplies the ADS error code associated with the most recently executed command if the Error output is set.

SercosErrId: Supplies the Sercos error code associated with the most recently executed command if the Error output is set.

Sample

```
fbExecuteCommand : FB_SoEExecuteCommand;
ExecuteCommand   : BOOL;
Idn              : WORD;

(* NcAxis *)
Axis             : AXIS_REF;
IF ExecuteCommand THEN
    Idn := P_0_IDN + 160;
    fbExecuteCommand(
       Axis    := Axis,
       Execute := TRUE,
       Timeout := DEFAULT_ADS_TIMEOUT,
       Idn     := Idn,
    );
    IF NOT fbExecuteCommand.Busy THEN
        fbExecuteCommand(Axis := Axis, Execute := FALSE);
        ExecuteCommand := FALSE;
    END_IF
END_IF
```

3.3.2 FB_SoEWriteCommandControl



The functionblock FB_SoEWriteCommandControl can be used to prepare, start, or cancel a command.

VAR_INPUT

```
VAR_INPUT
    NetId       : T_AmsNetId := '';
    Idn         : WORD;
    CmdControl  : E_SoE_CmdControl;
    Execute     : BOOL;
    Timeout     : TIME := DEFAULT_ADS_TIMEOUT;
END_VAR
```

NetId: A string containing the AMS network identifier of the PC.

Idn: Parameter number for the command, i.e. "P_0_IDN + 160" for executing a P-0-0160 command

CmdControl: prepare a command with eSoE_CmdControl_Set := 1, execute a command with eSoE_CmdControl_SetAndEnable := 3 or abort a command with eSoE_CmdControl_Cancel := 0

Execute: The block is activated by a rising edge at this input.

Timeout: Maximum time allowed for the execution of the function block.

VAR_IN_OUT

```
VAR_IN_OUT
    Axis : AXIS_REF; (* Axis reference *)
END_VAR
```

Axis: Axis structure (see TcMC2.lib).

VAR_OUTPUT

```
VAR_OUTPUT
    Busy         : BOOL;
    Error        : BOOL;
    AdsErrId     : UINT;
    SercosErrId  : UINT;
END_VAR
```

Busy: This output is set when the function block is activated and remains set until an acknowledgement is received.

Error: This output is set up after the bBusy output has been reset if there has been an error in transmission of the command.

AdsErrId: Supplies the ADS error code associated with the most recently executed command if the Error output is set.

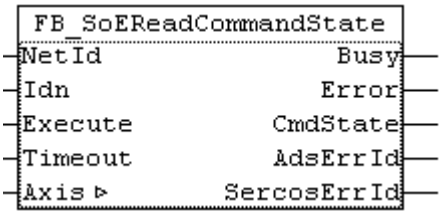
SercosErrId: Supplies the Sercos error code associated with the most recently executed command if the Error output is set.

Sample

```
fbWriteCommandControl : FB_SoEWriteCommandControl;
WriteCommandControl   : BOOL;
Idn                   : WORD;
CmdControl            : E_SoE_CmdControl;

(* NcAxis *)
```

```
Axis            : AXIS_REF;
IF WriteCommandControl THEN
    Idn := P_0_IDN + 160;
    fbWriteCommandControl(
       Axis        := Axis,
       Execute     := TRUE,
       Timeout     := DEFAULT_ADS_TIMEOUT,
       Idn         := Idn,
       CmdControl  := CmdControl
    );
    IF NOT fbWriteCommandControl.Busy THEN
       fbWriteCommandControl(Axis := Axis, Execute := FALSE);
       WriteCommandControl := FALSE;
    END_IF
END_IF
```

3.3.3 FB_SoEReadCommandState



The function block FB_SoEReadCommandState can be used to read the state of a command.

VAR_INPUT

```
VAR_INPUT
    NetId    : T_AmsNetId := '';
    Idn      : WORD;
    Execute  : BOOL;
    Timeout  : TIME := DEFAULT_ADS_TIMEOUT;
END_VAR
```

NetId: A string containing the AMS network identifier of the PC.

Idn: Parameter number for the command, i.e. "P_0_IDN + 160" for executing a P-0-0160 command

Execute: The block is activated by a rising edge at this input.

Timeout: Maximum time allowed for the execution of the function block.

VAR_IN_OUT

```
VAR_IN_OUT
    Axis : AXIS_REF; (* Axis reference *)
END_VAR
```

Axis: Axis structure (see TcMC2.lib).

VAR_OUTPUT

```
VAR_OUTPUT
    Busy        : BOOL;
    Error       : BOOL;
    CmdState    : E_SoE_CmdState;
    AdsErrId    : UINT;
    SercosErrId : UINT;
END_VAR
```

Busy: This output is set when the function block is activated and remains set until an acknowledgement is received.

Error: This output is set up after the bBusy output has been reset if there has been an error in transmission of the command.

AdsErrId: Supplies the ADS error code associated with the most recently executed command if the bError output is set.

SercosErrId: Supplies the Sercos error code associated with the most recently executed command if the bError output is set.

CmdState: Supplies the command state

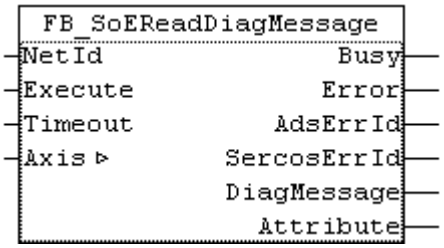
```
    eSoE_CmdState_NotSet =
0
- no command active

    eSoE_CmdState_Set =
1
- command set (prepared) but (not yet) executed

    eSoE_CmdState_Executed =
2
- command was executed

    eSoE_CmdState_SetEnabledExecuted =
3    - command set (prepared) and executed

    eSoE_CmdState_SetAndInterrupted =
5      - command was set but interupted

    eSoE_CmdState_SetEnabledNotExecuted = 7 -
command execution is stll active

    eSoE_CmdState_Error =
15
- error during command execution, switched to error state
```

Sample

```
fbReadCommandState : FB_SoEReadCommandState;
ReadCommandState   : BOOL;
Idn                : WORD;
CmdState           : E_SoE_CmdState;

(* NcAxis *)
Axis            : AXIS_REF;
IF ReadCommandState THEN
    Idn := P_0_IDN + 160;
    fbReadCommandState(
       Axis     := Axis,
       Execute  := TRUE,
       Timeout  := DEFAULT_ADS_TIMEOUT,
       Idn      := Idn,
       CmdState =>CmdState
    );
    IF NOT fbReadCommandState.Busy THEN
        fbReadCommandState(Axis:= Axis, Execute := FALSE);
        ReadCommandState := FALSE;
    END_IF
END_IF
```

3.4 Diagnosis FB

3.4.1 FB_SoEReadDiagMessage



The functionblock FB_SoEReadDiagMessage can be used to read the diagnose message as a Sercos-String (S-0-0095).

VAR_INPUT

```
VAR_INPUT
    NetId   : T_AmsNetId := '';
    Execute : BOOL;
    Timeout : TIME := DEFAULT_ADS_TIMEOUT;
END_VAR
```

NetId: A string containing the AMS network identifier of the PC.

Execute: The block is activated by a rising edge at this input.

Timeout: Maximum time allowed for the execution of the function block.

VAR_IN_OUT

```
VAR_IN_OUT
    Axis : AXIS_REF; (* Axis reference *)
END_VAR
```

Axis: Axis structure (see TcMC2.lib).

VAR_OUTPUT

```
VAR_OUTPUT
    Busy         : BOOL;
    Error        : BOOL;
    AdsErrId     : UINT;
    SercosErrId  : UINT;
    DiagMessage  : ST_SoE_String;
    Attribute    : DWORD;
END_VAR
```

Busy: This output is set when the function block is activated and remains set until an acknowledgement is received.

Error: This output is set up after the bBusy output has been reset if there has been an error in transmission of the command.

AdsErrId: Supplies the ADS error code associated with the most recently executed command if the Error output is set.

SercosErrId: Supplies the Sercos error code associated with the most recently executed command if the Error output is set.

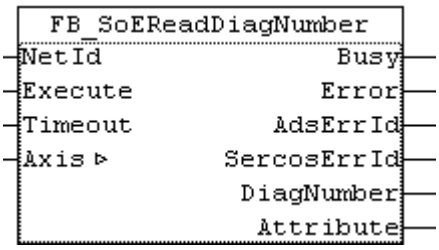
Attribute: Supplies the Sercos parameter attribute.

DiagMessage: Supplies the diagnostic message.

Sample

```
fbDiagMessage : FB_SoEReadDiagMessage;
bDiagMessage  : BOOL;
DiagMessage   : ST_SoE_String;

(* NcAxis *)
Axis            : AXIS_REF;'
IF bDiagMessage THEN
    fbDiagMessage(
       Axis     := Axis,
       Execute := TRUE,
       Timeout := DEFAULT_ADS_TIMEOUT,
       DiagMessage=>DiagMessage
    );
    IF NOT fbDiagMessage.Busy THEN
        fbDiagMessage(Axis := Axis, Execute := FALSE);
        bDiagMessage := FALSE;
    END_IF
END_IF
```

3.4.2 FB_SoEReadDiagNumber



The functionblock FB_SoEReadDiagNumber can be used to read the actual diagnose number as UDINT (S-0-0390).

VAR_INPUT

```
VAR_INPUT
    NetId   : T_AmsNetId := '';
    Execute : BOOL;
    Timeout : TIME := DEFAULT_ADS_TIMEOUT;
END_VAR
```

NetId: A string containing the AMS network identifier of the PC.

Execute: The block is activated by a rising edge at this input.

Timeout: Maximum time allowed for the execution of the function block.

VAR_IN_OUT

```
VAR_IN_OUT
    Axis : AXIS_REF; (* Axis reference *)
END_VAR
```

Axis: Axis structure (see TcMC2.lib).

VAR_OUTPUT

```
VAR_OUTPUT
    Busy         : BOOL;
    Error        : BOOL;
    AdsErrId     : UINT;
    SercosErrId  : UINT;
    DiagNumber   : UDINT;
    Attribute    : DWORD;
END_VAR
```

Busy: This output is set when the function block is activated and remains set until an acknowledgement is received.

Error: This output is set up after the bBusy output has been reset if there has been an error in transmission of the command.

AdsErrId: Supplies the ADS error code associated with the most recently executed command if the Error output is set.

SercosErrId: Supplies the Sercos error code associated with the most recently executed command if the Error output is set.

Attribute: Supplies the Sercos parameter attribute.

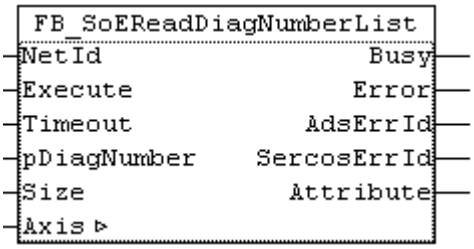
DiagNumber:Supplies the diagnostic number.

Sample

```
fbDiagNumber : FB_SoEReadDiagNumber;
bDiagNumber  : BOOL;
DiagNumber   : UDINT;

(* NcAxis *)
Axis            : AXIS_REF;
```

```
IF bDiagNumber THEN
    fbDiagNumber(
       Axis     := Axis,
       Execute := TRUE,
       Timeout := DEFAULT_ADS_TIMEOUT,
       DiagNumber =>DiagNumber
    );
    IF NOT fbDiagNumber.Busy THEN
        fbDiagNumber(Axis := Axis, Execute := FALSE);
        bDiagNumber := FALSE;
    END_IF
END_IF
```

3.4.3 FB_SoEReadDiagNumberList



The functionblock FB_SoEReadDiagNumberList can be used to read the history of the diagnose numbers as a list (S-0-0375).

VAR_INPUT

```
VAR_INPUT
    NetId          : T_AmsNetId := '';
    Execute        : BOOL;
    Timeout        : TIME := DEFAULT_ADS_TIMEOUT;
    pDiagNumber    : POINTER TO ST_SoE_DiagNumList;
    Size           : UDINT;
END_VAR
```

NetId: A string containing the AMS network identifier of the PC.

Execute: The block is activated by a rising edge at this input.

Timeout: Maximum time allowed for the execution of the function block.

pDiagNumber: Pointer to the list of the last max. 30 error numbers. The list consists of the actual and maximum number of bytes in the list, and of the last 30 list entries

Size: Size of the list in bytes (as Sizeof())

VAR_IN_OUT

```
VAR_IN_OUT
    Axis : AXIS_REF; (* Axis reference *)
END_VAR
```

Axis: Axis structure (see TcMC2.lib).

VAR_OUTPUT

```
VAR_OUTPUT
    Busy           : BOOL;
    Error          : BOOL;
    AdsErrId       : UINT;
    SercosErrId    : UINT;
    Attribute      : DWORD;
END_VAR
```

Busy: This output is set when the function block is activated and remains set until an acknowledgement is received.

Error: This output is set up after the bBusy output has been reset if there has been an error in transmission of the command.

AdsErrId: Supplies the ADS error code associated with the most recently executed command if the Error output is set.

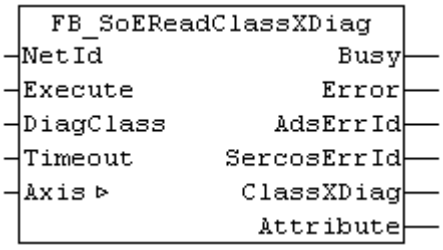
SercosErrId: Supplies the Sercos error code associated with the most recently executed command if the Error output is set.

Attribute: Supplies the Sercos parameter attribute.

Sample

```
fbDiagNumberList     : FB_SoEReadDiagNumberList;
DiagNumberList       : BOOL;
stDiagNumberList     : ST_SoE_DiagNumList;

(* NcAxis *)
Axis            : AXIS_REF;
IF DiagNumberList  THEN
    fbDiagNumberList(
        Axis     := Axis,
        Execute  := TRUE,
        Timeout  := DEFAULT_ADS_TIMEOUT,
        pDiagNumber:= ADR(stDiagNumberList),
        Size := SIZEOF(stDiagNumberList),
    );
    IF NOT fbDiagNumberList.Busy THEN
        fbDiagNumberList(Axis := Axis, Execute := FALSE);
        DiagNumberList := FALSE;
    END_IF
END_IF
```

3.4.4 FB_SoEReadClassXDiag



The function block FB_SoEReadClassXDiag can be used to read the actual Class 1 Diagnose (S-0-0011) ... Class 3 Diagnose (S-0-0013) as a WORD. There is a conversion function F_ConvWordToSTAX5000C1D for evaluation of the Class 1 Diagnose as a structure ST_AX5000_C1D. See Documentation of TcDrive.lib.

VAR_INPUT

```
VAR_INPUT
    NetId     : T_AmsNetId := '';
    Execute   : BOOL;
    DiagClass : USINT:= 1; (* 1: C1D (S-0-0011) is default, 2: C2D (S-0-0012), 3: C3D (S-0-0013) *)
    Timeout   : TIME := DEFAULT_ADS_TIMEOUT;
END_VAR
```

NetId: A string containing the AMS network identifier of the PC.

Execute: The block is activated by a rising edge at this input.

DiagClass: Selects which diagnose should be read. The diagnose info can be different with different drive vendors. Not always all diagnose parameters (C1D ... C3D) or all bits in these parameters are implementiert.
1: Error: Class 1 Diag (S-0-0011)
2: Warning: Class 2 Diag (S-0-0012)
3: Informationen: Class 3 Diag (S-0-0013)

Timeout: Maximum time allowed for the execution of the function block.

VAR_IN_OUT

```
VAR_IN_OUT
    Axis : AXIS_REF; (* Axis reference *)
END_VAR
```

Axis: Axis structure (see TcMC2.lib).

VAR_OUTPUT

```
VAR_OUTPUT
    Busy         : BOOL;
    Error        : BOOL;
    AdsErrId     : UINT;
    SercosErrId  : UINT;
    ClassXDiag   : WORD;
    Attribute    : DWORD;
END_VAR
```

Busy: This output is set when the function block is activated and remains set until an acknowledgement is received.

Error: This output is set up after the bBusy output has been reset if there has been an error in transmission of the command.

AdsErrId: Supplies the ADS error code associated with the most recently executed command if the Error output is set.

SercosErrId: Supplies the Sercos error code associated with the most recently executed command if the Error output is set.

ClassXDiag: Supplies the class X diagnose.

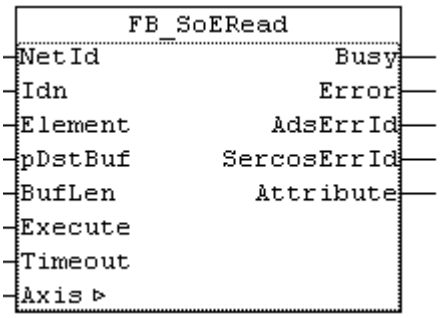
Attribute: Supplies the Sercos parameter attribute.

Sample

```
fbClassXDiag : FB_SoEReadClassXDiag;
bClassXDiag  : BOOL;
DiagClass    : USINT := 1;
Class1Diag   : WORD;
stAX5000C1D  : ST_AX5000_C1D;
Class2Diag   : WORD;

(* NcAxis *)
Axis : AXIS_REF;
IF bClassXDiag THEN
    fbClassXDiag(
        Axis       := Axis,
        Execute    := TRUE,
        DiagClass  := DiagClass,
        Timeout    := DEFAULT_ADS_TIMEOUT
    );
    IF NOT fbClassXDiag.Busy THEN
        fbClassXDiag(Axis := Axis, Execute := FALSE);
        bClassXDiag := FALSE;

        CASE
fbClassXDiag.DiagClass OF
        1:
           Class1Diag := fbClassXDiag.ClassXDiag;
           stAX5000C1D := F_ConvWordToSTAX5000C1D(Class1Diag);

        2:
           Class2Diag := fbClassXDiag.ClassXDiag;
        END_CASE
    END_IF
END_IF
```

3.5 FB for current values

3.5.1 FUNCTION_BLOCK FB_SoERead



The functionblock FB_SoERead can be used to read a parameter.

VAR_INPUT

```
VAR_INPUT
    NetId    : T_AmsNetId := '';
    Idn      : WORD;
    Element  : BYTE;
    pDstBuf  : DWORD;
    BufLen   : UDINT;
    Execute  : BOOL;
    Timeout  : TIME := DEFAULT_ADS_TIMEOUT;
END_VAR
```

NetId: A string containing the AMS network identifier of the PC.

Idn: Parameter number for the command, i.e. "S_0_IDN + 33" for executing a S-0-0033 command

Element: Shows on which parameter part is to be read, e.g. 16#40 is the value of the parameter.

```
    EC_SOE_ELEMENT_DATASTATE :BYTE :=16#01;
    EC_SOE_ELEMENT_NAME      :BYTE :=16#02;
    EC_SOE_ELEMENT_ATTRIBUTE :BYTE :=16#04;
    EC_SOE_ELEMENT_UNIT      :BYTE :=16#08;
    EC_SOE_ELEMENT_MIN       :BYTE :=16#10;
    EC_SOE_ELEMENT_MAX       :BYTE :=16#20;
    EC_SOE_ELEMENT_VALUE     :BYTE :=16#40;
    EC_SOE_ELEMENT_DEFAULT   :BYTE :=16#80;
```

pSrcBuf: Contains the address of the buffer containing the data to be read.

BufLen: The maximum available buffer size for the data to be read, in bytes.

Execute: The block is activated by a rising edge at this input.

Timeout: Maximum time allowed for the execution of the function block.

Execute: The block is activated by a rising edge at this input.

Timeout: Maximum time allowed for the execution of the function block.

VAR_IN_OUT

```
VAR_IN_OUT
    Axis : AXIS_REF; (* Axis reference *)
END_VAR
```

Axis: Axis structure (see TcMC2.lib).

VAR_OUTPUT

```
VAR_OUTPUT
    bBusy           : BOOL;
    bError          : BOOL;
    iAdsErrId           : UINT;
```

```
    iSercosErrId        : UINT;
    dwAttribute         : DWORD;
END_VAR
```

Busy: This output is set when the function block is activated and remains set until an acknowledgement is received.

Error: This output is set up after the bBusy output has been reset if there has been an error in transmission of the command.

AdsErrId: Supplies the ADS error code associated with the most recently executed command if the Error output is set.

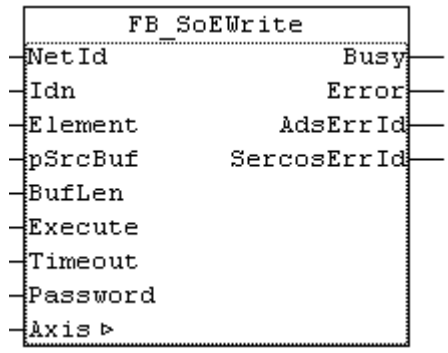
SercosErrId: Supplies the Sercos error code associated with the most recently executed command if the Error output is set.

Attribute: Supplies the Sercos parameter attribute.

Sample

```
fbRead : FB_SoERead;
Read    : BOOL;
Idn     : WORD;
ReadValue : UINT;

(* NcAxis *)
Axis            : AXIS_REF;
IF Read THEN
    Idn := S_0_IDN + 33;
    fbRead(
        Axis    := Axis,
        Idn     := Idn,
        Element := 16#40,
        pDstBuf := ADR(ReadValue),
        BufLen  := SIZEOF(ReadValue),
        Execute := TRUE,
        Timeout := DEFAULT_ADS_TIMEOUT,
    );
    IF NOT fbRead.Busy THEN
        fbRead(Axis := Axis,Execute := FALSE);
        Read := FALSE;
    END_IF
END_IF
```

3.5.2 FUNCTION_BLOCK FB_SoEWrite



The functionblock FB_SoEWrite can be used to write a parameter.

VAR_INPUT

```
VAR_INPUT
    NetId       : T_AmsNetId := '';
    Idn         : WORD;
    Element     : BYTE;
    pSrcBuf     : DWORD;
    BufLen      : UDINT;
    Execute     : BOOL;
```

```
    Timeout    : TIME := DEFAULT_ADS_TIMEOUT;
    sPassword  : ST_SoE_String;
END_VAR
```

NetId: A string containing the AMS network identifier of the PC.

Idn: Parameter number for the command, i.e. "S_0_IDN + 47" for executing a S-0-0047 command

Element: Shows on which parameter part is to be read, e.g. 16#40 is the value of the parameter. Most times only write access on this value is possible, other parameter parts are write-protected.

```
    EC_SOE_ELEMENT_DATASTATE :BYTE :=16#01;
    EC_SOE_ELEMENT_NAME      :BYTE :=16#02;
    EC_SOE_ELEMENT_ATTRIBUTE :BYTE :=16#04;
    EC_SOE_ELEMENT_UNIT      :BYTE :=16#08;
    EC_SOE_ELEMENT_MIN       :BYTE :=16#10;
    EC_SOE_ELEMENT_MAX       :BYTE :=16#20;
    EC_SOE_ELEMENT_VALUE     :BYTE :=16#40;
    EC_SOE_ELEMENT_DEFAULT   :BYTE :=16#80;
```

pSrcBuf: Contains the address of the buffer containing the data to be send.

BufLen: The maximum available buffer size for the data to be written, in bytes.

Execute: The block is activated by a rising edge at this input.

Timeout: Maximum time allowed for the execution of the function block.

Password: contains the password as Sercos-String. Not yet used. The password has to be written with FB_SoEWritePassword [▶ 11].

VAR_IN_OUT

```
VAR_IN_OUT
    Axis : AXIS_REF; (* Axis reference *)
END_VAR
```

Axis: Axis structure (see TcMC2.lib).

VAR_OUTPUT

```
VAR_OUTPUT
    Busy         : BOOL;
    Error        : BOOL;
    AdsErrId     : UINT;
    SercosErrId  : UINT;
END_VAR
```

Busy: This output is set when the function block is activated and remains set until an acknowledgement is received.

Error: This output is set up after the bBusy output has been reset if there has been an error in transmission of the command.

AdsErrId: Supplies the ADS error code associated with the most recently executed command if the Error output is set.

SercosErrId: Supplies the Sercos error code associated with the most recently executed command if the Error output is set.

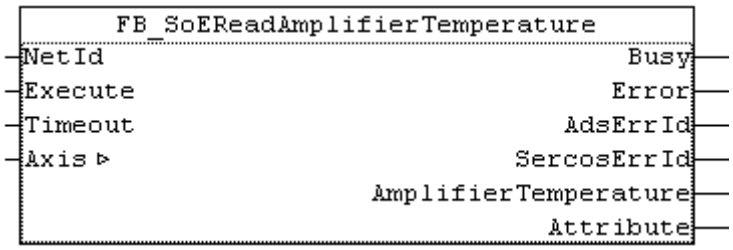
Sample

```
fbWrite : FB_SoEWrite;
Idn     : WORD;
Write   : BOOL;
WriteValue : UINT;
Password   : ST_SoE_String;

(* NcAxis *)
Axis            : AXIS_REF;
```

```
IF Write THEN
    Idn := S_0_IDN + 33;
    fbWrite(
        Axis     := Axis,
```

```
        Idn      := Idn,
        Element  :=16#40,
        pSrcBuf  :=ADR(WriteValue),
        BufLen   :=SIZEOF(WriteValue),
        Password :=Password,
        Execute  :=TRUE,
        Timeout  :=DEFAULT_ADS_TIMEOUT,
    );
    IF NOT fbWrite.Busy THEN
        fbWrite(Axis := Axis,Execute := FALSE);
        Write := FALSE;
    END_IF
END_IF
```

3.5.3 FUNCTION_BLOCK FB_SoEReadAmplifierTemperature



The functionblock FB_SoEReadAmplifierTemperature can be used to read the amplifier temperature (S-0-0384).

VAR_INPUT

```
VAR_INPUT
    NetId   : T_AmsNetId := '';
    Execute : BOOL;
    Timeout : TIME := DEFAULT_ADS_TIMEOUT;
END_VAR
```

NetId: A string containing the AMS network identifier of the PC.

Execute: The block is activated by a rising edge at this input.

Timeout: Maximum time allowed for the execution of the function block.

VAR_IN_OUT

```
VAR_IN_OUT
    Axis : AXIS_REF; (* Axis reference *)
END_VAR
```

Axis: Axis structure (see TcMC2.lib).

VAR_OUTPUT

```
VAR_OUTPUT
    Busy                : BOOL;
    Error               : BOOL;
    AdsErrId            : UINT;
    SercosErrId         : UINT;
    AmplifierTemperature : REAL;
    Attribute           : DWORD;
END_VAR
```

Busy: This output is set when the function block is activated and remains set until an acknowledgement is received.

Error: This output is set up after the bBusy output has been reset if there has been an error in transmission of the command.

AdsErrId: Supplies the ADS error code associated with the most recently executed command if the Error output is set.

SercosErrId: Supplies the Sercos error code associated with the most recently executed command if the Error output is set.

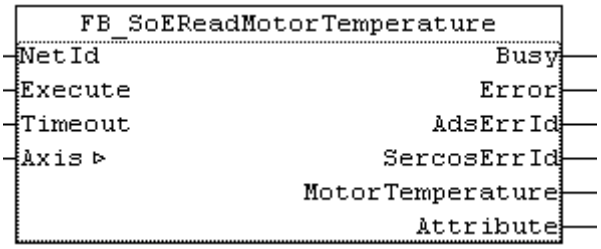
Attribute: Supplies the Sercos parameter attribute.

AmplifierTemperature: Supplies the amplifier temperature (e.g. 26.2 means to 26.2°C).

Sample

```
fbReadAmplifierTemp  : FB_SoEReadAmplifierTemperature;
ReadAmplifierTemp    : BOOL;
AmplifierTemperature : REAL;

(* NcAxis *)
Axis            : AXIS_REF;
IF ReadAmplifierTemp THEN
    fbReadAmplifierTemp(
        Axis     := Axis,
        Execute  := TRUE,
        Timeout  := DEFAULT_ADS_TIMEOUT,
        AmplifierTemperature=>AmplifierTemperature
    );
    IF NOT fbReadAmplifierTemp.Busy THEN
        fbReadAmplifierTemp(Axis:= Axis, Execute := FALSE);
        ReadAmplifierTemp :=FALSE;
    END_IF
END_IF
```

3.5.4 FUNCTION_BLOCK FB_SoEReadMotorTemperature



The functionblock FB_SoEReadMotorTemperature can be used to read the temperature of the motor (S-0-0383). If the motor does not contain a temperature sensor then the FB reports 0.0, means 0.0°C.

VAR_INPUT

```
VAR_INPUT
    NetId   : T_AmsNetId := '';
    Execute : BOOL;
    Timeout : TIME := DEFAULT_ADS_TIMEOUT;
END_VAR
```

NetId: A string containing the AMS network identifier of the PC.

Execute: The block is activated by a rising edge at this input.

Timeout: Maximum time allowed for the execution of the function block.

VAR_IN_OUT

```
VAR_IN_OUT
    Axis : AXIS_REF; (* Axis reference *)
END_VAR
```

Axis: Axis structure (see TcMC2.lib).

VAR_OUTPUT

```
VAR_OUTPUT
    Busy              : BOOL;
    Error             : BOOL;
    AdsErrId          : UINT;
    SercosErrId       : UINT;
```

```
    MotorTemperature  : REAL;
    Attribute         : DWORD;
END_VAR
```

Busy: This output is set when the function block is activated and remains set until an acknowledgement is received.

Error: This output is set up after the bBusy output has been reset if there has been an error in transmission of the command.

AdsErrId: Supplies the ADS error code associated with the most recently executed command if the Error output is set.

SercosErrId: Supplies the Sercos error code associated with the most recently executed command if the Error output is set.

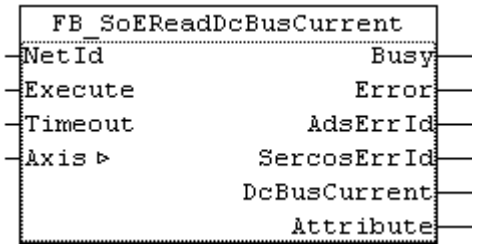
Attribute: Supplies the Sercos parameter attribute.

MotorTemperature: Supplies the motor temperature (i.e. 30.5 means 30.5°C). If the motor does not contain a temperature sensor, then the value is 0.0, means 0.0°C.

Sample

```
fbReadMotorTemp  :FB_SoEReadMotorTemperature;
ReadMotorTemp    : BOOL;
MotorTemperature : REAL;

(* NcAxis *)
Axis             : AXIS_REF;
IF ReadMotorTemp THEN
    fbReadMotorTemp(
        Axis    := Axis,
        Execute := TRUE,
        Timeout := DEFAULT_ADS_TIMEOUT,
        MotorTemperature=>MotorTemperature
    );
    IF NOT fbReadMotorTemp.Busy THEN
        fbReadMotorTemp(Axis :=Axis, Execute := FALSE);
        ReadMotorTemp :=FALSE;
    END_IF
END_IF
```

3.5.5 FUNCTION_BLOCK FB_SoEReadDcBusCurrent



The functionblock FB_SoEAX5000ReadDcBusCurrent_ByDriveRef can be used to read the DC-Bus-Current (S-0-0381).

VAR_INPUT

```
VAR_INPUT
    NetId   : T_AmsNetId := '';
    Execute : BOOL;
    Timeout : TIME := DEFAULT_ADS_TIMEOUT;
END_VAR
```

NetId: A string containing the AMS network identifier of the PC.

Execute: The block is activated by a rising edge at this input.

Timeout: Maximum time allowed for the execution of the function block.

VAR_IN_OUT

```
VAR_IN_OUT
    Axis : AXIS_REF; (* Axis reference *)
END_VAR
```

Axis: Axis structure (see TcMC2.lib).

VAR_OUTPUT

```
VAR_OUTPUT
    Busy          : BOOL;
    Error         : BOOL;
    AdsErrId      : UINT;
    SercosErrId   : UINT;
    DcBusCurrent  : REAL;
    Attribute     : DWORD;
END_VAR
```

Busy: This output is set when the function block is activated and remains set until an acknowledgement is received.

Error: This output is set up after the bBusy output has been reset if there has been an error in transmission of the command.

AdsErrId: Supplies the ADS error code associated with the most recently executed command if the Error output is set.

SercosErrId: Supplies the Sercos error code associated with the most recently executed command if the Error output is set.

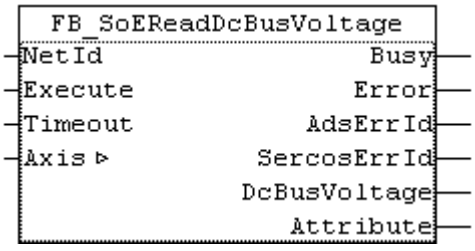
Attribute: Supplies the Sercos parameter attribute.

DcBusCurrent: Supplies the DC-Bus-Current (i.e. 2.040 means 2.040A).

Sample

```
fbReadDcBusCurrent : FB_SoEReadDcBusCurrent;
ReadDcBusCurrent   : BOOL;
DcBusCurrent       : REAL;

(* NcAxis *)
Axis            : AXIS_REF;
IF ReadDcBusCurrent THEN
    fbReadDcBusCurrent(
        Axis     := Axis,
        Execute  := TRUE,
        Timeout  := DEFAULT_ADS_TIMEOUT,
        DcBusCurrent=>DcBusCurrent
    );
    IF NOT fbReadDcBusCurrent.Busy THEN
        fbReadDcBusCurrent(Axis:= Axis, Execute := FALSE);
        ReadDcBusCurrent :=FALSE;
    END_IF
END_IF
```

3.5.6 FUNCTION_BLOCK FB_SoEReadDcBusVoltage



The functionblock FB_SoEReadDcBusVoltage can be used to read the DC-Bus-Voltage of the amplifier (S-0-0380).

VAR_INPUT

```
VAR_INPUT
    NetId   : T_AmsNetId := '';
    Execute : BOOL;
    Timeout : TIME := DEFAULT_ADS_TIMEOUT;
END_VAR
```

NetId: A string containing the AMS network identifier of the PC.

Execute: The block is activated by a rising edge at this input.

Timeout: Maximum time allowed for the execution of the function block.

VAR_IN_OUT

```
VAR_IN_OUT
    Axis : AXIS_REF; (* Axis reference *)
END_VAR
```

Axis: Axis structure (see TcMC2.lib).

VAR_OUTPUT

```
VAR_OUTPUT
    Busy          : BOOL;
    Error         : BOOL;
    AdsErrId      : UINT;
    SercosErrId   : UINT;
    DcBusVoltage  : REAL;
    Attribute     : DWORD;
END_VAR
```

Busy: This output is set when the function block is activated and remains set until an acknowledgement is received.

Error: This output is set up after the bBusy output has been reset if there has been an error in transmission of the command.

AdsErrId: Supplies the ADS error code associated with the most recently executed command if the bError output is set.

SercosErrId: Supplies the Sercos error code associated with the most recently executed command if the bError output is set.

Attribute: Supplies the Sercos parameter attribute.

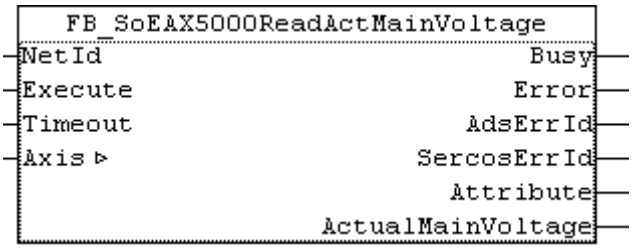
DcBusVoltage: Supplies the DC-Bus-Voltage (i.e. 294.0 means 294.0V).

Sample

```
fbReadDcBusVoltage : FB_SoEReadDcBusVoltage;
ReadDcBusVoltage   : BOOL;
DcBusVoltage       : REAL;

(* NcAxis *)
Axis            : AXIS_REF;
IF ReadDcBusVoltage THEN
    fbReadDcBusVoltage(
        Axis     := Axis,
        Execute  := TRUE,
        Timeout  := DEFAULT_ADS_TIMEOUT,
        DcBusVoltage=>DcBusVoltage
    );
    IF NOT fbReadDcBusVoltage.Busy THEN
        fbReadDcBusVoltage(Axis:= Axis, Execute := FALSE);
        ReadDcBusVoltage :=FALSE;
    END_IF
END_IF
```

4 AX5000 specific FB

4.1 FB_SoEAX5000ReadActMainVoltage



The function block FB_SoEAX5000ReadActMainVoltage can be used to read the main voltage (P-0-0200) of the AX5000.

VAR_INPUT

```
VAR_INPUT
    NetId   : T_AmsNetId := '';
    Execute : BOOL;
    Timeout : TIME := DEFAULT_ADS_TIMEOUT;
END_VAR
```

NetId: A string containing the AMS network identifier of the PC.

Execute: The block is activated by a rising edge at this input.

Timeout: Maximum time allowed for the execution of the function block.

VAR_IN_OUT

```
VAR_IN_OUT
    Axis : AXIS_REF; (* Axis reference *)
END_VAR
```

Axis: Axis structure (see TcMC2.lib).

VAR_OUTPUT

```
VAR_OUTPUT
    Busy              : BOOL;
    Error             : BOOL;
    AdsErrId          : UINT;
    SercosErrId       : UINT;
    Attribute         : DWORD;
    ActualMainVoltage : LREAL;
END_VAR
```

Busy: This output is set when the function block is activated and remains set until an acknowledgement is received.

Error: This output is set up after the bBusy output has been reset if there has been an error in transmission of the command.

AdsErrId: Supplies the ADS error code associated with the most recently executed command if the Error output is set.

SercosErrId: Supplies the Sercos error code associated with the most recently executed command if the Error output is set.

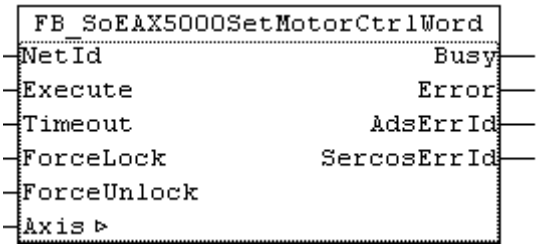
Attribute: Supplies the Sercos parameter attribute.

ActualMainVoltage: Supplies the main voltage of the AX5000 (i.e. 303.0 means 303.0V).

Sample

```
fbReadActMainVoltage : FB_SoEAX5000ReadActMainVoltage;
ReadActMainVoltage   : BOOL;
ActualMainVoltage    : REAL;

(* NcAxis *)
Axis            : AXIS_REF;
IF ReadActMainVoltage THEN
    fbReadActMainVoltage(
        Axis     := Axis,
        Execute  := TRUE,
        Timeout  := DEFAULT_ADS_TIMEOUT,
        ActualMainVoltage=>ActualMainVoltage
    );
    IF NOT fbReadActMainVoltage.Busy THEN
       fbReadActMainVoltage(Axis := Axis, Execute := FALSE);
        ReadActMainVoltage :=FALSE;
    END_IF
END_IF
```

4.2 FB_SoEAX5000SetMotorCtrlWord



The functionblock FB_SoEAX5000SetMotorCtrlWord can be used to set the ForceLock-Bit (Bit 0) or the ForceUnlock-Bit in the motor control word (P-0-0096), to set or release the brake. The brake is set and released automatically via the enable of the drive.

TheForceLock-Bit can be used to set the brake independent of the enable, the ForceUnlock-Bit can be used to release the brake independent of the enable. If ForceLock and ForceUnlock are set simultaneously then the ForceLock (brake locked) has the higher priority.

VAR_INPUT

```
VAR_INPUT
    NetId       : T_AmsNetId := '';
    Execute     : BOOL;
    Timeout     : TIME := DEFAULT_ADS_TIMEOUT;
    ForceLock   : BOOL;
    ForceUnlock : BOOL;
END_VAR
```

NetId: A string containing the AMS network identifier of the PC.

Execute: The block is activated by a rising edge at this input.

Timeout: Maximum time allowed for the execution of the function block.

ForceLock: Lock the brake independent of the enable.

ForceUnlock: Release (unlock) the brake independent of the enable.

VAR_IN_OUT

```
VAR_IN_OUT
    Axis : AXIS_REF; (* Axis reference *)
END_VAR
```

Axis: Axis structure (see TcMC2.lib).

VAR_OUTPUT

```
VAR_OUTPUT
    Busy        : BOOL;
    Error       : BOOL;
    AdsErrId    : UINT;
    SercosErrId : UINT;
END_VAR
```

Busy: This output is set when the function block is activated and remains set until an acknowledgement is received.

Error: This output is set up after the bBusy output has been reset if there has been an error in transmission of the command.

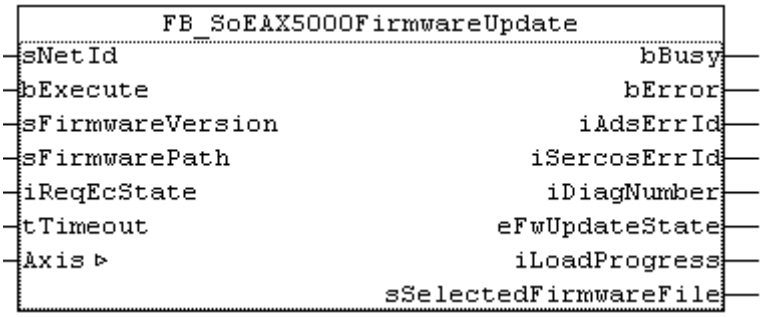
AdsErrId: Supplies the ADS error code associated with the most recently executed command if the Error output is set.

SercosErrId: Supplies the Sercos error code associated with the most recently executed command if the Error output is set.

Sample

```
fbSetMotorCtrlWord : FB_SoEAX5000SetMotorCtrlWord;
SetMotorCtrlWord   : BOOL;
ForceLock          : BOOL;
ForceUnlock        : BOOL;

(* NcAxis *)
Axis            : AXIS_REF;
IF SetMotorCtrlWord THEN
    fbSetMotorCtrlWord(
        Axis       := Axis,
        Execute    := TRUE,
        Timeout    := DEFAULT_ADS_TIMEOUT,
        ForceLock  := ForceLock,
        ForceUnlock:= ForceUnlock
    );
    IF NOT fbSetMotorCtrlWord.Busy THEN
        fbSetMotorCtrlWord(Axis:= Axis, Execute := FALSE);
        SetMotorCtrlWord :=FALSE;
    END_IF
END_IF
```

4.3 FB_SoEAX5000FirmwareUpdate



The functionblock FB_SoEAX5000FirmwareUpdate can be used to check and update the firmware of the AX5000 to a requested version (revision and build) or to the newest build of the configured revision.

In order to update the following sequence is executed:
- get configured slave type, i.e. AX5103-0000-0010
- get scanned slave type for the slave address, i.e. AX5103-0000-0009
- get current slave firmware, i.e. v1_05_b0009
- compare configured and scanned slave (number of channels, current, revision, firmware)
- create firmware files name and search for the file
- update firmware (if required)
- rescan slave
- switch the slave to the requested EtherCAT state

A successful updatefinishes with**eFwUpdateState = eFwU_FwUpdateDone**. If the update is not required, then the state returns **eFwUpdateState = eFwU_NoFwUpdateRequired**. The firmware update is executed via the channel of the drive (A=0 or B=1) set in stDriveRef. With two channel devices, the firmware update can only be executed via one of the channels. The other channel signals**eFwUpdateState = eFwU_UpdateViaOtherChannelActive** or **= eFwU_UpdateViaOtherChannel**.

During the firmware update (**eFwUpdateState = eFwU_FwUpdateInProgress**) the update progress is reported via**iLoadProgress in percent**.

NOTICE

Faulty update due to interruptions

Interruptions during the update may result in it not being executed or executed incorrectly. Afterwards, the terminal may no longer be usable without the appropriate firmware.

The rules during the update are:

- The PLC and TwinCAT must not be stopped.
- The EtherCAT connection must not be interrupted.
- The AX5000 must not be switched off.

VAR_INPUT

```
VAR_INPUT
   sNetId           : T_AmsNetId;
   bExecute         : BOOL;
   sFirmwareVersion : STRING(20);  (* version string vx_yy_bnnnn, e.g. "v1_05_b0009" for
v1.05 Build 0009 *)
   sFirmwarePath    : T_MaxString; (* drive:\path, e.g. "C:
\TwinCAT\Io\TcDriveManager\FirmwarePool" *)
   iReqEcState      : UINT := EC_DEVICE_STATE_OP;
   tTimeout     : TIME := DEFAULT_ADS_TIMEOUT;
END_VAR
```

bExecute: The block is activated by a rising edge at this input.

sFirmwareVersion: The required firmware version in form of **v**x_yy_**b**nnnn, i.e. "**v**1_05_**b**0009" or "**v**1.05_**b**0009" for version v1.05 build 0009.

sFirmwarePath: The path for the firmware pool, where the firmware files are located, i.e. "C:\TwinCAT\Io\TcDriveManager\FirmwarePool".

sNetIdIPC: AMS-NetID of the controller (IPC).

iReqEcState: Requested EtherCAT state after the update (only if an update is executed). The states are defined in the TcEtherCAT.lib as globale constants.

tTimeout: The firmware update can take a few minutes, the timeout here defines the timeout for internal ADS instances.

VAR_IN_OUT

```
VAR_IN_OUT
    Axis : AXIS_REF; (* Axis reference *)
END_VAR
```

Axis: Axis structure (see TcMC2.lib).

VAR_OUTPUT

```
VAR_OUTPUT
   bBusy                : BOOL;
   bError               : BOOL;
   iAdsErrId            : UINT;
   iSercosErrId         : UINT;
   iDiagNumber          : UDINT;
   eFwUpdateState       : E_FwUpdateState;
   iLoadProgress        : INT;
   sSelectedFirmwareFile : STRING(MAX_STRING_LENGTH); (* found firmware file,
e.g. "AX5200-0000-0010_v1_05_b0009.efw" *)
END_VAR
```

bBusy: This output is set when the function block is activated and remains set until an acknowledgement is received.

bError: This output is set up after the bBusy output has been reset if there has been an error in transmission of the command.

iAdsErrId: Supplies the ADS error code associated with the most recently executed command if the bError output is set.

iSercosErrId: Supplies the Sercos error code associated with the most recently executed command if the bError output is set.

iDiagNumber: Supplies the drive error code associated with the most recently executed firmware update if the bError output is set.

eFwUpdateState: Supplies the status of the firmware update. See E_FwUpdateState [▶ 37].

iLoadProgress: Supplies the progress of the firmware load in percent.

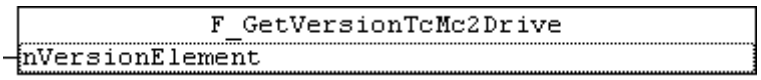
sSelectedFirmwareFile: Supplies the name of the searched firmware file.

Sample

```
VAR CONSTANT
   iNumOfDrives         : INT:= 2;
END_VAR
VAR
    fbFirmwareUpdate     : ARRAY[1..iNumOfDrives] OF FB_SoEAX5000FirmwareUpdate;
    Axes                 : ARRAY [1..iNumOfDrives] OF AXIS_REF;
    sFirmwareVersion     : ARRAY[1..iNumOfDrives] OF STRING(20)(* :=2('v1_04_b0002')*);
    eFwUpdateState       : ARRAY[1..iNumOfDrives] OF E_FwUpdateState;
    sSelectedFirmwareFile: ARRAY [1..iNumOfDrives]OF STRING(MAX_STRING_LENGTH);
    iUpdateState         :INT;
    bExecute             : BOOL;
    sNetIdIPC            : T_AmsNetId := '';
    sFirmwarePath        :T_MaxString :='C:\TwinCAT\Io\TcDriveManager\FirmwarePool';
    I                    : INT;
    bAnyBusy             : BOOL;
    bAnyError            : BOOL;
END_VAR
CASE iUpdateState OF
0:
    IF bExecute THEN
        iUpdateState := 1;
    END_IF

1:
    FOR I := 1 TO iNumOfDrives DO
       fbFirmwareUpdate[I](
           Axis := Axes[I],
           bExecute := TRUE,
           tTimeout := T#15s,
           sFirmwareVersion := sFirmwareVersion[I],
           sFirmwarePath := sFirmwarePath,
           sNetId := sNetIdIPC,
           iReqEcState := EC_DEVICE_STATE_OP,
           eFwUpdateState => eFwUpdateState[I],
        );
    END_FOR
    iUpdateState := 2;

2:
    bAnyBusy := FALSE;
    bAnyError:= FALSE;
    FOR I := 1 TO iNumOfDrives DO
       fbFirmwareUpdate[I](
           Axis := Axes[I],
           eFwUpdateState => eFwUpdateState[I],
           sSelectedFirmwareFile => sSelectedFirmwareFile[I],
        );

        IF NOT fbFirmwareUpdate[I].bBusy THEN
           fbFirmwareUpdate[I](bExecute := FALSE, Axis := Axes[I];
           IF fbFirmwareUpdate[I].bError THEN
               bAnyError := TRUE;
           END_IF
```

```
        ELSE
           bAnyBusy := TRUE;
        END_IF
    END_FOR

    IF NOT bAnyBusy THEN
        bExecute := FALSE;
        IF NOT bAnyError THEN
           iUpdateState := 0; (* OK *)
        ELSE
           iUpdateState := 3; (* Error *)
        END_IF
    END_IF
3:
    (* Error handling *)
    iUpdateState := 0;

END_CASE
```

5 F_GetVersionTcMc2Drive



This function can be used to read PLC library version information.

FUNCTION F_GetVersionTcMc2Drive : UINT

```
VAR_INPUT
    nVersionElement : INT;
END_VAR
```

nVersionElement : Version element to be read. Possible parameters:

- 1 : major number;
- 2 : minor number;
- 3 : revision number;

Requirements

Development environment	Target system type	PLC libraries to be linked
TwinCAT v2.10.0 Build >= 1329	PC or CX (x86)	TcMc2.lib, TcMath.lib, TcMathBase.lib, TcDrive.lib, TcEtherCAT.lib, TcUtilities.Lib, TcSystem.lib, TcBase.lib
TwinCAT v2.10.0 Build >= 1329	CX (ARM)	

6 Data types

6.1 E_FwUpdateState

E_FwUpdateState describes the state of the firmware update.

```
TYPE E_SoE_CmdState :(
   (* update states *)
   eFwU_NoError := 0,
   eFwU_CheckCfgIdentity,
   eFwU_CheckSlaveCount,
   eFwU_CheckFindSlavePos,
   eFwU_WaitForScan,
   eFwU_ScanningSlaves,
   eFwU_CheckScannedIdentity,
   eFwU_CheckScannedFirmware,
   eFwU_FindFirmwareFile,
   eFwU_WaitForUpdate,
   eFwU_WaitForSlaveState,
   eFwU_StartFwUpdate,
   eFwU_FwUpdateInProgress,
   eFwU_FwUpdateDone,
   eFwU_NoFwUpdateRequired,

   (* not updating via this channel *)
   eFwU_UpdateViaOtherChannelActive,
   eFwU_UpdatedViaOtherChannel,

   (* error states *)
   eFwU_GetSlaveIdentityError         := -1,
   eFwU_GetSlaveCountError            := -2,
   eFwU_GetSlaveAddrError             := -3,
   eFwU_StartScanError                := -4,
   eFwU_ScanStateError                := -5,
   eFwU_ScanIdentityError             := -6,
   eFwU_GetSlaveStateError            := -7,
   eFwU_ScanFirmwareError             := -8,
   eFwU_FindFileError                 := -9,
   eFwU_CfgTypeInNoAX5xxx             := -10,
   eFwU_ScannedTypeInNoAX5xxx         := -11,
   eFwU_ChannelMismatch               := -12,
   eFwU_ChannelMismatch_1Cfg_2Scanned := -13,
   eFwU_ChannelMismatch_2Cfg_1Scanned := -14,
   eFwU_CurrentMismatch               := -15,
   eFwU_FwUpdateError                 := -16,
   eFwU_ReqSlaveStateError            := -17
);
END_TYPE
```

```
Update Status

eFwU_NoError
: initial state


eFwU_CheckCfgIdentity
: reading of the configured slave type (number of channels,
current, revision)


eFwU_CheckSlaveCount
: get configured amount of slaves


eFwU_CheckFindSlavePos
: search slave address in the master object directory


eFwU_WaitForScan
: wait for online scan


eFwU_ScanningSlaves
: online scan of slaves
```

```
eFwU_CheckScannedIdentity
: reading of scanned slave types (number of channels, current,
revision)


eFwU_CheckScannedFirmware
: get firmware version of the drive


eFwU_FindFirmwareFile
: search for firmware file


eFwU_WaitForUpdate
: wait for updates (short delay before the update)


eFwU_WaitForSlaveState
: get EtherCAT slave state


eFwU_StartFwUpdate
: Start firmware update


eFwU_FwUpdateInProgress
: firmware update active


eFwU_FwUpdateDone
: firmware update succeeded


eFwU_NoFwUpdateRequired
: no firmware update required


   eFwU_UpdateViaOtherChannelActive   : Update
via the other drive channel active


eFwU_UpdatedViaOtherChannel
: Updated via the other drive channel

Update Errors

eFwU_GetSlaveIdentityError
: reading of the configured slave type failed, see iAdsErrId


eFwU_GetSlaveCountError
: get configured amount of slaves failed, see iAdsErrId


eFwU_GetSlaveAddrError
: search slave address in the master object directory failed, see
iAdsErrId


eFwU_StartScanError
: start of online scan of slaves failed, see iAdsErrId


eFwU_ScanStateError
: online scan failed, see iAdsErrId


eFwU_ScanIdentityError
: reading of scanned slave types (number of channels, current,
revision) failed, see iAdsErrId


eFwU_GetSlaveStateError
: get EtherCAT slave state failed, see iAdsErrId


eFwU_ScanFirmwareError
: get firmware version of the drive failed, see iAdsErrId +
iSercosErrId
```

```
eFwU_FindFileError
: search for firmware file failed, see iAdsErrId


eFwU_CfgTypeInNoAX5xxx
: the configured slave is not an AX5000


eFwU_ScannedTypeInNoAX5xxx
: the scanned slave is not an AX5000


eFwU_ChannelMismatch
: The amoutn of configured and scanned channels of the AX5000 do
not match

   eFwU_ChannelMismatch_1Cfg_2Scanned : one channel
device configured but two channel device found

   eFwU_ChannelMismatch_2Cfg_1Scanned : two channel
device configured but one channel device found


eFwU_CurrentMismatch
: current of the AX5000 type does not match, i.e. AX5103 (3A)
configured but AX5106 (6A) found


eFwU_FwUpdateError
: general update error, see iAdsErrId


eFwU_ReqSlaveStateError
: switching ot requested EtherCAT state failed, see iAdsErrId
```

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