BECKHOFF New Automation Technology

Manual | EN

TS511x

TwinCAT 2 | Kinematic Transformation

Supplement | Motion

Inhaltsverzeichnis

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.

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 notice.
No claims to modify products that have already been supplied may be made on the basis of the data, diagrams, and descriptions in this documentation.

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1.2 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.

Exclusion of liability

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

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

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2   Installation

The kinematics package integrates itself transparently into the existing Motion Control world of TwinCAT: simple insertion of an additional Kinematic channel is sufficient. The complete parameterization is done in the TwinCAT System Manager. The package supports different parallel and serial kinematic systems, as used for e.g. Pick & Place tasks.

The supplement is based on TwinCAT NC I for interpolating movements and G-Code (DIN 66025). In addition, standard PTP and cam plate applications can be realized. Programming is usually based on the Cartesian coordinate system, with the control system calculating the inverse kinematics for the relevant motor positions. The kinematic system can be selected in the TwinCAT System Manager. The kinematic channel is used to parameterize the type (e.g. delta) and the bar lengths and offsets. Mass and mass inertia values can be specified for dynamic pre-control. The "flying saw" and "cam plate" functions enable synchronization with conveyor belts for picking or placing work pieces, for example.

Installation Requirements

The supplement TwinCAT Kinematic Transformation requires TwinCAT **NCI-Level** and at least Version 2.11 R3. It runs generally on Windows XP/Vista/7 and CE devices.

Installation Levels

TwinCAT Kinematic Transformation is divided in 4 different levels, depending on the transformation's number of axes. A higher level includes all sub-levels.

Level 1

Supports the static transformation. This includes a translation and rotation of the coordinate system.

Level 2

Supports level 1 and easy (mainly 2D) kinematic transformation like H-Bot and 2D-Parallel-Kinematics.

Level 3

Supports level 2 and more complex (3D,4D) kinematic transformation like Delta-Robot.

Level 4

Supports level 3 and complex kinematic transformation (up to 6D).

3   Configuration

Based on the PLCopen we distinguish two main coordinate systems:

- Axis Coordinate System (ACS)
  The axes of the ACS are connected to the real motor. So this coordinate system represents the positioning of the motor without taking care about the position of the tool center point (TCP).

- Machine Coordinate System (MCS)
  this is by default a Cartesian coordinate system. Programming of movements are usually done here and therefore the axes X, Y, and Z are used. The backward transformation is calculating the positions for the axes coordinate system. The axes in MCS are pure software axes and of type simulation encoder.
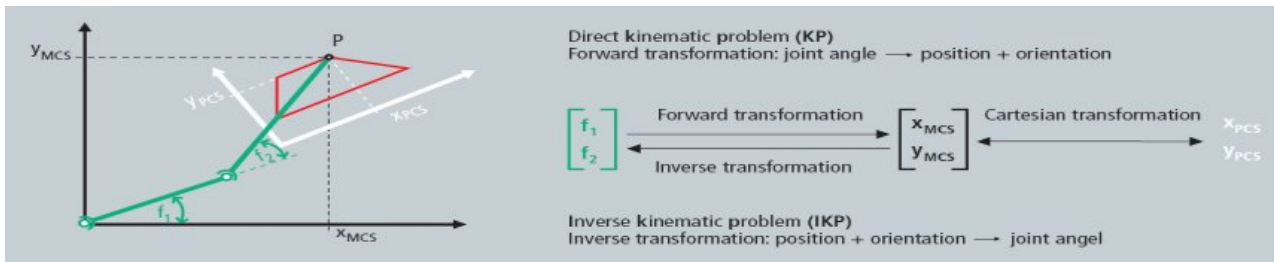
All ACS and MCS axes that are used in a kinematic transformation channel must be created in the System Manager. So for example a Delta-Robot will have 3 ACS axes (M1...M3) and 3 MCS axes (X, Y, Z).

Configure Kinematic Transformation Channel

1. Append all axes (ACS and MCS) to the NC-Configuration in System Manager equal to PTP axes.
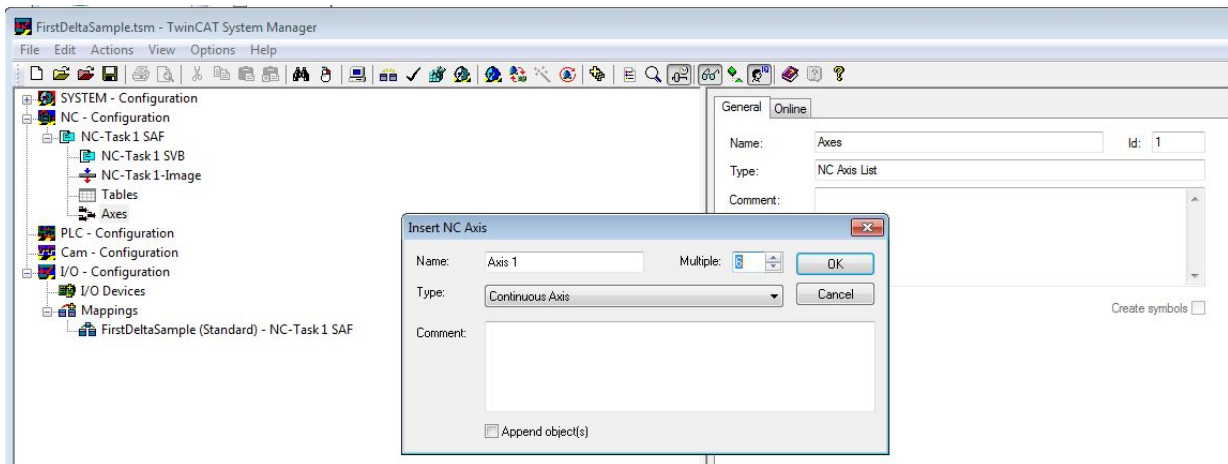
2. Append a kinematic channel to the System Manager configuration.
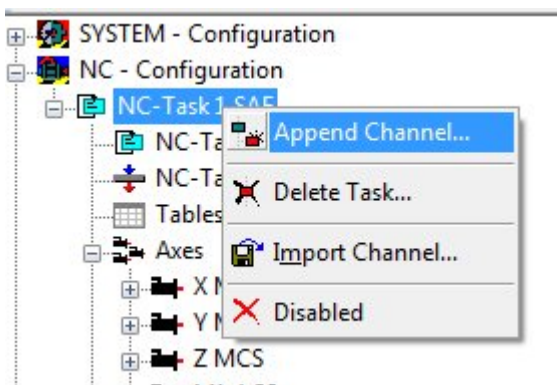
⇨ Appending a channel creates an instance of the kinematic group.

3. Select the channel type: **NC-Channel (for Kinematic Transformation)** to run a kinematic transformation.
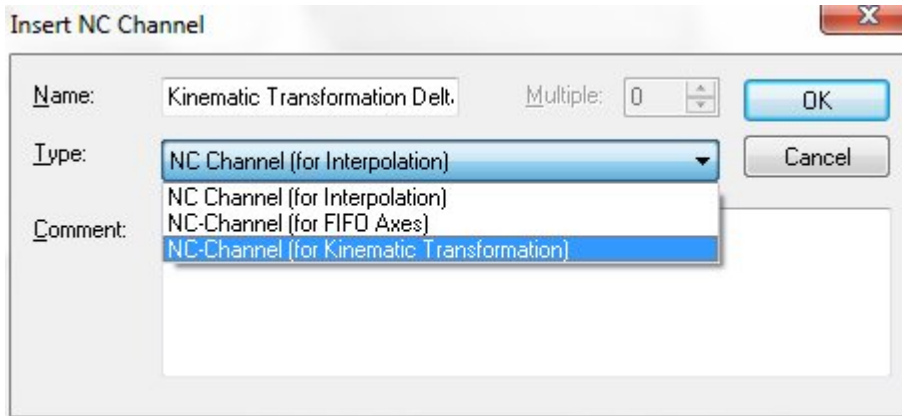
4. Append the objects under the group that represent the user's kinematic configuration.
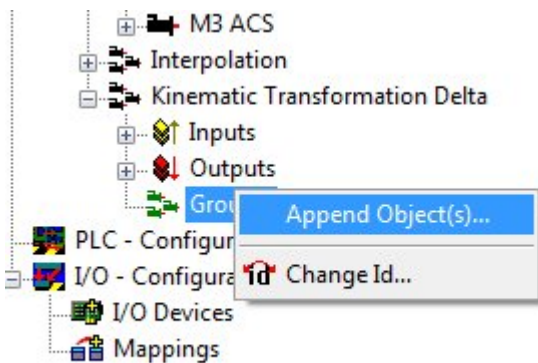
5. Browse for **TcNcKin.tmc** in TwinCAT\IO-Folder.

6. To start-up for instance the transformation for a delta-robot select
   - Delta Type 1
   - Static-Trafo 6D (optional MCS shift)
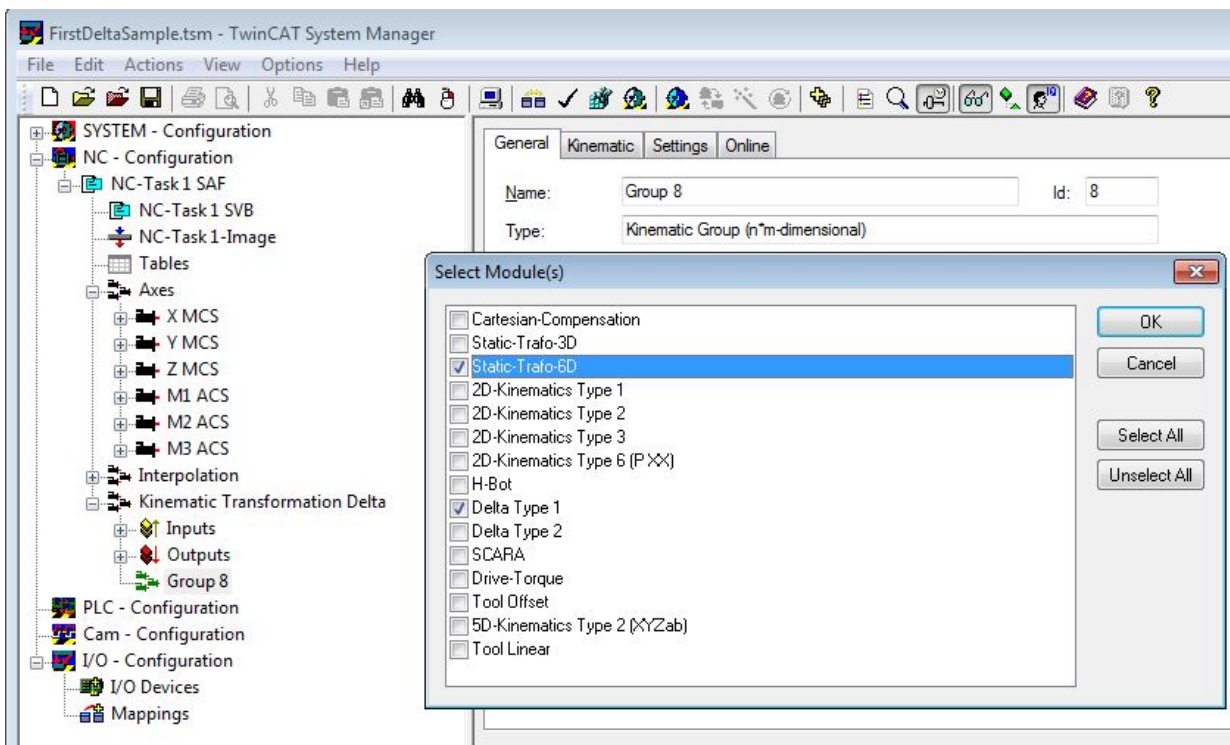
7. The transformation group has to know what root module has to be called. Therefore the object ID of the kinematics (in this case Delta Type1) must be selected. The kinematic object defines the number of ACS and MCS axes to be used in PLC (cf. ST_KinAxes [▶ 37]).
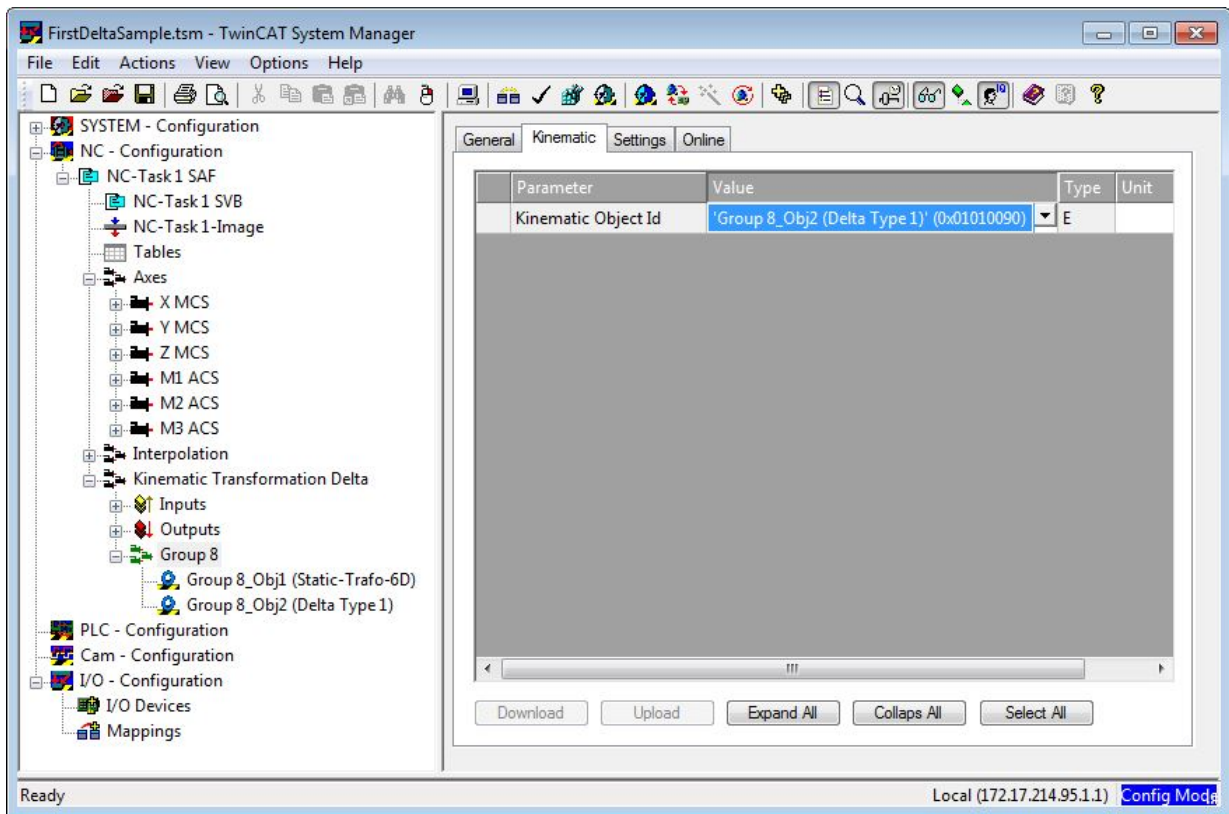
8. Parameterize the objects parameters to the used kinematics.
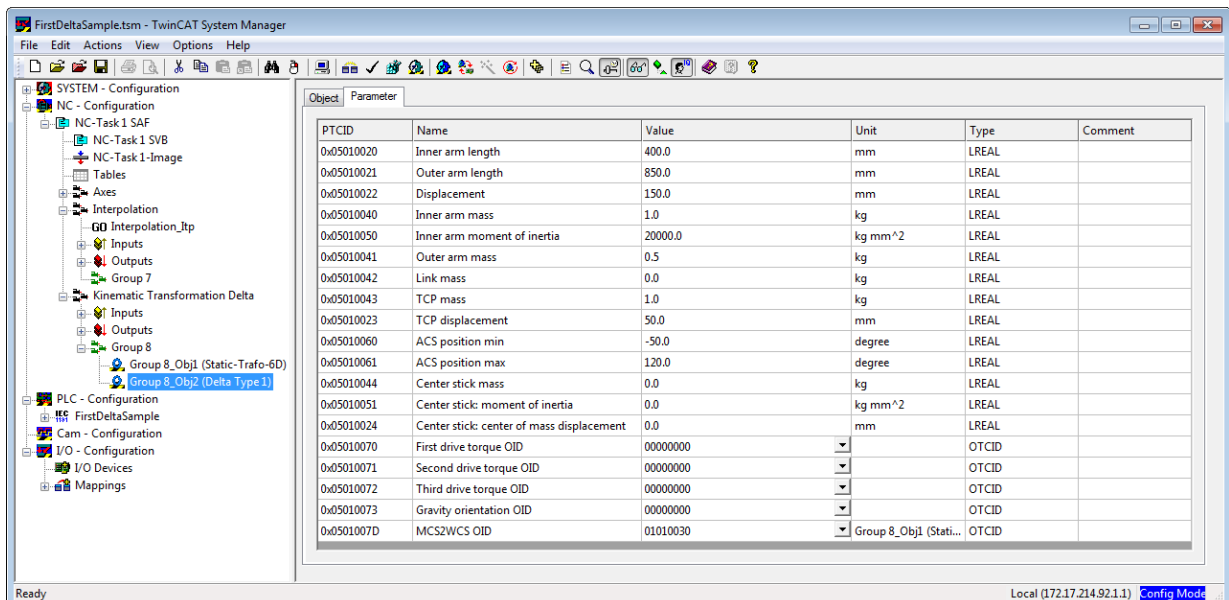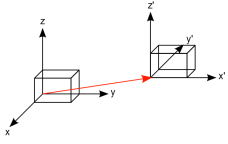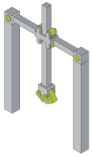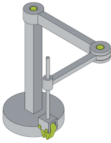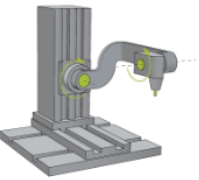
⇨ After this the System Manager configuration is done.

9. The Transformation can now be activated from PLC (cf. Plc Library [▶ 24]). To address the transformation define a cyclical channel interface in the PLC and link it to the kinematic channel's I/O.

```
in_stKinToPlc      AT %I*      : NciChannelToPlc;
out_stPlcToKin     AT %Q*      : NciChannelFromPlc;
```

4 Supported Transformations

Overview

Transformation Type	Scheme	Required Level and Version
Static Transformation (3D, 6D) [▶ 13]		Level 1 Version 2.11.0 Build 3
H-Bot [▶ 14]		Level 2 Version 2.11.0 Build 3
2D-Type 1 [▶ 15]		Level 2 Version 2.11.0 Build 3
2D-Type 2 [▶ 16]		Level 2 Version 2.11 Build 6
2D-Type 3 [▶ 17]		Level 2 Version 2.11 Build 6
2D-Kinematics Type 6 (P XX)		Level 2
Delta Type 1 [▶ 18]		Level 3 Version 2.11.0 Build 3
Delta Type 2		Level 3
SCARA [▶ 20]		Level 3
5D-Kinematics Type 2 (XYZab) [▶ 20]		Level 4

Additional Objects

Object type	Description	Required Level and Version
Static Transformation (3D, 6D) [▶ 13]	Describes a user defined coordinate system.	Level 1

Object type	Description	Required Level and Version
Tool Offset [▶ 22]	Describes a tool at the kinematics flange.	Level 1
Tool Linear [▶ 23]	Describes a 1D tool attached to the kinematics flange which offers the possibility to move TCP in tool direction.	Level 1
Drive Torque [▶ 22]	Represents the inertia and efficiency of motor and gear box to calculate the dynamic model more precisely.	Level 1

4.1   Static Transformation
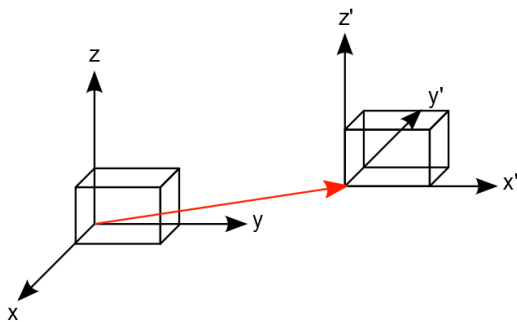
The static transformation supports a translation and rotation. By using this transformation, it is possible to define a User Coordinate System (UCS). This module takes care of the transformation from UCS to the Machine Coordinate System (MCS).
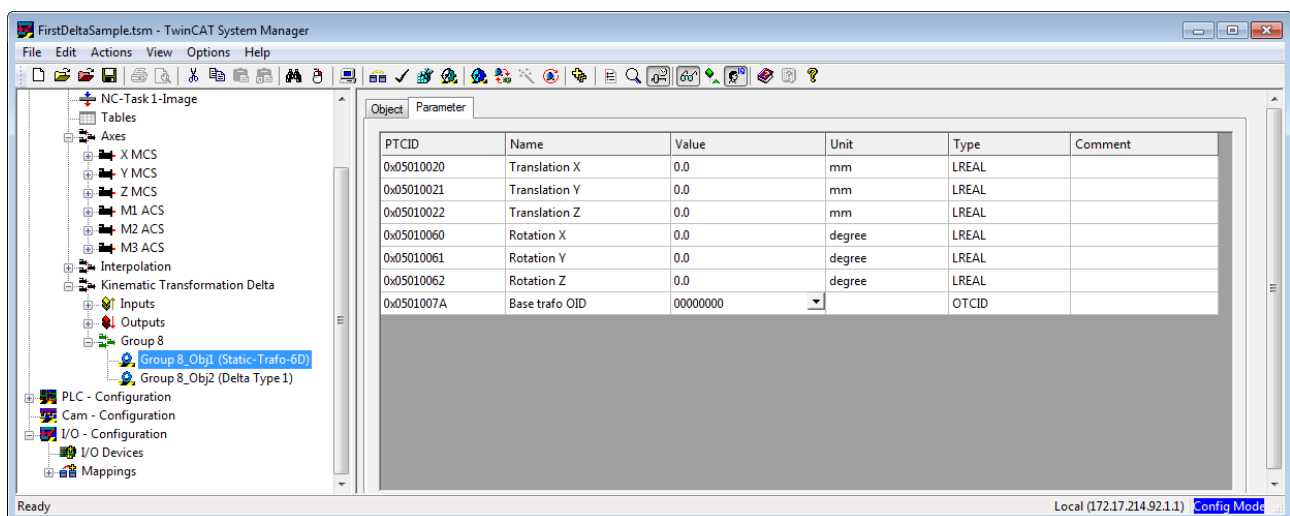
The parameterization is done from MCS to UCS (forward transformation).

First the translation must be described and then the rotation is calculated. Therefore the yaw-pitch-roll-rule that is described in DIN9300 is used. The calculation sequence for the forward transformation is Z, Y', X"

Parameter	Description	Unit
Translation X	Shift in x direction from MCS to user defined coordinate system	mm
Translation Y	Shift in y direction from MCS to user defined coordinate system.	mm
Translation Z	Shift in z direction from MCS to user defined coordinate system	mm
Rotation X	Right handed rotation around the x"-axis in degree	degree
Rotation Y	Right handed rotation around the y'-axis in degree	degree

Parameter	Description	Unit
Rotation Z	Right handed rotation around the z-axis in degree	degree
Base Trafo OID	In case of a cascaded static transformation object id of the base transformation is parameterized here	

4.2   H-Bot
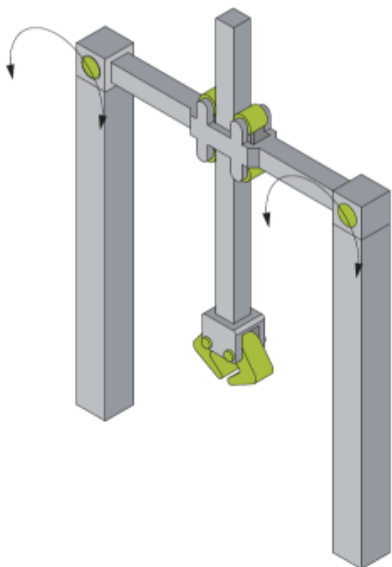
The H-Bot is built up as shown in the schema above.

The motor axes have to be scaled in mm representing the cable length at each side of the TCP. To calculate the transformation the relative cable movements are sufficient and no absolute cable lengths are needed.

The origin of the machine coordinate system is defined by the point where the position of both motors is zero.

Parameter for kinematics

Parameter	Description	Unit
MCS2WCS OID	Object ID of a static transformation which defines the position of MCS in base coordinate system (normally WCS).	

Parameter for dynamic model

Parameter	Description	Unit
FirstDriveTorqueOID	Object ID of the first drive torque If motors and gear boxes for all motors behaves similar, all drive torques can be represented by one OID. So both parameters refer to the same object ID.	
SecondDriveTorqueOID	Object ID of the second drive torque	
GravityOrientationOID	Object ID of a static transformation that describes the mounting orientation. This parameter is used if the gripper does not show to the ground. The static transformation's Z-axis defines the gravity orientation. If the robot is mounted as shown in the picture this OID can be zero.	

4.3   2-D-Kinematics Type 1

The 2-D-kinematics type 1 is built up as shown in the schema above.

All motor axes are scaled in degree and 0° is defined as shown in the schema with positive direction in direction of the arrow.

Parameter for kinematics

Parameter	Description	Unit
InnerArmLength	Length from pivot point to pivot point of the inner arm.	mm
OuterArmLength	Length from pivot point to pivot point of the outer arm.	mm
Displacement	Length from center of the ground plate to the virtual rotary axes of the inner arm	mm
MCS2WCS OID	Object ID of a static transformation which defines the position of MCS in base coordinate system (normally WCS).	

Parameter for dynamic model

Parameter	Description	Unit
InnerArmMass	Total mass of the inner arm	kg
InnerArmMomentOfInertia	Moment of inertia of the inner arm related to the turning point P1 that is connected to the motor	kg mm^2
OuterArmMass	Mass of the outer arm. Optionally the link mass can described in an own parameter	kg
FirstLinkMass	Mass of the link that connects inner and outer arm. Can be used if the link mass is not yet included to outer and inner arms. The link mass that connects the gripper plate and the outer arm is not specified here. That can be added to the TcpMass First link mass is related to the inner arm that is linked to motor 1	kg
SecondLinkMass	cf. FirstLinkMass Second link mass is related to the inner arm that is linked to motor 2	kg
TcpMass	Mass of the tool center point including gripper plate and gripper. The payload is usually written to a separate parameter.	kg

Parameter	Description	Unit
FirstDriveTorqueOID	Object ID of the first drive torque If motors and gear boxes for all motors behaves similar, all drive torques can be represented by one OID. So both parameters refer to the same object ID.	
SecondDriveTorqueOID	Object ID of the second drive torque	
GravityOrientationOID	Object ID of a static transformation that describes the mounting orientation. This parameter is used if the gripper does not show to the ground. The static transformation's Z-axis defines the gravity orientation. If the robot is mounted as shown in the picture this OID can be zero.	

Required Product Level:
Level 2

4.4   2-D-Kinematics Type 2

The 2-D-kinematics type 2 is built up as shown in the schema above.

All motor axes are scaled in degree and 0° is defined as shown in the schema with positive direction in direction of the arrow.

Parameter for kinematics

Parameter	Description	Unit
InnerArmLength	Length from pivot point to pivot point of the inner arm.	mm
OuterArmLength	Length from pivot point to pivot point of the outer arm.	mm
Displacement	Length from center of the ground plate to the virtual rotary axes of the inner arm	mm
TcpLinkDistance	Distance from pivot point to pivot point of the outer arms	mm
MCS2WCS OID	Object ID of a static transformation which defines the position of MCS in base coordinate system (normally WCS).	

Parameter for dynamic model

Parameter	Description	Unit
InnerArmMass	Total mass of the inner arm	kg
InnerArmMomentOfInertia	Moment of inertia of the inner arm related to the turning point P1 that is connected to the motor	kg mm^2
OuterArmMass	Mass of the outer arm. Optionally the link mass can described in an own parameter	kg

Parameter	Description	Unit
FirstLinkMass	Mass of the link that connects inner and outer arm. Can be used if the link mass is not yet included to outer and inner arms. The link mass that connects the gripper plate and the outer arm is not specified here. That can be added to the TcpMass First link mass is related to the inner arm that is linked to motor 1	kg
SecondLinkMass	cf. FirstLinkMass Second link mass is related to the inner arm that is linked to motor 2	kg
TcpMass	Mass of the tool center point including gripper plate and gripper. The payload is usually written to a separate parameter.	kg
FirstDriveTorqueOID	Object ID of the first drive torque If motors and gear boxes for all motors behaves similar, all drive torques can be represented by one OID. So both parameters refer to the same object ID.	
SecondDriveTorqueOID	Object ID of the second drive torque	
GravityOrientationOID	Object ID of a static transformation that describes the mounting orientation. This parameter is used if the gripper does not show to the ground. The static transformation's Z-axis defines the gravity orientation. If the robot is mounted as shown in the picture this OID can be zero.	

Required Product Level:
Level 2

4.5   2-D-Kinematics Type 3
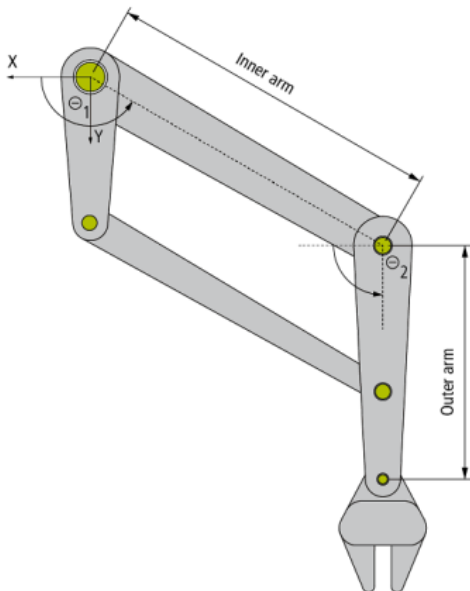
The 2-D-kinematics type 3 is built up as shown in the schema above.

All motor axes are scaled in degree and 0° is defined as shown in the schema with positive direction in direction of the arrow.

This kinematic type is implemented as left handed. The shaft of motor 1 & 2 are located in the origin of the coordinate system.

Parameter for kinematics

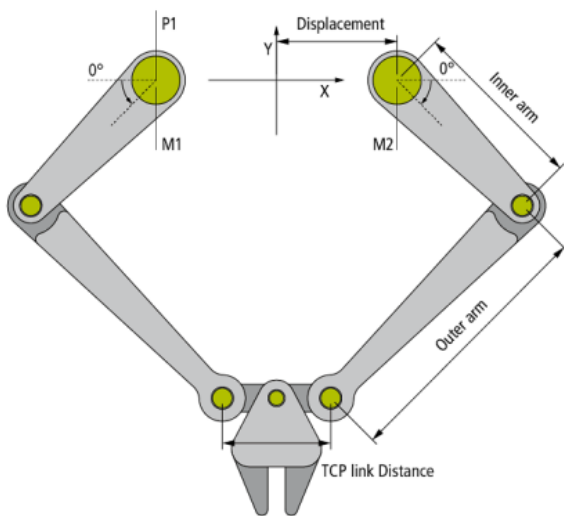| Parameter	Description	Unit
InnerArmLength	Length from motor shaft to pivot point of the outer arm.	mm
OuterArmLength	Length from pivot point to tool center point of the outer arm.	mm
MCS2WCS OID	Object ID of a static transformation which defines the position of MCS in base coordinate system (normally WCS).	

Parameter for dynamic model

Parameter	Description	Unit
InnerArmMass	Total mass of the inner arm	kg
OuterArmMass	Mass of the outer arm.	kg
ToolCenterpointMass	Mass of the tool center point including gripper plate and gripper. The payload is usually written to a separate parameter.	kg
FirstDriveTorqueOID	Object ID of the first drive torque If motors and gear boxes for all motors behaves similar, all drive torques can be represented by one OID. So both parameters refer to the same object ID.	
SecondDriveTorqueOID	Object ID of the second drive torque	
GravityOrientationOID	Object ID of a static transformation that describes the mounting orientation. This parameter is used if the gripper does not show to the ground. The static transformation's Z-axis defines the gravity orientation. If the robot is mounted as shown in the picture this OID can be zero.	

Required Product Level:
Level 2

4.6   Delta Type 1
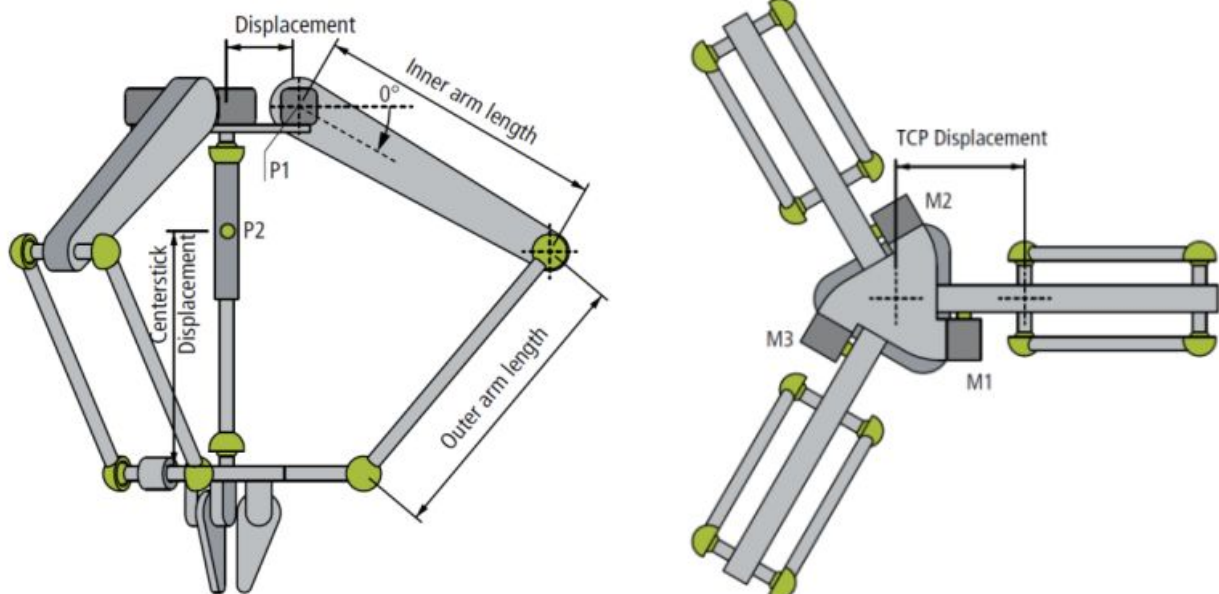
The delta kinematics type 1 is built up as shown in the schema above. The kinematic transformation expects ball joints (or elements with the same behavior) in the connection of the arms and to the lower plate.

Optionally the center stick for the orientation of the gripper can be parameterized.

All motor axes are scaled in degree and 0° is defined as shown in the schema with positive direction in direction of the arrow. That is for all 3 motors the same.

Parameter for kinematics

| Parameter	Description	Unit
InnerArmLength	Length from pivot point to pivot point of the inner arm. That is the arm which is directly linked to the motor	mm
OuterArmLength	Length from pivot point to pivot point of the outer arm.	mm
Displacement	Length from center of the ground plate to the virtual rotary axes of the inner arm	mm
TcpDisplacement	Length from center of the gripper plate to the virtual rotary axes of the outer arm	mm
MCS2WCS OID	Object ID of a static transformation which defines the position of MCS in base coordinate system (normally WCS).	

Parameter for dynamic model

Parameter	Description	Unit
InnerArmMass	Total mass of the inner arm	kg
InnerArmMomentOfInertia	Moment of inertia of the inner arm related to the turning point P1 that is connected to the motor	kg mm^2
OuterArmMass	Mass of the outer arm. If there are 2 rods the total mass is required. Optionally the link mass can described in an own parameter	kg
LinkMass	Mass of the link that connects inner and outer arm. Can be used if the link mass is not yet included to outer and inner arms. The link mass that connects the gripper plate and the outer arm is not specified here. That can be added to the TcpMass	kg
TcpMass	Mass of the tool center point including gripper plate and gripper. The payload is usually written to a separate parameter.	kg
CenterStickMass	Total mass of the center stick	kg
CenterStickMomentOfInertia	Moment of inertia of the center stick related to the center of gravity (P2)	kg mm^2
CenterStickCenterOfMassDisplacement	Length from gripper plate to center of gravity of the stick.	mm
FirstDriveTorqueOID	Object ID of the first drive torque If motors and gear boxes for all motors behaves similar, all drive torques can be represented by one OID. So all 3 parameters refer to the same object ID.	
SecondDriveTorqueOID	Object ID of the second drive torque	
ThirdDriveTorqueOID	Object ID of the third drive torque	
GravityOrientationOID	Object ID of a static transformation that describes the mounting orientation. This parameter is used if the gripper does not show to the ground. The static transformation's Z-axis defines the gravity orientation. If the robot is mounted as shown in the picture this OID can be zero.	

Required Product Level:
Level 3

4.7   SCARA
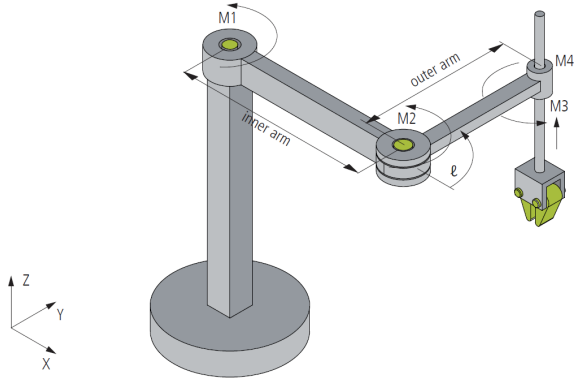
The SCARA (Selective Compliance Assembly Robot Arm) kinematics is built up as shown in the schema above.

The motor axes 1, 2 and 4 are scaled in degree with positive direction in direction of the arrow. The third motor axis is scaled in mm.

The origin of the MCS is set at the first joint (M1). The x-axis is defined by the SCARA arm when all rotary motor axes are 0°.

Parameter for kinematics

Parameter	Description	Unit
Inner arm length	Length from pivot point to pivot point of the inner arm. This is the arm at the side of the base.	mm
Outer arm length	Length from pivot point to pivot point of the outer arm. This is the arm at the side of the TCP	mm
Tool offset	Object ID of a tool attached at the flange of the kinematics.	
MCS2WCS OID	Object ID of a static transformation which defines the position of MCS in base coordinate system (normally WCS).	

Required Product Level:
Level 3

4.8   5D-Kinematics Type 2 (XYZab)
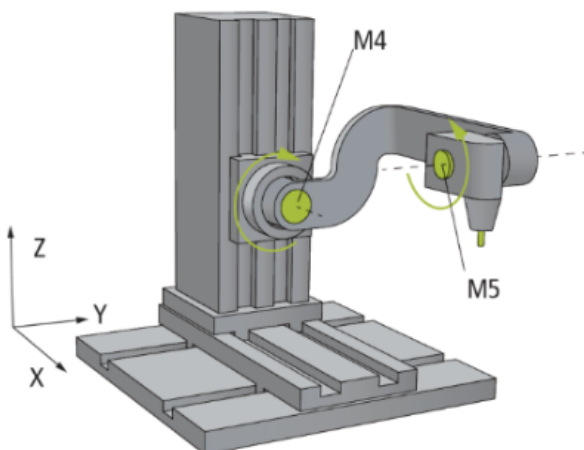
The 5D-kinematics type 2 is built up as shown in the schema above.

Motor axes 1-3 (X, Y ,Z) are scaled in mm. Motor axes 4 and 5 are scaled in degree. 0° is defined as shown in the schema with positive rotation direction in direction of the arrows.

Parameter for kinematics

| Parameter	Description	Unit
D4	Arm length in direction of x from motor axis 4 to motor axis 5 as illustrated in picture.	mm
Offset 4	Offset in direction of y between motor axis 4 and TCP	mm
Offset 5	Offset in direction of x between motor axis 5 and TCP	mm
Offset 6	Offset in direction of z between motor axis 4 and motor axis 5	mm
Tool offset OID	Object ID of a tool attached at the flange of the kinematics.	
MCS2WCS OID	Object ID of a static transformation which defines the position of MCS in base coordinate system (normally WCS).	
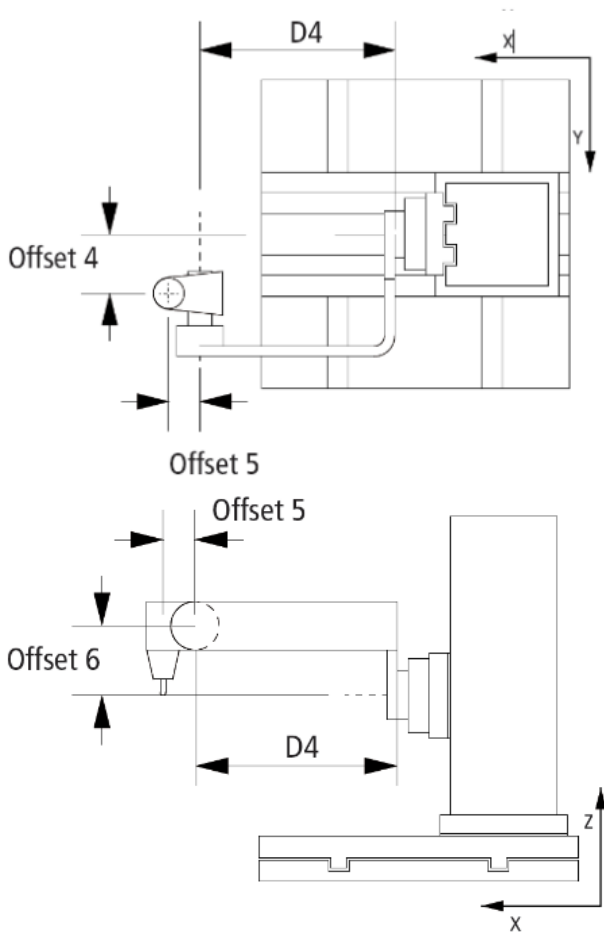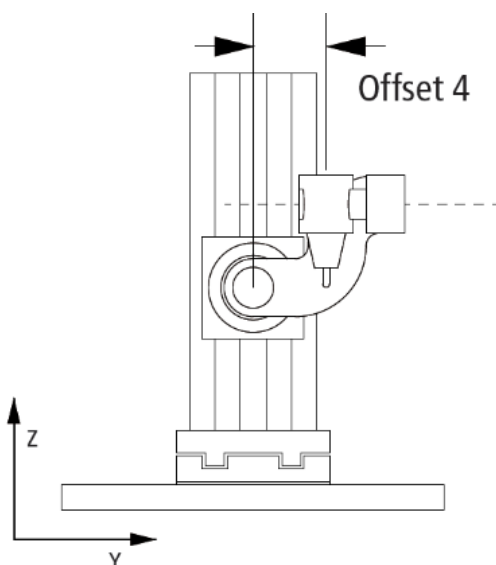
Required Product Level:
Level 4

4.9   Drive Torque

The drive torque represents the inertia and efficiency of motor and gear box. This is used for a precise calculation of the dynamic model.

Parameter for drive

Parameter	Description	Unit
Drive moment of inertia	Rotor Moment of inertia of the motor	kg mm^2

Parameter for gear box

Parameter	Description	Unit
Ratio	Ratio of gear box	kg mm^s2
Gearbox moment of inertia	Moment of inertia of the gear box related to the drive	kg mm^2
Coulomb friction	Represents the kinetic ratio of friction	Nm
Stokes friction	Represents the velocity proportional ratio of friction	Nms

Required Product Level:
Level 1

4.10   Tool Offset

The tool offset allows the user to connect a tool to the kinematics.

Parameter	Description	Unit
Extension X	X-Offset of static tool attached to the flange coordinate frame of the parent transformation	mm
Extension Y	Y-Offset of static tool attached to the flange coordinate frame of the parent transformation	mm
Extension Z	Z-Offset of static tool attached to the flange coordinate frame of the parent transformation	mm

4.11   Tool Linear

Describes a 1D tool attached to the kinematics. By using an additional simulation axis it is possible to move in tool direction. The linear tool can be used to move the TCP in a defined distance of a work piece.

When the axis position is 0 the TCP is at the position of the tool offset.

Parameter	Description	Unit
Tool offset	Length of the tool	mm
Tool axis ID	Axis ID of a simulation axis. By moving this axis the TCP moves in direction of the linear tool.	

5 Plc Library

Function block	Description
Kinematic Tranformation	
FB_ConfigKinGroup [▶ 24]	Configures ACS and MCS axes to the kinematic transformation group and activates Cartesian or joint mode
FB_ResetKinGroup [▶ 26]	Resets the kinematic transformation group
FB_CheckActualKinStatus [▶ 28]	Reads the status of the kinematic transformation group acyclically
F_GetKinChnOperationState [▶ 35]	Reads the status of the kinematic transformation group cyclically
F_GetAcsMcsAxisIds [▶ 36]	Reads the active ACS and MCS axes of the kinematics group
Transformation calculation	
FB_CalcTrafo [▶ 30]	Calculates the kinematic transformation without connection to axes
FB_CalcMultiTrafo	Calculates the kinematic transformation for multiple poses
Editing Parameters and Coordinate Systems online	
FB_LockTrafoParam [▶ 34]	Locks the kinematic transformation group parameters, disables write access
FB_UnlockTrafoParam [▶ 32]	Unlocks the kinematic transformation group parameters, enables write access

Structures and Enums

Name	Description
ST_KinAxes [▶ 37]	Structure of ACS and MCS axes, which constitute a kinematics
E_KINSTATUS [▶ 37]	Status of the kinematic group (Enum)

Development Environment	Target System	PLC libraries to include
TwinCAT v2.11.2000	PC(i386)	TcNcKinematicTransformation.lib

5.1 Function Blocks

5.1.1 FB_ConfigKinGroup


```
                          FB_CONFIGKINGROUP
  —bExecute : BOOL                                      bBusy : BOOL—
  —bCartesianMode : BOOL                                bDone : BOOL—
  —stAxesList : ST_KinAxes (VAR_IN_OUT)               bError : BOOL—
  —stKinRefIn : NciChannelToPlc (VAR_IN_OUT)       nErrorId : UDINT—
                            stAxesList : ST_KinAxes (VAR_IN_OUT)—
                            stKinRefIn : NciChannelToPlc (VAR_IN_OUT)—
```
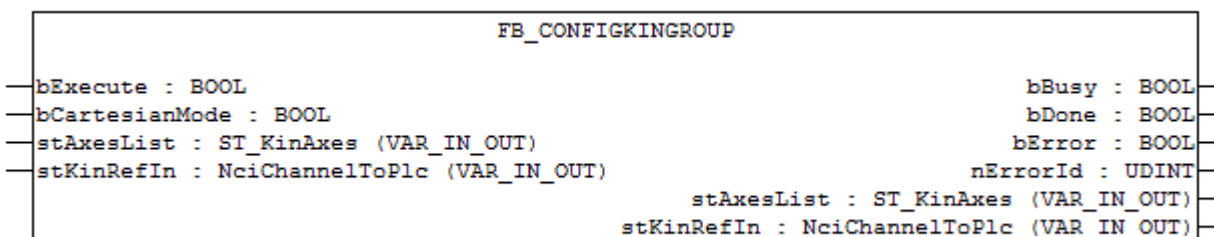
The Function Block FB_ConfigKinGroup configures axes to the kinematic transformation. These are axes for the ACS (Axis Coordinate System, Joint) and MCS (Machine Coordinate System, Cartesian). The Function Block takes the ACS and MCS Axes defined in the **stAxesList** and configures them into the kinematic group of **stKinRefIn**.

VAR_INPUT

```
VAR_INPUT
    bExecute            : BOOL;
    bCartesianMode      : BOOL;
END_VAR
```

bExecute: The command is triggered by a rising edge at this input.

bCartesianMode: If FALSE, the ACS (Axis Coordinate system, Joint) axes can be moved directly. If TRUE, movement in the MCS (Cartesian) axes will be transformed into the ACS (Joint) axes. The ACS axes cannot be moved directly.

VAR_IN_OUT

```
VAR_IN_OUT
    stAxesList          : ST_KinAxes;
    stKinRefIn          : NciChannelToPlc;
END_VAR
```

stAxesList: Determines the ACS and MCS axes included in the configuration. See ST_KinAxes [▶ 37].

stKinRefIn: Determines the kinematic group of the configuration. See NciChannelToPlc.

VAR_OUTPUT

```
VAR_OUTPUT
    bBusy               : BOOL;
    bDone               : BOOL;
    bError              : BOOL;
    nErrorId            : UDINT;
END_VAR
```

bBusy: The output becomes TRUE when the command is started with *bExecute* as long as the function block is executing the command. While *bBusy* is TRUE, no new instructions will be accepted at the inputs. When *bBusy* becomes FALSE again, the function block is ready for a new command. At the same time one of the outputs *bDone* or *bError* is set.

bDone: The output becomes true if the command succeeded.

bError: The output *bError* becomes true if an error occurs as the command is executed.

nErrorId: Contains the command-specific error code of the most recently executed command. The error code can be found in the ADS error documentation [▶ 39] or in the NC error documentation (error codes above 0x4000).

Example

```
VAR
    io_X                    : AXIS_REF;
    io_Y                    : AXIS_REF;
    io_Z                    : AXIS_REF;
    io_M1                   : AXIS_REF;
    io_M2                   : AXIS_REF;
    io_M3                   : AXIS_REF;
    out_stPlcToKin AT %Q* : NciChannelFromPlc;
    out_stPlcToItp AT %Q* : NciChannelFromPlc;
    fbConfigKinGroup        : FB_ConfigKinGroup;
    stAxesConfig            : ST_KinAxes;
    bAllAxesReady           : BOOL;
    bExecuteConfigKinGroup: BOOL;
    bUserConfigKinGroup    : BOOL;
    bUserCartesianMode     : BOOL; := TRUE;
    (*true: cartesian mode - false: direct mode (without transformation) *)
END_VAR
```

```
(* read the IDs from the cyclic axis interface so the axes can mapped later to the kinematic group
*)
stAxesConfig.nAxisIdsAcs[1] := io_M1.NcToPlc.AxisId;
stAxesConfig.nAxisIdsAcs[2] := io_M2.NcToPlc.AxisId;
stAxesConfig.nAxisIdsAcs[3] := io_M3.NcToPlc.AxisId;
stAxesConfig.nAxisIdsMcs[1] := io_X.NcToPlc.AxisId;
stAxesConfig.nAxisIdsMcs[2] := io_Y.NcToPlc.AxisId;
stAxesConfig.nAxisIdsMcs[3] := io_Z.NcToPlc.AxisId;

IF bAllAxesReady AND bUserConfigKinGroup THEN
```

```
    bExecuteConfigKinGroup := TRUE;
ELSE
    bExecuteConfigKinGroup := FALSE;
END_IF

fbConfigKinGroup(
    bExecute        := bExecuteConfigKinGroup ,
    bCartesianMode  := bUserCartesianMode ,
    stAxesList      := stAxesConfig,
    stKinRefIn      := in_stKinToPlc );
```

Kinematic Group State
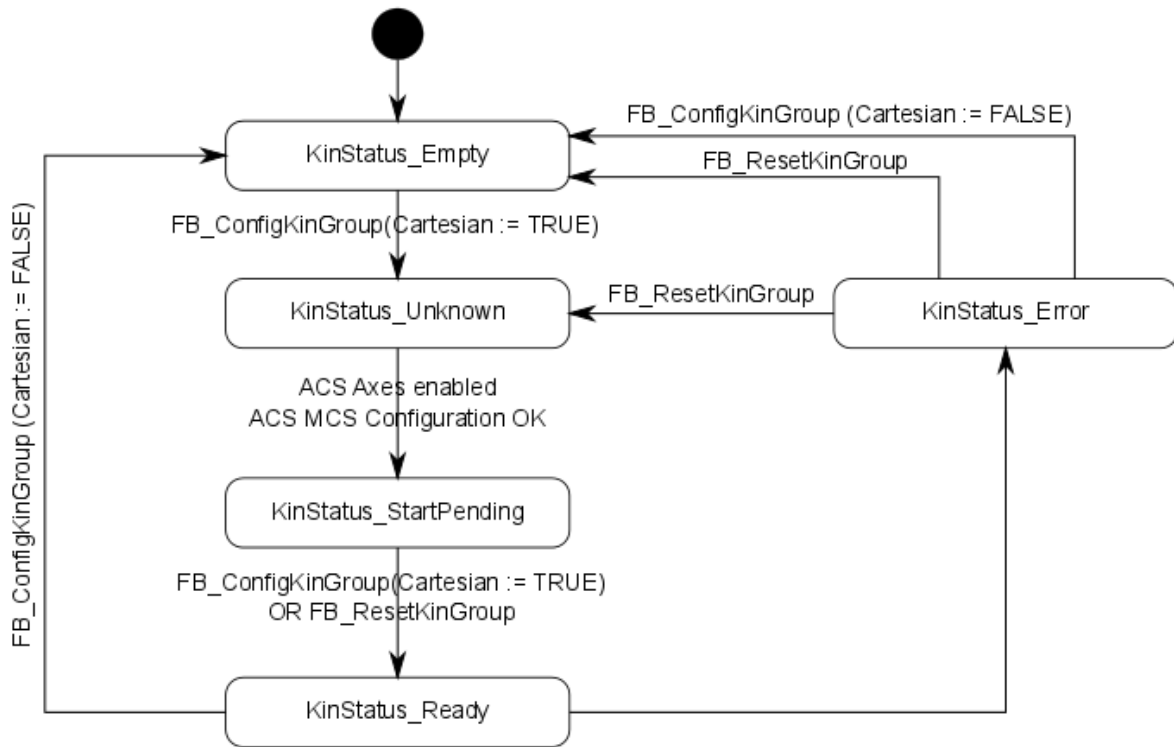
ℹ **Enabling Configuration**

The ACS axes must be enabled for the state to reach **KinStatus_Ready**. If the ACS Axes are not enabled, enable the axes and then call FB_ConfigKinGroup or FB_ResetKinGroup.

5.1.2   FB_ResetKinGroup
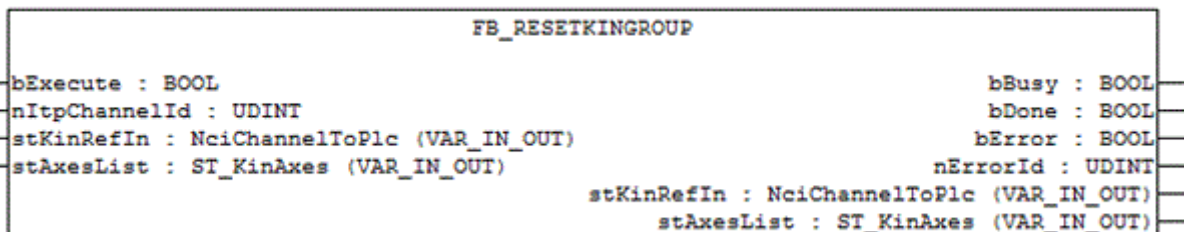
The Function Block FB_ResetKinGroup resets the Kinematic group. All ACS and MCS axes will be reset. Moreover, the input *nItpChannelId* can be used to specify the associated interpolation channel. The channel will be reset if the nItpChannelId is not 0.

If all axes are enabled and the group was in Cartesian Mode the group will return to KinStatus_Ready. If the group was not in Cartesian Mode the group will return to KinStatus_Empty. If the axes are not enabled the group will remain in KinStatus_Empty.

VAR_INPUT

```
VAR_INPUT
    bExecute      : BOOL;
    nItpChannelId : UDINT;
END_VAR
```

bExecute: The command is triggered by a rising edge at this input.

nItpChannelId: ID of the associated interpolation channel. If the input is not 0, the associated interpolation channel is reset.

VAR_IN_OUT

```
VAR_IN_OUT
    stAxesList            : ST_KinAxes;
    stKinRefIn            : NciChannelToPlc;
END_VAR
```

stAxesList: Determines the ACS and MCS axes included in the configuration. See ST_KinAxes [▶ 37].

stKinRefIn: Determines the kinematic group of the configuration. See NciChannelToPlc.

VAR_OUTPUT

```
VAR_OUTPUT
    bBusy                 : BOOL;
    bDone                 : BOOL;
    bError                : BOOL;
    nErrorId              : UDINT;
END_VAR
```

bBusy: The output becomes TRUE when the command is started with *bExecute* as long as the function block is executing the command. While *bBusy* is TRUE, no new instructions will be accepted at the inputs. When *bBusy* becomes FALSE again, the function block is ready for a new command. At the same time one of the outputs *bDone* or *bError* is set.

bDone: The output becomes true if the command succeeded.

bError: The output *bError* becomes true if an error occurs as the command is executed.

nErrorId: Contains the command-specific error code of the most recently executed command. The error code can be found in the ADS error documentation [▶ 39] or in the NC error documentation (error codes above 0x4000).

Example

```
VAR
    fbFB_ResetKinGroup   : FB_ResetKinGroup;
    stAxesConfig         : stAxesConfig;
    in_stKinToPlc AT %I* : NciChannelToPlc;
END_VAR
```

```
fbFB_ResetKinGroup(
    bExecute := TRUE,
    nItpChannelId := 3,
    stKinRefIn := in_stKinToPlc,
    stAxesList := stAxesConfig,
    bBusy=> ,
    bDone=> ,
    bError=> ,
    nErrorId=> );
```

Kinematic Group State
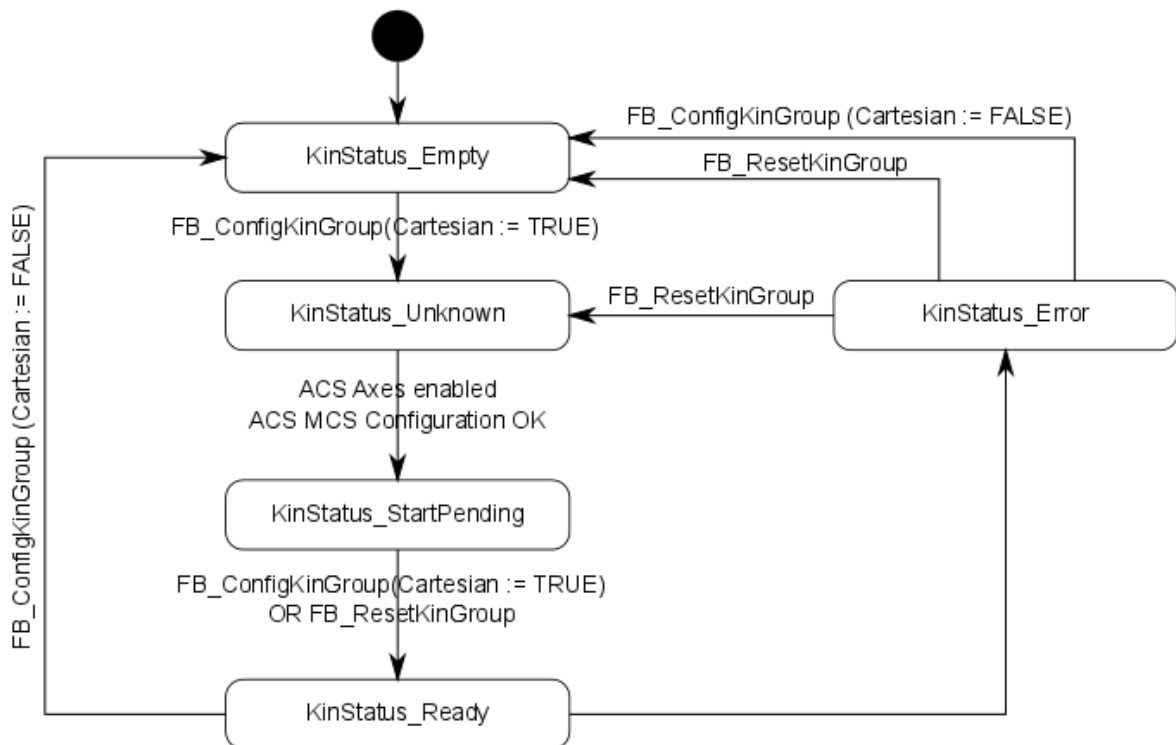
5.1.3 FB_CheckActualKinStatus
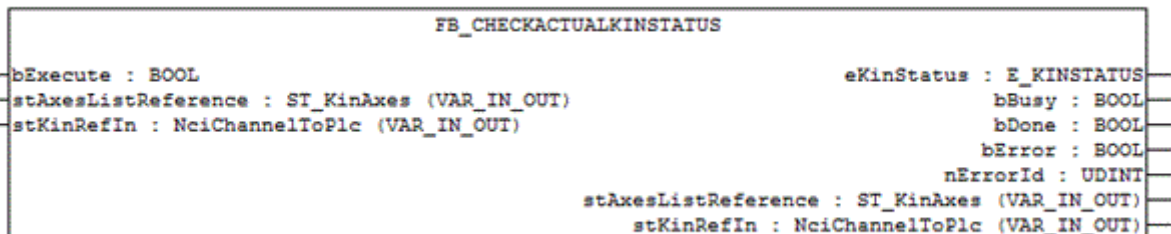
The Function Block FB_CheckActualKinStatus returns the status of the Kinematic channel.

> **ⓘ** **Getting the Kinematic channel status cyclically**
>
> This Function Block needs more than one PLC cycle to read the Kinematic channel status. To get it for every cycle use F_GetKinChnOperationState [▶ 35].

VAR_INPUT

```
VAR_INPUT
    bExecute            : BOOL;
END_VAR
```

bExecute: The command is triggered by a rising edge at this input.

VAR_IN_OUT

```
VAR_IN_OUT
    stAxesList          : ST_KinAxes;
    stKinRefIn          : NciChannelToPlc;
END_VAR
```

stAxesList: Determines the ACS and MCS axes included in the configuration. See ST_KinAxes [▶ 37].

stKinRefIn: Determines the kinematic group of the configuration. See NciChannelToPlc.

VAR_OUTPUT

```
VAR_OUTPUT
    eKinStatus          : E_KINSTATUS;
    bBusy               : BOOL;
    bDone               : BOOL;
    bError              : BOOL;
    nErrorId            : UDINT;
END_VAR
```

eKinStatus: Returns the status of the kinematic channel. See E_KINSTATUS [▶ 37]

bBusy: The output becomes TRUE when the command is started with *bExecute* as long as the function block is executing the command. While *bBusy* is TRUE, no new instructions will be accepted at the inputs. When *bBusy* becomes FALSE again, the function block is ready for a new command. At the same time one of the outputs *bDone* or *bError* is set.

bDone: The output becomes true if the command succeeded.

bError: The output *bError* becomes true if an error occurs as the command is executed.

nErrorId: Contains the command-specific error code of the most recently executed command. The error code can be found in the ADS error documentation [▶ 39] or in the NC error documentation (error codes above 0x4000).

Example

```
VAR
    fbFB_CheckActualKinStatus  : FB_CheckActualKinStatus;
    in_stKinToPlc AT %I*       : NciChannelToPlc;
    stAxesConfig               : ST_KinAxes;
    eKinStatus                 : E_KINSTATUS;
END_VAR
```

```
fbFB_CheckActualKinStatus(
    bExecute              := TRUE,
    stAxesListReference := stAxesConfig,
    stKinRefI             := in_stKinToPlc,
    eKinStatus            => eKinStatus        );
```

Kinematic Group State
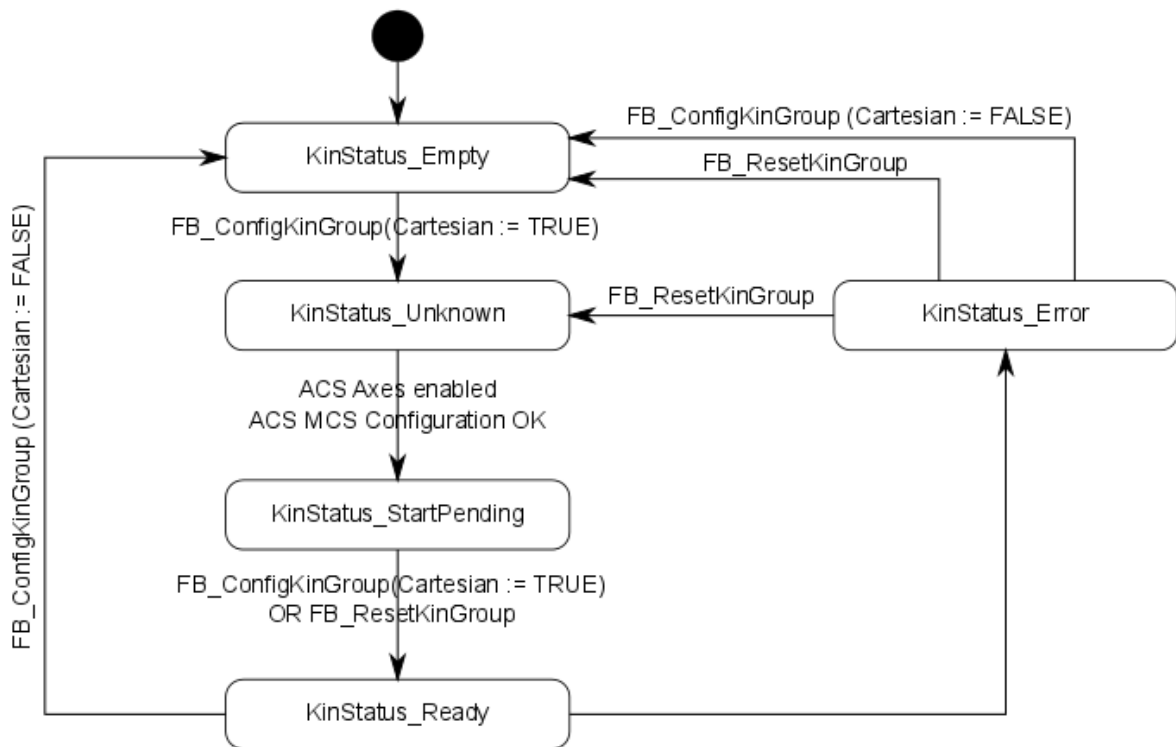
5.1.4   FB_CalcTrafo
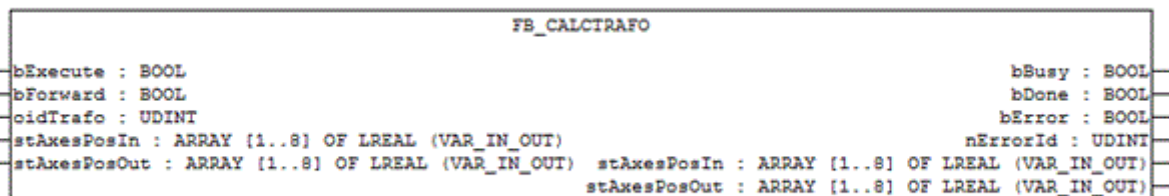
The Function Block FB_CalcTrafo calculates the forward or backward transformation even if no kinematic group is built with FB_ConfigKinGroup [▶ 24].

VAR_INPUT

```
VAR_INPUT
    bExecute            : BOOL;
    bForward            : BOOL;
    oidTrafo            : UDINT;
END_VAR
```

bExecute: The command is triggered by a rising edge at this input.

bForward: Determines whether the forward or backward transformation is calculated.

oidTrafo: Object-ID of the kinematic transformation object to be calculated. See example [▶ 31] below.

VAR_IN_OUT

```
VAR_IN_OUT
    stAxesPosIn          : ARRAY[1..8] OF LREAL;
    stAxesPosOut         : ARRAY[1..8] OF LREAL;
END_VAR
```

stAxesPosIn: Array which contains the input positions of the transformation. In order to calculate a forward transformation this would be the joint positions. In order to calculate a backward transformation this would be the Cartesian axes positions.

stAxesPosOut: Array which contains the resulting positions of the transformation. If a forward transformation is calculated this would be the Cartesian axes positions. If a backward transformation is calculated this would be the joint positions.

VAR_OUTPUT

```
VAR_OUTPUT
    bBusy               : BOOL;
    bDone               : BOOL;
    bError              : BOOL;
    nErrorId            : UDINT;
END_VAR
```

bBusy: The output becomes TRUE when the command is started with *bExecute* as long as the function block is executing the command. While *bBusy* is TRUE, no new instructions will be accepted at the inputs. When *bBusy* becomes FALSE again, the function block is ready for a new command. At the same time one of the outputs *bDone* or *bError* is set.

bDone: The output becomes true if the command succeeded.

bError: The output *bError* becomes true if an error occurs as the command is executed.

nErrorId: Contains the command-specific error code of the most recently executed command. The error code can be found in the ADS error documentation [▶ 39] or in the NC error documentation (error codes above 0x4000).

Example

The Scara Transformation has 4 ACS (joint) axes and 4 MCS (Cartesian) axes

Scara Transformation Example Configuration
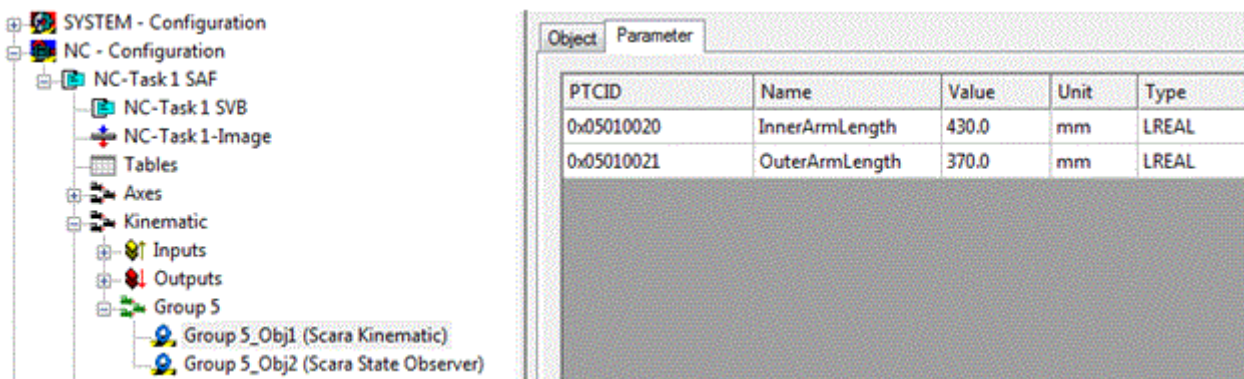
Scara Transformation Example Object Id
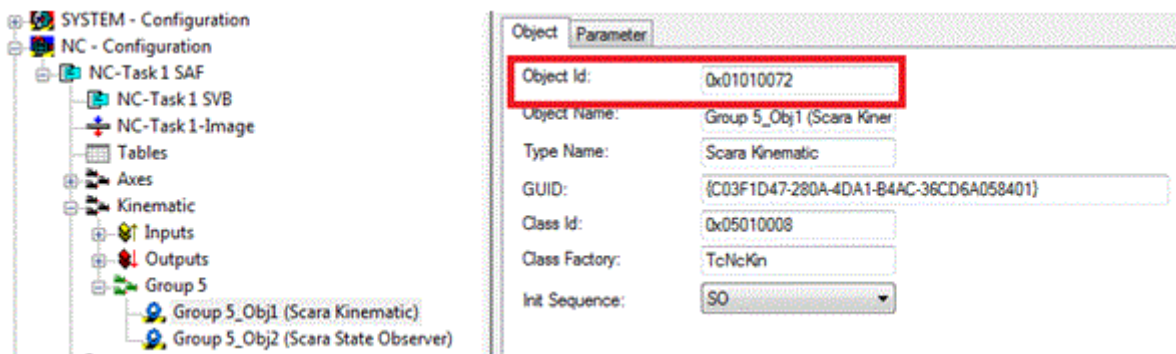
```
VAR
    fbFB_CalcTrafo      : FB_CalcTrafo;
    stAxesPosIn         : ARRAY[1..8] OF LREAL;
    stAxesPosOut        : ARRAY[1..8] OF LREAL;
    bUserExecute        : BOOL;
    bUserCalcFwdTrafo   : BOOL;
END_VAR
```

```
fbFB_CalcTrafo(
    bExecute := bUserExecute,
    bForward := bUserCalcFwdTrafo,
    oidTrafo := 16#01010072,
    stAxesPosIn := stAxesPosIn,
    stAxesPosOut := stAxesPosOut,
    bBusy=> ,
    bDone=> ,
    bError=> ,
    nErrorId=> );
```

5.1.5   FB_UnlockTrafoParam
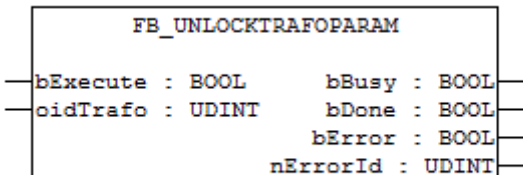
The Function Block FB_UnlockTrafoParam unlocks the transformation parameters so that they can be written.

After the Unlock the Kinematic Parameters can be written from the PLC with ADSWRITE. The required Index Group is the Object Id and the Index Offset is the Parameter Id. The written parameters are not persistent.

NOTICE
Changing parameters may lead to discontinuities
Beware this is to be used with extreme caution. Redefining kinematic parameters can introduce discontinuities in the Kinematic chain.

VAR_INPUT

```
VAR_INPUT
    bExecute            : BOOL;
    oidTrafo            : UDINT;
END_VAR
```

bExecute: The command is triggered by a rising edge at this input.

oidTrafo: Object-ID of the kinematic transformation object. See example [▶ 33] below.

VAR_OUTPUT

```
VAR_OUTPUT
    bBusy           : BOOL;
    bDone           : BOOL;
    bError          : BOOL;
    nErrorId        : UDINT;
END_VAR
```

bBusy: The output becomes TRUE when the command is started with *bExecute* as long as the function block is executing the command. While *bBusy* is TRUE, no new instructions will be accepted at the inputs. When *bBusy* becomes FALSE again, the function block is ready for a new command. At the same time one of the outputs *bDone* or *bError* is set.

bDone: The output becomes true if the command succeeded.

bError: The output *bError* becomes true if an error occurs as the command is executed.

nErrorId: Contains the command-specific error code of the most recently executed command. The error code can be found in the <u>ADS error documentation [▶ 39]</u> or in the NC error documentation (error codes above 0x4000).

Example

The Object Id and Parameter Id needed to unlock and write a new value to a transformation parameter can be read from the Transformation Object in System Manager.
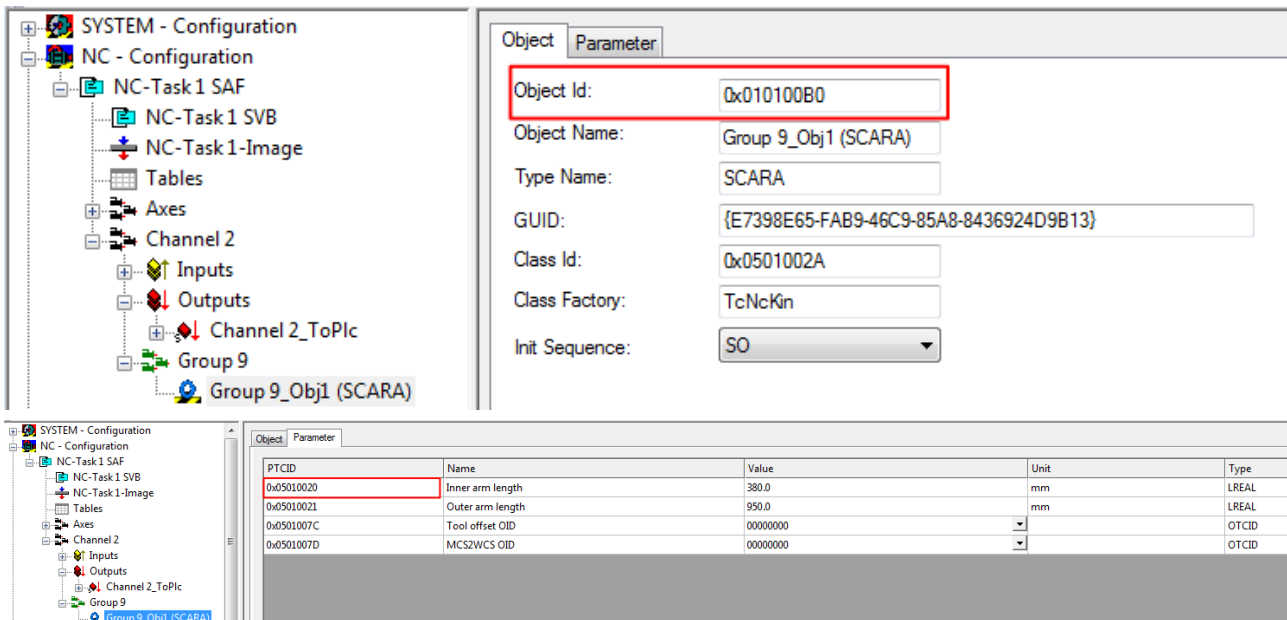

```
VAR
    bUserExecuteUnlock      : BOOL;
    fbFB_UnlockTrafoParam   : FB_UnlockTrafoParam;
    bUserExecuteWriteParam  : BOOL;
    fbADSWRITE              : ADSWRITE;
    oidTrafo                : UDINT := 16#010100B0; (*Trafo object id*)
    pidTrafo                : UDINT := 16#05010020; (*parameter id*)
    fParamValue             : LREAL;
END_VAR

fbFB_UnlockTrafoParam(
    bExecute := bUserExecuteUnlock,
    oidTrafo := oidTrafo,
    bBusy=>,
    bDone=>,
    bError=>,
    nErrorId=> );

(*After unlocking new parameter value can be written*)
fbADSWRITE(
    NETID:='' ,
    PORT:= AMSPORT_R0_NCSAF,
    IDXGRP:=oidTrafo ,
    IDXOFFS:= pidTrafo,
```

```
    LEN:=SIZEOF(fParamValue) ,
    SRCADDR:= ADR(fParamValue),
    WRITE:=bUserExecuteWriteParam ,
    TMOUT:= ,
    BUSY=> ,
    ERR=> ,
    ERRID=> );
```

5.1.6   FB_LockTrafoParam

```
              FB_LOCKTRAFOPARAM

─bExecute : BOOL          bBusy : BOOL─
─oidTrafo : UDINT         bDone : BOOL─
                         bError : BOOL─
                     nErrorId : UDINT─
```
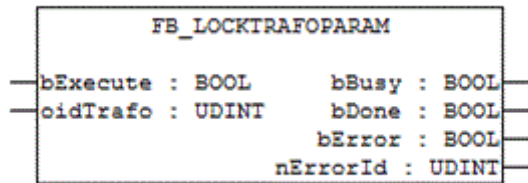
After changing transformation parameters by using FB_UnlockTrafoParam [▶ 32], the Function Block FB_LockTrafoParam locks the transformation parameters again, so they cannot be written anymore.

VAR_INPUT

```
VAR_INPUT
    bExecute            : BOOL;
    oidTrafo            : UDINT;
END_VAR
```

bExecute: The command is triggered by a rising edge at this input.

oidTrafo: Object-ID of the kinematic transformation object. See example [▶ 34] below.

VAR_OUTPUT

```
VAR_OUTPUT
    bBusy               : BOOL;
    bDone               : BOOL;
    bError              : BOOL;
    nErrorId            : UDINT;
END_VAR
```

bBusy: The output becomes TRUE when the command is started with *bExecute* as long as the function block is executing the command. While *bBusy* is TRUE, no new instructions will be accepted at the inputs. When *bBusy* becomes FALSE again, the function block is ready for a new command. At the same time one of the outputs *bDone* or *bError* is set.

bDone: The output becomes true if the command succeeded.

**bError:** The output *bError* becomes true if an error occurs as the command is executed.

nErrorId: Contains the command-specific error code of the most recently executed command. The error code can be found in the ADS error documentation [▶ 39] or in the NC error documentation (error codes above 0x4000).

Example

Scara Transformation Example Object Id

```
VAR
    bUserExecute        : BOOL;
    fbFB_LockTrafoParam : FB_LockTrafoParam;
    oidTrafo            : UDINT := 16#010100B0; (*Trafo object id*)
END_VAR
```

```
fbFB_LockTrafoParam(
    bExecute := bUserExecute,
    oidTrafo := oidTrafo,
    bBusy=>,
    bDone=>,
    bError=>,
    nErrorId=> );
```

5.2   Functions

5.2.1   F_GetKinChnOperationState
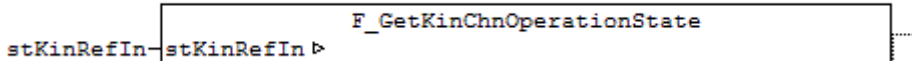
This function returns the operation state of the Kinematic Channel.

Function F_GetKinChnOperationState : E_KINSTATUS

```
VAR_IN_OUT
    stKinRefIn : NciChannelToPlc
END_VAR
```

stKinRefIn: Determines the configuration's kinematic group. See NciChannelToPlc

Return value

E_KINSTATUS [▶ 37]: State of the kinematics channel (cf. below). If an invalid version of cyclic interface is used, *KinStatus_InvalidItfVersion* is returned.
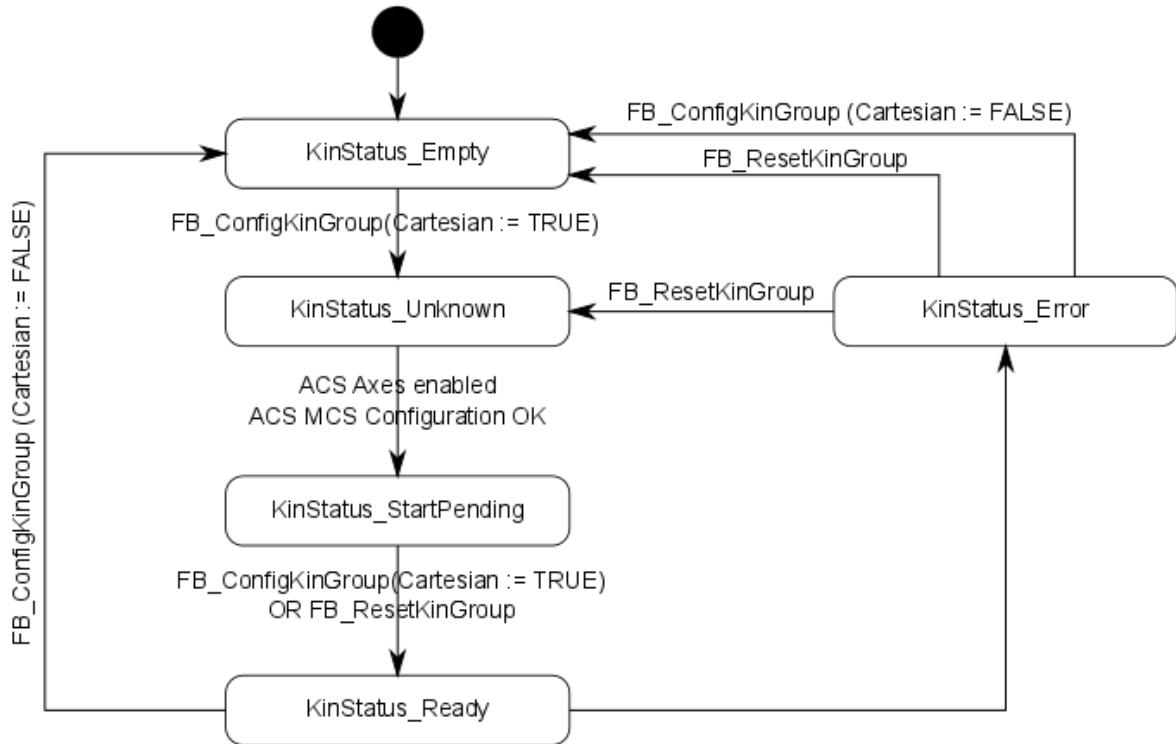
Example

```
VAR
    stKinRefIn AT %I*      : NciChannelToPlc;
    nErrId                 : UDINT;
    eKinOperationState     : E_KINSTATUS;
END_VAR
```

```
IF F_GetKinChnOperationState(stKinRefIn) <> KinStatus_InvalidItfVersion THEN
    eKinOperationState := F_GetKinChnOperationState(stKinRefIn);
ELSE
    nErrId := F_GetKinChnOperationState(stKinRefIn);
END_IF
```

Requirements

This function is valid from version 6 of the cyclic interface. If the version is lower *KinStatus_InvalidItfVersion* (see E_KINSTATUS [▶ 37]) is returned.

5.2.2   F_GetAcsMcsAxisIds
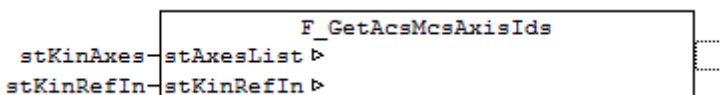
This function reads the configured ACS and MCS axes from the cyclic interface. The IDs are written into stAxesList.

FUNCTION F_GetAcsMcsAxisIds : UDINT

```
VAR_IN_OUT
    stAxesList : ST_KinAxes;
    stKinRefIn : NciChannelToPlc;
END_VAR
```

stAxesList: List of the Axis Ids for the Axis Coordinate System and the Machine Coordinate System

stKinRefIn: Structure of the cyclic channel interface from the Kinematic Channel to the PLC. This structure is only accessed for reading.

Return value

UDINT: Error code. This function is valid from version 6 of the cyclic interface. If the version is correct 0 is returned, otherwise an error code.

Example

```
VAR
    stAxesList          : ST_KinAxes;
    stKinRefIn AT %I*   : NciChannelToPlc;
    nErrId              : UDINT;
END_VAR
```

```
nErrId := F_GetAcsMcsAxisIds(stAxesList, stKinRefIn);
IF nErrId=0 THEN
    ;(*Axes List is valid*)
END_IF
```

Requirements

This function is valid from version 6 of the cyclic interface. If the version is lower *KinStatus_InvalidItfVersion* (see E_KINSTATUS [▶ 37]) is returned.

5.3   Datatypes

5.3.1   ST_KinAxes

This structure defines the axes, which constitute a kinematics.

```
TYPE ST_KinAxes :
STRUCT
    nAxisIdsMcs: ARRAY[1..8] OF DWORD;
    nAxisIdsAcs: ARRAY[1..8] OF DWORD;
END_STRUCT
END_TYPE
```

nAxisIdsMcs: List of the Axis Ids of the Axes constituting the Machine Coordinate System. Normally the first three array elements contain the Cartesian axes (X,Y,Z), the following array elements contain rotation axes.

nAxisIdsAcs: List of the Axis Ids of the Axes constituting the Axis Coordinate System

Example

```
VAR
    stAxesConfig            : ST_KinAxes;
    io_X                    : AXIS_REF;
    io_Y                    : AXIS_REF;
    io_Z                    : AXIS_REF;
    io_M1                   : AXIS_REF;
    io_M2                   : AXIS_REF;
    io_M3                   : AXIS_REF;
END_VAR
```

```
(* read the IDs from the cyclic axis interface so the axes can mapped later to the kinematic group
*)
stAxesConfig.nAxisIdsAcs[1] := io_M1.NcToPlc.AxisId;
stAxesConfig.nAxisIdsAcs[2] := io_M2.NcToPlc.AxisId;
stAxesConfig.nAxisIdsAcs[3] := io_M3.NcToPlc.AxisId;
stAxesConfig.nAxisIdsMcs[1] := io_X.NcToPlc.AxisId;
stAxesConfig.nAxisIdsMcs[2] := io_Y.NcToPlc.AxisId;
stAxesConfig.nAxisIdsMcs[3] := io_Z.NcToPlc.AxisId;
```

5.3.2   E_KINSTATUS

This enumeration defines the kinematic group state.

```
TYPE E_KINSTATUS :
(
    KinStatus_Error,
    KinStatus_Empty,
    KinStatus_Unknown,
    KinStatus_StartPending,
    KinStatus_Ready,
    KinStatus_InvalidItfVersion := 16#4000
);
END_TYPE
```
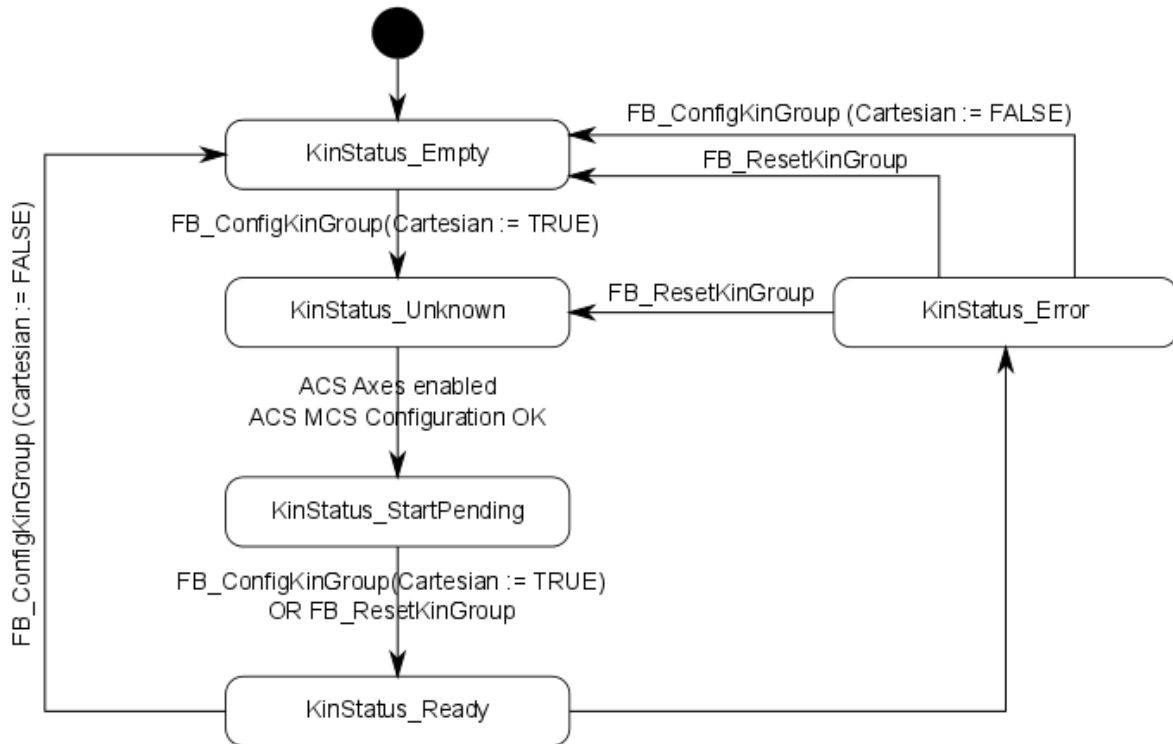

KinStatus_Empty: ACS axes can be moved. No transformation activated

KinStatus_Ready: MCS axes can be moved.Transformation active.

KinStatus_InvalidItfVersion: A Function or Function block is not supported by this version of cyclic channel interface. To use the function it is required to update

Enabling Configuration

The ACS axes must be enabled for the state to reach **KinStatus_Ready**.

6 Error Codes

6.1 ADS Return Codes

Grouping of error codes:
Global error codes: <u>ADS Return Codes [▶ 39]</u>... (0x9811_0000 ...)
Router error codes: <u>ADS Return Codes [▶ 39]</u>... (0x9811_0500 ...)
General ADS errors: <u>ADS Return Codes [▶ 40]</u>... (0x9811_0700 ...)
RTime error codes: <u>ADS Return Codes [▶ 41]</u>... (0x9811_1000 ...)

Global error codes

Hex	Dec	HRESULT	Name	Description
0x0	0	0x98110000	ERR_NOERROR	No error.
0x1	1	0x98110001	ERR_INTERNAL	Internal error.
0x2	2	0x98110002	ERR_NORTIME	No real time.
0x3	3	0x98110003	ERR_ALLOCLOCKEDMEM	Allocation locked – memory error.
0x4	4	0x98110004	ERR_INSERTMAILBOX	Mailbox full – the ADS message could not be sent. Reducing the number of ADS messages per cycle will help.
0x5	5	0x98110005	ERR_WRONGRECEIVEHMSG	Wrong HMSG.
0x6	6	0x98110006	ERR_TARGETPORTNOTFOUND	Target port not found – ADS server is not started or is not reachable.
0x7	7	0x98110007	ERR_TARGETMACHINENOTFOUND	Target computer not found – AMS route was not found.
0x8	8	0x98110008	ERR_UNKNOWNCMDID	Unknown command ID.
0x9	9	0x98110009	ERR_BADTASKID	Invalid task ID.
0xA	10	0x9811000A	ERR_NOIO	No IO.
0xB	11	0x9811000B	ERR_UNKNOWNAMSCMD	Unknown AMS command.
0xC	12	0x9811000C	ERR_WIN32ERROR	Win32 error.
0xD	13	0x9811000D	ERR_PORTNOTCONNECTED	Port not connected.
0xE	14	0x9811000E	ERR_INVALIDAMSLENGTH	Invalid AMS length.
0xF	15	0x9811000F	ERR_INVALIDAMSNETID	Invalid AMS Net ID.
0x10	16	0x98110010	ERR_LOWINSTLEVEL	Installation level is too low –TwinCAT 2 license error.
0x11	17	0x98110011	ERR_NODEBUGINTAVAILABLE	No debugging available.
0x12	18	0x98110012	ERR_PORTDISABLED	Port disabled – TwinCAT system service not started.
0x13	19	0x98110013	ERR_PORTALREADYCONNECTED	Port already connected.
0x14	20	0x98110014	ERR_AMSSYNC_W32ERROR	AMS Sync Win32 error.
0x15	21	0x98110015	ERR_AMSSYNC_TIMEOUT	AMS Sync Timeout.
0x16	22	0x98110016	ERR_AMSSYNC_AMSERROR	AMS Sync error.
0x17	23	0x98110017	ERR_AMSSYNC_NOINDEXINMAP	No index map for AMS Sync available.
0x18	24	0x98110018	ERR_INVALIDAMSPORT	Invalid AMS port.
0x19	25	0x98110019	ERR_NOMEMORY	No memory.
0x1A	26	0x9811001A	ERR_TCPSEND	TCP send error.
0x1B	27	0x9811001B	ERR_HOSTUNREACHABLE	Host unreachable.
0x1C	28	0x9811001C	ERR_INVALIDAMSFRAGMENT	Invalid AMS fragment.
0x1D	29	0x9811001D	ERR_TLSSEND	TLS send error – secure ADS connection failed.
0x1E	30	0x9811001E	ERR_ACCESSDENIED	Access denied – secure ADS access denied.

Router error codes

Hex	Dec	HRESULT	Name	Description
0x500	1280	0x98110500	ROUTERERR_NOLOCKEDMEMORY	Locked memory cannot be allocated.
0x501	1281	0x98110501	ROUTERERR_RESIZEMEMORY	The router memory size could not be changed.
0x502	1282	0x98110502	ROUTERERR_MAILBOXFULL	The mailbox has reached the maximum number of possible messages.
0x503	1283	0x98110503	ROUTERERR_DEBUGBOXFULL	The Debug mailbox has reached the maximum number of possible messages.

Hex	Dec	HRESULT	Name	Description
0x504	1284	0x98110504	ROUTERERR_UNKNOWNPORTTYPE	The port type is unknown.
0x505	1285	0x98110505	ROUTERERR_NOTINITIALIZED	The router is not initialized.
0x506	1286	0x98110506	ROUTERERR_PORTALREADYINUSE	The port number is already assigned.
0x507	1287	0x98110507	ROUTERERR_NOTREGISTERED	The port is not registered.
0x508	1288	0x98110508	ROUTERERR_NOMOREQUEUES	The maximum number of ports has been reached.
0x509	1289	0x98110509	ROUTERERR_INVALIDPORT	The port is invalid.
0x50A	1290	0x9811050A	ROUTERERR_NOTACTIVATED	The router is not active.
0x50B	1291	0x9811050B	ROUTERERR_FRAGMENTBOXFULL	The mailbox has reached the maximum number for fragmented messages.
0x50C	1292	0x9811050C	ROUTERERR_FRAGMENTTIMEOUT	A fragment timeout has occurred.
0x50D	1293	0x9811050D	ROUTERERR_TOBEREMOVED	The port is removed.

General ADS error codes

Hex	Dec	HRESULT	Name	Description
0x700	1792	0x98110700	ADSERR_DEVICE_ERROR	General device error.
0x701	1793	0x98110701	ADSERR_DEVICE_SRVNOTSUPP	Service is not supported by the server.
0x702	1794	0x98110702	ADSERR_DEVICE_INVALIDGRP	Invalid index group.
0x703	1795	0x98110703	ADSERR_DEVICE_INVALIDOFFSET	Invalid index offset.
0x704	1796	0x98110704	ADSERR_DEVICE_INVALIDACCESS	Reading or writing not permitted.
0x705	1797	0x98110705	ADSERR_DEVICE_INVALIDSIZE	Parameter size not correct.
0x706	1798	0x98110706	ADSERR_DEVICE_INVALIDDATA	Invalid data values.
0x707	1799	0x98110707	ADSERR_DEVICE_NOTREADY	Device is not ready to operate.
0x708	1800	0x98110708	ADSERR_DEVICE_BUSY	Device is busy.
0x709	1801	0x98110709	ADSERR_DEVICE_INVALIDCONTEXT	Invalid operating system context. This can result from use of ADS blocks in different tasks. It may be possible to resolve this through multitasking synchronization in the PLC.
0x70A	1802	0x9811070A	ADSERR_DEVICE_NOMEMORY	Insufficient memory.
0x70B	1803	0x9811070B	ADSERR_DEVICE_INVALIDPARM	Invalid parameter values.
0x70C	1804	0x9811070C	ADSERR_DEVICE_NOTFOUND	Not found (files, ...).
0x70D	1805	0x9811070D	ADSERR_DEVICE_SYNTAX	Syntax error in file or command.
0x70E	1806	0x9811070E	ADSERR_DEVICE_INCOMPATIBLE	Objects do not match.
0x70F	1807	0x9811070F	ADSERR_DEVICE_EXISTS	Object already exists.
0x710	1808	0x98110710	ADSERR_DEVICE_SYMBOLNOTFOUND	Symbol not found.
0x711	1809	0x98110711	ADSERR_DEVICE_SYMBOLVERSIONINVALID	Invalid symbol version. This can occur due to an online change. Create a new handle.
0x712	1810	0x98110712	ADSERR_DEVICE_INVALIDSTATE	Device (server) is in invalid state.
0x713	1811	0x98110713	ADSERR_DEVICE_TRANSMODENOTSUPP	AdsTransMode not supported.
0x714	1812	0x98110714	ADSERR_DEVICE_NOTIFYHNDINVALID	Notification handle is invalid.
0x715	1813	0x98110715	ADSERR_DEVICE_CLIENTUNKNOWN	Notification client not registered.
0x716	1814	0x98110716	ADSERR_DEVICE_NOMOREHDLS	No further handle available.
0x717	1815	0x98110717	ADSERR_DEVICE_INVALIDWATCHSIZE	Notification size too large.
0x718	1816	0x98110718	ADSERR_DEVICE_NOTINIT	Device not initialized.
0x719	1817	0x98110719	ADSERR_DEVICE_TIMEOUT	Device has a timeout.
0x71A	1818	0x9811071A	ADSERR_DEVICE_NOINTERFACE	Interface query failed.
0x71B	1819	0x9811071B	ADSERR_DEVICE_INVALIDINTERFACE	Wrong interface requested.
0x71C	1820	0x9811071C	ADSERR_DEVICE_INVALIDCLSID	Class ID is invalid.
0x71D	1821	0x9811071D	ADSERR_DEVICE_INVALIDOBJID	Object ID is invalid.
0x71E	1822	0x9811071E	ADSERR_DEVICE_PENDING	Request pending.
0x71F	1823	0x9811071F	ADSERR_DEVICE_ABORTED	Request is aborted.
0x720	1824	0x98110720	ADSERR_DEVICE_WARNING	Signal warning.
0x721	1825	0x98110721	ADSERR_DEVICE_INVALIDARRAYIDX	Invalid array index.
0x722	1826	0x98110722	ADSERR_DEVICE_SYMBOLNOTACTIVE	Symbol not active.
0x723	1827	0x98110723	ADSERR_DEVICE_ACCESSDENIED	Access denied.
0x724	1828	0x98110724	ADSERR_DEVICE_LICENSENOTFOUND	Missing license.
0x725	1829	0x98110725	ADSERR_DEVICE_LICENSEEXPIRED	License expired.
0x726	1830	0x98110726	ADSERR_DEVICE_LICENSEEXCEEDED	License exceeded.
0x727	1831	0x98110727	ADSERR_DEVICE_LICENSEINVALID	Invalid license.
0x728	1832	0x98110728	ADSERR_DEVICE_LICENSESYSTEMID	License problem: System ID is invalid.

Hex	Dec	HRESULT	Name	Description
0x729	1833	0x98110729	ADSERR_DEVICE_LICENSENOTIMELIMIT	License not limited in time.
0x72A	1834	0x9811072A	ADSERR_DEVICE_LICENSEFUTUREISSUE	Licensing problem: time in the future.
0x72B	1835	0x9811072B	ADSERR_DEVICE_LICENSETIMETOLONG	License period too long.
0x72C	1836	0x9811072C	ADSERR_DEVICE_EXCEPTION	Exception at system startup.
0x72D	1837	0x9811072D	ADSERR_DEVICE_LICENSEDUPLICATED	License file read twice.
0x72E	1838	0x9811072E	ADSERR_DEVICE_SIGNATUREINVALID	Invalid signature.
0x72F	1839	0x9811072F	ADSERR_DEVICE_CERTIFICATEINVALID	Invalid certificate.
0x730	1840	0x98110730	ADSERR_DEVICE_LICENSEOEMNOTFOUND	Public key not known from OEM.
0x731	1841	0x98110731	ADSERR_DEVICE_LICENSERESTRICTED	License not valid for this system ID.
0x732	1842	0x98110732	ADSERR_DEVICE_LICENSEDEMODENIED	Demo license prohibited.
0x733	1843	0x98110733	ADSERR_DEVICE_INVALIDFNCID	Invalid function ID.
0x734	1844	0x98110734	ADSERR_DEVICE_OUTOFRANGE	Outside the valid range.
0x735	1845	0x98110735	ADSERR_DEVICE_INVALIDALIGNMENT	Invalid alignment.
0x736	1846	0x98110736	ADSERR_DEVICE_LICENSEPLATFORM	Invalid platform level.
0x737	1847	0x98110737	ADSERR_DEVICE_FORWARD_PL	Context – forward to passive level.
0x738	1848	0x98110738	ADSERR_DEVICE_FORWARD_DL	Context – forward to dispatch level.
0x739	1849	0x98110739	ADSERR_DEVICE_FORWARD_RT	Context – forward to real time.
0x740	1856	0x98110740	ADSERR_CLIENT_ERROR	Client error.
0x741	1857	0x98110741	ADSERR_CLIENT_INVALIDPARM	Service contains an invalid parameter.
0x742	1858	0x98110742	ADSERR_CLIENT_LISTEMPTY	Polling list is empty.
0x743	1859	0x98110743	ADSERR_CLIENT_VARUSED	Var connection already in use.
0x744	1860	0x98110744	ADSERR_CLIENT_DUPLINVOKEID	The called ID is already in use.
0x745	1861	0x98110745	ADSERR_CLIENT_SYNCTIMEOUT	Timeout has occurred – the remote terminal is not responding in the specified ADS timeout. The route setting of the remote terminal may be configured incorrectly.
0x746	1862	0x98110746	ADSERR_CLIENT_W32ERROR	Error in Win32 subsystem.
0x747	1863	0x98110747	ADSERR_CLIENT_TIMEOUTINVALID	Invalid client timeout value.
0x748	1864	0x98110748	ADSERR_CLIENT_PORTNOTOPEN	Port not open.
0x749	1865	0x98110749	ADSERR_CLIENT_NOAMSADDR	No AMS address.
0x750	1872	0x98110750	ADSERR_CLIENT_SYNCINTERNAL	Internal error in Ads sync.
0x751	1873	0x98110751	ADSERR_CLIENT_ADDHASH	Hash table overflow.
0x752	1874	0x98110752	ADSERR_CLIENT_REMOVEHASH	Key not found in the table.
0x753	1875	0x98110753	ADSERR_CLIENT_NOMORESYM	No symbols in the cache.
0x754	1876	0x98110754	ADSERR_CLIENT_SYNCRESINVALID	Invalid response received.
0x755	1877	0x98110755	ADSERR_CLIENT_SYNCPORTLOCKED	Sync Port is locked.
0x756	1878	0x98110756	ADSERR_CLIENT_REQUESTCANCELLED	The request was cancelled.

RTime error codes

Hex	Dec	HRESULT	Name	Description
0x1000	4096	0x98111000	RTERR_INTERNAL	Internal error in the real-time system.
0x1001	4097	0x98111001	RTERR_BADTIMERPERIODS	Timer value is not valid.
0x1002	4098	0x98111002	RTERR_INVALIDTASKPTR	Task pointer has the invalid value 0 (zero).
0x1003	4099	0x98111003	RTERR_INVALIDSTACKPTR	Stack pointer has the invalid value 0 (zero).
0x1004	4100	0x98111004	RTERR_PRIOEXISTS	The request task priority is already assigned.
0x1005	4101	0x98111005	RTERR_NOMORETCB	No free TCB (Task Control Block) available. The maximum number of TCBs is 64.
0x1006	4102	0x98111006	RTERR_NOMORESEMAS	No free semaphores available. The maximum number of semaphores is 64.
0x1007	4103	0x98111007	RTERR_NOMOREQUEUES	No free space available in the queue. The maximum number of positions in the queue is 64.
0x100D	4109	0x9811100D	RTERR_EXTIRQALREADYDEF	An external synchronization interrupt is already applied.
0x100E	4110	0x9811100E	RTERR_EXTIRQNOTDEF	No external sync interrupt applied.
0x100F	4111	0x9811100F	RTERR_EXTIRQINSTALLFAILED	Application of the external synchronization interrupt has failed.
0x1010	4112	0x98111010	RTERR_IRQLNOTLESSOREQUAL	Call of a service function in the wrong context
0x1017	4119	0x98111017	RTERR_VMXNOTSUPPORTED	Intel VT-x extension is not supported.
0x1018	4120	0x98111018	RTERR_VMXDISABLED	Intel VT-x extension is not enabled in the BIOS.
0x1019	4121	0x98111019	RTERR_VMXCONTROLSMISSING	Missing function in Intel VT-x extension.

Hex	Dec	HRESULT	Name	Description
0x101A	4122	0x9811101A	RTERR_VMXENABLEFAILS	Activation of Intel VT-x fails.

Specific positive HRESULT Return Codes:

HRESULT	Name	Description
0x0000_0000	S_OK	No error.
0x0000_0001	S_FALSE	No error. Example: successful processing, but with a negative or incomplete result.
0x0000_0203	S_PENDING	No error. Example: successful processing, but no result is available yet.
0x0000_0256	S_WATCHDOG_TIMEOUT	No error. Example: successful processing, but a timeout occurred.

TCP Winsock error codes

Hex	Dec	Name	Description
0x274C	10060	WSAETIMEDOUT	A connection timeout has occurred - error while establishing the connection, because the remote terminal did not respond properly after a certain period of time, or the established connection could not be maintained because the connected host did not respond.
0x274D	10061	WSAECONNREFUSED	Connection refused - no connection could be established because the target computer has explicitly rejected it. This error usually results from an attempt to connect to a service that is inactive on the external host, that is, a service for which no server application is running.
0x2751	10065	WSAEHOSTUNREACH	No route to host - a socket operation referred to an unavailable host.
		More Winsock error codes: Win32 error codes	

6.2 Overview of NC Errors

Error code (hex)	Description
0x4000 - 0x4FFF: NC error code range	
0x40nn	General errors [▶ 42]
0x41nn	Channel Errors [▶ 45]
0x42nn	Group Errors [▶ 48]
0x43nn	Axis Errors [▶ 70]
0x44nn	Encoder Errors [▶ 78]
0x45nn	Controller Errors [▶ 88]
0x46nn	Drive Errors [▶ 94]
0x4Ann	Table Errors [▶ 101]
0x4Bnn	NC PLC errors [▶ 103]
0x4Cnn	Kinematic Transformation [▶ 111]
0x8000 … 0x8FFF: New extended NC error code range	
0x81nn - 0x811F	Bode plot (diagnosis) [▶ 111]
0x8120 - 0x8FFF	further errors [▶ 114]

See also:

- ADS Return Codes

6.2.1 General NC Errors

Error(Hex)	Error(Dec)	Error type	Description
4000	**16384**	Internal	**Internal error**

Error(Hex)	Error(Dec)	Error type	Description
			Internal system error in the NC on ring 0, no further details.
4001	16385	Memory	**Memory error** The ring-0 memory management is not providing the required memory. This is usually a result of another error, as a result of which the controller will halt normal operation (now if not before).
4002	16386	Internal	**NC Retain data error (persistent data)** An error occurred when loading the NC Retain data, so that the affected axes are no longer referenced (status bit "Homed" is FALSE). This error can have the following reasons: - no NC Retain data were found - only old NC Retain data were found (old backup data set) - the NC Retain data are corrupt or inconsistent.
4003	16387	Parameter	**Parameter for monitoring the NC setpoint output is invalid** The parameter for activating or deactivating the "cyclic monitoring of NC setpoint output for steadiness and consistency" function is invalid. (Special function)
4004	16388	Internal	**External error** This error code can be set by an external module (e.g. third-party module) or can be set if an external module has an error.
4010	16400	Parameter	**Channel identifier not allowed** Either an unacceptable value (not 1...255) has been used, or a channel that does not exist in the system has been named.
4011	16401	Parameter	**Group identifier not allowed** Either an unacceptable value (not 1...255) has been used, or a group that does not exist in the system has been named.
4012	16402	Parameter	**Axis identifier not allowed** Either an unacceptable value (not 1...255) has been used, or an axis that does not exist in the system has been named.
4013	16403	Parameter	**Encoder identifier not allowed** Either an unacceptable value (not 1...255) has been used, or a encoder that does not exist in the system has been named.
4014	16404	Parameter	**Controller identifier not allowed** Either an unacceptable value (not 1...255) has been used, or a controller that does not exist in the system has been named.
4015	16405	Parameter	**Drive identifier not allowed** Either an unacceptable value (not 1...255) has been used, or a drive that does not exist in the system has been named.
4016	16406	Parameter	**Table identifier not allowed** Either an unacceptable value (not 1...255) has been used, or a table that does not exist in the system has been named.

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Error(Hex)	Error(Dec)	Error type	Description
4020	16416	Internal	**Missing process image**
			There is no PLC-axis interface when creating an axis.
4021	16417	Internal	**Missing process image**
			There is no axis-PLC interface when creating an axis.
4022	16418	Internal	**Missing process image**
			There is no encoder-I/O interface when creating an axis.
4023	16419	Internal	**Missing process image**
			There is no I/O-encoder interface when creating an axis.
4024	16420	Internal	**Missing process image**
			There is no drive-I/O interface when creating an axis.
4025	16421	Internal	**Missing process image**
			There is no I/O-drive interface when creating an axis.
4030	16432	Internal	**Coupling type not allowed**
			The master/slave coupling type is not allowed.
4031	16433	Internal	**Axis type not allowed**
			The type specification in the axis generation is inadmissible.
4032	16434	Parameter	**Unknown channel type**
			The NC channel type is unknown. Known types are e.g. an NCI channel, a FIFO channel, etc.
4040	16448	Internal	**Axis is incompatible**
			The axis is not suitable for the intended purpose. A high speed/low speed axis, for example, cannot function as a slave in an axis coupling.
4050	16464	Internal	**Channel not ready to operate**
			The channel is not complete, and is therefore not ready for operation. This is usually a consequence of problems at system start-up.
4051	16465	Internal	**Group not ready to operate**
			The group is not complete, and is therefore not ready for operation. This is usually a consequence of problems at system start-up.
4052	16466	Internal	**Axis not ready to operate**
			The axis is not complete, and is therefore not ready for operation. This is usually a consequence of problems at system start-up.
4060	16480	Internal	**Channel exists**
			The channel that is to be created already exists.
4061	16481	Internal	**Group exists**
			The group that is to be created already exists.
4062	16482	Internal	**Axis exists**
			The axis that is to be created already exists.
4063	16483	Internal	**Table exists**
			The table that is to be created already exists, or attempts are made to use an already existing table id internally (e.g. for the universal flying saw).
4070	16496	Internal	**Axis index not allowed**

Error(Hex)	Error(Dec)	Error type	Description
			The location within the channel specified for an axis is not allowed.
4071	16497	Internal	**Axis index not allowed**
			The location within the group specified for an axis is not allowed.

6.2.2 Channel Errors

Error(Hex)	Error(Dec)	Error type	Description
4101	16641	Parameter	**Group index not allowed**
			The location within the channel specified for a group is not allowed.
4102	16642	Address	**Null pointer**
			The pointer to the group is invalid. This is usually a consequence of an error during system start.
4103	16643	Internal	**Missing process image**
			It is not possible to exchange data with the PLC. Possible causes: 1. The channel has no interface (no interpreter available). 2. The connection to the PLC is faulty.
4104	16644	Parameter	**M-function index not allowed**
			Unacceptable M-function (not 0...159) detected at the execution level.
4105	16645	Memory	**No memory**
			There is no more system memory available. This is usually the result of another error.
4106	16646	Function	**Not ready**
			The function is not presently available, because a similar function is already being processed. Usually this is a result of access conflicts: more than one instance wants to issue commands to the channel. This can, for example, be the consequence of an incorrect PLC program.
4107	16647	Function	**Function/command not supported**
			A requested function or command is not supported by the channel.
4108	16648	Parameter	**Invalid parameter while starting**
			Parameters to start the channel (TwinCAT-Start) are invalid. Typically there is an invalid memory size or channel type requested.
4109	16649	Function	**Channel function (command) is not executable.**
			A channel function e.g. interpreter start is not executable because the channel is already busy, no program is loaded or in an error state.
410A	16650	Function	**ItpGoAhead is not executable.**
			The requested ItpGoAhead command is not executable because the interpreter is not executing a decoder stop.
4110	16656	Parameter	**Error opening a file**
			The specified file does not exist. Example: NC program unknown.

Error(Hex)	Error(Dec)	Error type	Description
4111	16657	NC programming	**Syntax error when loading** The NC found a syntax error when loading an NC program.
4112	16658	NC programming	**Syntax error when interpreting** The NC found a syntax error when processing an NC program.
4113	16659	NC programming	**Missing subroutine** The NC found a missing subroutine while loading.
4114	16660	Memory	**Loading buffer of interpreter is too small** The capacity of the interpreter loading buffer has been exceeded.
4115	16661	Internal	**Symbolism** Reserved, not currently used
4116	16662	Internal	**Symbolism** Reserved, not currently used
4117	16663	NC programming	**Subroutine incomplete** The header of the subroutine is missing.
4118	16664	NC programming	**Error while loading the NC program** The maximum number of loadable NC programs has been reached. Possible cause: Too many subprograms have been loaded from a main program.
4119	16665	NC programming	**Error while loading the NC program** The program name is too long.
4120	16672	NC programming	**Divide by Zero** The NC encountered a computation error during execution: division by 0.
4121	16673	NC programming	**Invalid circle parameterization** The NC detected a calculation error during processing: the specified circle is not calculable.
4122	16674	NC programming	**Invalid FPU-Operation** The NC encountered an invalid FPU-Operation during execution. This error occurs e.g. by calculating the square root of a negative number.
4130	16688	NC programming	**Stack overflow: Subroutines** The NC detected a stack overflow while processing: Too many subroutine levels.
4131	16689	NC programming	**Stack underflow: Subroutines** The NC detected a stack underflow while processing: Too many subroutine return commands. **A main program must not be terminated with a return command.**
4132	16690	NC programming	**Stack overflow: Arithmetic unit** The NC detected a stack overflow during processing: the calculation is too complex or is not written correctly.
4133	16691	NC programming	**Stack underflow: Arithmetic unit**

Error(Hex)	Error(Dec)	Error type	Description
			The NC detected a stack underflow during processing: The calculation is too complex or is not written correctly.
4140	16704	Parameter	**Register index not allowed**
			The NC detected an invalid register index during processing: The program contains an invalid specification (not R0...R999) or a pointer register contains an invalid value.
4141	16705	NC programming	**G-function index not allowed**
			The NC encountered an unacceptable G-function (not 0...159) during execution.
4142	16706	NC programming	**M-function index not allowed**
			The NC encountered an unacceptable M-function (not 0...159) during execution.
4143	16707	NC programming	**Extended address specification not allowed**
			The NC encountered an unacceptable extended address (not 1...9) during execution.
4144	16708	NC programming	**Index to the internal H-function not allowed**
			The NC encountered an unacceptable internal H-function in the course of processing. This is usually a consequence of an error during loading.
4145	16709	Parameter	**Machine data value not allowed**
			While processing instructions the NC detected an impermissible value for the machine data (MDB) (not 0…7).
4150	16720	Parameter	**Tool compensation parameters cannot be changed here.**
			The NC encountered an unacceptable change of parameters for the tool compensation during execution. This can be, for example, a changed tool radius while a circle was programmed.
4151	16721	Parameter	**Cannot calculate tool compensation.**
			The NC encountered an error in the calculation of the tool compensation.
4152	16722	NC programming	**Tool compensation**
			The plane for the tool compensation cannot be changed here. This error occurred for instance by changing the plane when the tool radius compensation is turned on or active.
4153	16723	NC programming	**Tool compensation**
			The D-Word is missing or invalid by turning on the tool compensation.
4154	16724	NC programming	**Tool compensation**
			The specified tool radius is invalid because the value is less or equal zero.
4155	16725	NC programming	**Tool compensation**
			The tool radius cannot be changed here.
4156	16726	Internal	**Tool compensation**
			The collision detection table is full.
4157	16727	Internal	**Tool compensation**
			An internal error occurred when switching on the bottleneck detection.

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Error(Hex)	Error(Dec)	Error type	Description
4158	16728	Internal	**Tool compensation**
			An internal error occurred in the bottleneck detection: Update Reversed Geo failed.
4159	16729	NC programming	**Tool compensation**
			An unexpected combination of geometry types with bottleneck detection turned on was detected.
415A	16730	NC programming	**Tool compensation**
			The programmed inner circle is smaller than the cutter radius.
415B	16731	NC programming	**Tool compensation**
			The bottleneck detection recognized a contour violation.
415C	16732	Memory	**No memory**
			The table for corrected entries is full.
415D	16733	Memory	**No memory**
			The input table for tangential following is full.
415E	16734	Memory	**No memory**
			The executing table for tangential following is full.
415F	16735	Internal	**Geometry calculation**
			The geometric entry for the tangential following cannot be calculated.
4160	16736	Internal	**Reserved**
			Reserved, not currently used
4161	16737	Internal	**Reserved**
			Reserved, not currently used
4162	16738	Parameter	**Interpolation rules can not be determined**
			The actual active interpolation rules (G-Code), zero offset shifts or rotation cannot be detected.
4170	16752	NC programming	**Error loading: invalid parameter**
			The NC found an invalid parameter while loading an NC program.
4171	16753	Internal	**Invalid contour start position**
			The NC detected a calculation error during processing: The specified contour cannot be calculated because the start position is not on the contour.
4172	16754	Internal	**Reverse: invalid table index**
			The NC encountered an invalid internal entry index during execution of the retrace function.
4173	16755	NC programming	**Invalid G code**
			Invalid default G code/Wrong expression/syntax in the default G code
4174	16756	NC programming	**Error opening the G code file**
			Error opening the default G code file

6.2.3   Group Errors

Error(Hex)	Error(Dec)	Error type	Description
4200	16896	Parameter	**Group ID not allowed**

Error(Hex)	Error(Dec)	Error type	Description
			The value for the group ID is not allowed because, for example, it has already been assigned, is less than or equal to zero or is greater than 255.
			Value range: [1 ... 255] — Unit: 1
4201	**16897**	Parameter	**Group type not allowed**
			The value for the group type is unacceptable because it is not defined. Type 1: PTP group with slaves (servo) Type 4: DxD group with slaves (3D group) Type 5: fast/creep group Type 6: stepper motor group Type 9: encoder group with slaves (servo) …
			Value range: [1 ... 12] — Unit: 1
4202	**16898**	Initialization	**Master axis index not allowed**
			The value for the master axis index in an interpolating 3D group is not allowed, because, for example, it has left the value range. Index 0: x-axis (first master axis) Index 1: Y axis (second master axis) Index 2: Z axis (third master axis)
			Value range: [0, 1, 2] — Unit: 1
4203	**16899**	Initialization	**Slave axis index not allowed (internal error)**
			The value for the slave axis index in a group is not allowed, because, for example, it has left the value range, the slave position to be used when inserting a new slave connection is already occupied, or because no slave is present when such a connection is being removed. Index 0: first slave axis Index 1: second slave axis Index 2: etc.
			Value range: [0 ... 7] — Unit: 1
4204	**16900**	Initialization	**Internal error**
			An unexpected internal error has occurred. The following situations could be the cause:
			Not enough TC router memory or Windows memory available to build the internal NC objects,
			internal NC structures and links (pointers between the NC objects) are faulty or missing,
			a fatal internal error has occurred in the calculation for a stop command,
			internal checks of the NC own logic and algorithms (self-monitoring software),
			unexpected modes and cases that are not regularly foreseen but are detected as erroneous.
			Often in such an error situation an additional error message is output in the logger (Windows Event Viewer), which can be helpful for more detailed analysis by Beckhoff or the user.
4205	**16901**	Parameter	**Cycle time for set execution task (SAF) not allowed**
			The value of the cycle time for the NC set execution task (SAF 1/2) is not allowed, because it has left the value range.
			Value range: [0.001 ... 0.1] — Unit: s
4206	**16902**	Initialization	**"GROUPERR_RANGE_MAXELEMENTSINAXIS "**

Error(Hex)	Error(Dec)	Error type	Description
4207	16903	Parameter	**Cycle time for the set preparation task (SVB) not allowed**
			The value of the cycle time for the NC set preparation task (SVB 1/2) is not allowed, because it has passed outside the value range.
			Value range: [0.001 ... 1.0] · Unit: s
4208	16904	Parameter	**Single step mode not allowed**
			The flag for the activation or deactivation of single step mode is not allowed. Value 0: passive (buffer mode) Value 1: active (single step mode)
			Value range: [0, 1] · Unit: 1
4209	16905	Parameter	**Group (de)activation invalid (internal error)**
			The flag for (de)activating the full group is invalid. Value 0: group active Value 1: group passive
			Value range: [0, 1] · Unit: 1
420A	16906	Initialization	**Set execution state (SAF state) not allowed (internal error)**
			The value for the state of the set execution state machine (SAF state) is not allowed. This error occurs on passing outside the range of values, or if the state machine enters an error state.
			Value range: [0 ... 5] · Unit: 1
420B	16907	Address	**Channel address**
			The group does not have a channel, or the channel address has not been initialized.
420C	16908	Address	**Axis address (master axis)**
			The group does not have a master axis (or axes) or the axis address(es) has (have) not been initialized.
420D	16909	Address	**Master axis address**
			A master/slave coupling is to be inserted into the group, but there is no valid address for the leading master axis.
420E	16910	Address	**Slave axis address**
			A master/slave coupling is to be inserted into the group, but there is no valid address for the slave axis.
420F	16911	Address	**Slave setpoint generator address**
			A master/slave coupling is to be inserted into the group, but there is no valid address for the slave setpoint generator.
4210	16912	Address	**Encoder address**
			An axis in the group does not have an encoder, or the encoder address has not been initialized.
4211	16913	Address	**Controller address**
			An axis in the group does not have a controller, or the controller address has not been initialized.
4212	16914	Address	**Drive address**
			An axis in the group does not have a drive, or the drive address has not been initialized.
4213	16915	Address	**Master setpoint generator address**
			A group (e.g. FIFO group) does not have a master setpoint generator or the setpoint generator address has not been initialized. There may not be enough memory available.

Error(Hex)	Error(Dec)	Error type	Description
4214	16916	Address	**Axis interface NC to PLC address**
			Group/axis does not have an axis interface from the NC to the PLC, or the axis interface address has not been initialized.
4215	16917	Address	**Slave axis address**
			An existing master/slave coupling is to be removed from the group, but there is no valid address for the slave axis.
4216	16918	Address	**Table unknown**
			The table, respectively the table ID, is unknown. This table is used for the master/slave coupling or for the characteristic curve.
4217	16919	Address	**NcControl address**
			The NcControl address has not been initialized.
4218	16920	Initialization	**Command lock because persistent NC data is waiting to be transferred**
			Axis is blocked for commands while waiting for valid I/O data to accept the queued persistent NC data.
4219	16921	Function	**The scaling mode MASTER-AUTOOFFSET is invalid because no reference table was found.**
			The scaling mode MASTER-AUTOOFFSET used is invalid in this context because no reference to an existing reference table can be established. This error can occur, for example, when tables are added if no unique reference to an existing reference table can be established (e.g. because the reference is not unique, etc.).
421A	16922	Parameter	**The master axis start position does not permit synchronization**.
			When a slave axis is being coupled on, the position of the master axis does not permit synchronization at the given synchronization positions.
421B	16923	Parameter	**Slave coupling factor (gear ratio) of 0.0 is not allowed.**
			A master/slave coupling with a gear ratio of 0.0 is being created. This value is not allowed, since it does not correspond to any possible coupling, and division will generate an FPU exception.
421C	16924	Function	**Insertion of master axis into group is not allowed.**
			A master axis is to be inserted into a group at a location that is already occupied by another master axis. Maybe the reconfiguration cannot be done, because this axis has got an existing slave coupling. This master/slave coupling must be revoked before.
421D	16925	Function	**Deletion of master axis from group not allowed (internal error).**
			A master axis is to be removed from a location in a group that is not in fact occupied by master axis.
421E	16926	Function	**Function/feature is not supported from the setpoint generator.**
			A function or feature is not supported from the setpoint generation (e.g. PTP master setpoint generator). This can be in general or only in a special situation.
421F	16927	Initialization	**Group initialization**

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Error(Hex)	Error(Dec)	Error type	Description
			The group has not been initialized. Although the group has been created, the rest of the initialization has not been performed (1. initialization group I/O, 2. initialization group, 3. reset group).
4220	16928	Monitoring	**Group not ready / group not ready for new task**
			The group is being given a new task while it is still in the process of executing an existing task. This request is not allowed because it would interrupt the execution of the previous task. The new task could, for example, be a positioning command, or the "set actual position" function. Precisely the converse relationships apply for the "set new end position" function. In that case, the group/axis must still be actively moving in order to be able to cause a change in the end position.
4221	16929	Monitoring	**Requested target velocity is not allowed.**
			The value requested for the target velocity of a positioning task is less than or equal to zero, larger than the "maximum velocity" (see axis parameters), or, in the case of servo drives, is larger than the "reference velocity" of the axis (see drive parameters).
4222	16930	Monitoring	**Requested target position is not allowed (master axis).**
			The requested value for the target position of a positioning task is not within the software end positions. In other words, it is either less than the minimum software end position or larger than the maximum software end position. This check is only carried out if the relevant end position monitoring is active.
4223	16931	Monitoring	**No enable for controller and/or feed (master axis)**
			The axis enables for the master axis needed for positioning are not present. This can involve the controller enable and/or the relevant, direction-dependent feed enable (see axis interface PlcToNc).
4224	16932	Monitoring	**Travel path smaller than one encoder increment (internal error)**
			The travel path that a group/axis is supposed to move is smaller than the physical significance of one encoder increment. In other words the movement is smaller than the scaling factor of the axis. The reaction to this is that the axis is reported as having logically finished without having actively moved. This means that an external error is not generated for the user. This error is also issued for rapid/slow traverse axes if a looping distance with nonzero parameters is smaller than the sum of the creeping and braking distances. In such a case it is not meaningful to either exceed or to fail to reach the target position.
4225	16933	Monitoring	**Drive hardware not ready to operate at axis start**
			During an axis start it is ascertained that the drive hardware is not ready to operate. This can be caused by the following reasons: - the drive is in error state (hardware error) - the drive is in the start-up phase (e.g. after an axis reset preceded by a hardware error) - the drive lacks the controller enable (ENABLE) **The time required for the "start-up" of a drive after a hardware error can be in the range of several seconds.**
4226	16934	Monitoring	**The parameters of the emergency stop are invalid.**

Error(Hex)	Error(Dec)	Error type	Description
			Either, both, the deceleration and the jerk are less than zero or one of the parameters is weaker than the corresponding parameter of the start data.
4227	16935	Function	**Setpoint generator not active**
			The setpoint generator is inactive such that no instructions are accepted.
4228	16936	Monitoring	**Requested travel path/looping distance is not allowed**
			The requested travel path or looping distance is smaller than the braking distance of the rapid/slow traverse axis.
4229	16937	Monitoring	**Requested target position is not allowed (slave axis)**
			The value for the target position of a positioning task when calculated for the slave axis is not within the software end positions. In other words, it is either less than the minimum software end position or larger than the maximum software end position. This check is only carried out if the relevant end position monitoring is active.
422A	16938	Monitoring	**No enable for controller and/or feed (slave axis)**
			The axis enables for one or more coupled slave axes needed for positioning are not present. This can involve the controller enable and/or the relevant, direction-dependent feed enable (see axis interface PlcToNc).
422B	16939	Parameter	**The activation position (position threshold) is out of range of the actual positioning**
			The activation position (position threshold) of a new axis command (e.g. "new velocity activated at a position") is out of range. E.g. the activation position is before the actual position or behind the target position.
422C	16940	Parameter	**The start or activation data of the external setpoint generation are not valid**
			This may be caused through: 1. The external setpoint generation is active and a new activation with a start type (1: absolute, 2: relative) unequal to the current one is send. 2. The internal setpoint generation is active (e.g. PTP) and the external one is activated with the start type absolute (2 setpoint generators of the type absolute are not possible).
422D	16941	Parameter	**Velocity is not constant**
			For changing the dynamic parameter 'acceleration' und 'deceleration' the axis has to be in dynamic state without acceleration and deceleration (that means constant velocity).
422E	16942	Parameter	**Jerk less than or equal to 0.0 is not allowed**
			A value less than or equal to 0.0 for the jerk (PTP and CNC) is not allowed, since the jerk is by definition positive, and with a jerk of 0.0, division will generate an FPU exception.
422F	16943	Parameter	**Acceleration less than or equal to 0.0 is not allowed**
			A value less than or equal to 0.0 for the acceleration (PTP and CNC) is not allowed, since the acceleration is positive by definition, and an acceleration of 0.0 will not allow a motion to be generated.
4230	16944	Parameter	**Absolute deceleration value less than or equal to 0.0 is not allowed**

Error(Hex)	Error(Dec)	Error type	Description
			A value less than or equal to 0.0 for the absolute value of the deceleration (PTP and CNC) is not allowed, since the absolute value of the deceleration is positive by definition, and an absolute value of the deceleration of 0.0 will not allow a motion to be generated.
4231	16945	Parameter	**Target velocity less than or equal to 0.0 is not allowed** A value less than or equal to 0.0 or outside the range from 10^{-3} up to 10^{+10} for the target velocity (PTP and CNC) is not allowed, since the target velocity is by definition strictly positive, and with a target velocity of 0.0, division will generate an FPU exception.
4232	16946	Monitoring	**Loss of resolution accuracy for requested positioning** The positioning is so long in space or time that decimal places become irrelevant and inaccuracies may occur during positioning (LOSS_OF_PRECISION).
4233	16947	Parameter	**Cycle time less than or equal to 0.0 is not allowed** A value less than or equal to 0.0 for the cycle time (PTP and CNC) is not allowed, since the cycle time is by definition strictly positive, and with a cycle time of 0.0, division will generate an FPU exception.
4234	16948	Internal	**PTP data type <intasdouble> range exceeded** Such extreme parameters have been supplied for the start task, the override or the new target position that the internal data type loses its precision.
4235	16949	Function	**PTP LHL velocity profile cannot be generated (internal error)** Such extreme parameters have been supplied for the start task, the override or the new target position that it is not possible to generate a velocity profile of the type LHL (Low-High-Low).
4236	16950	Function	**PTP HML velocity profile cannot be generated (internal error)** Such extreme parameters have been supplied for the override or the new target position that it is not possible to generate a velocity profile of the type HML (High-Middle-Low).
4237	16951	Address	**Start data address is invalid** The address of the start data is invalid.
4238	16952	Parameter	**Velocity override (start override) is not allowed** The value for the velocity override is not allowed, because it is less than 0.0% or more than 100.0% (see axis interface PlcToNc). Here, 100.0 % corresponds to the integral value 1000000 in the axis interface. Value range: [0 ... 1000000]
4239	16953	Parameter	**Start type not allowed** The start type supplied does not exist.
423A	16954	Monitoring	**Velocity overshoot** The new dynamics with the parameterized jerk is so weak that a velocity overshoot is imminent under given boundary conditions. The command is therefore not supported.
423B	16955	Parameter	**Start parameter for the axis structure is invalid**

Error(Hex)	Error(Dec)	Error type	Description
			External or internal parameters for the start structure for a positioning task are invalid. Thus, for instance, the scaling factor, the SAF cycle time or the requested velocity may be less than or equal to zero, which is not allowed.
423C	16956	Parameter	**Override generator initialization parameter invalid**
			One of the override generator (re)initialization parameters is invalid.
423D	16957	Monitoring	**Slave axis has not setpoint generator (internal error)**
			It is found that a slave axis within a group does not have a valid slave generator (setpoint generator). A slave axis and a slave setpoint generator must always be present as a pair. This is an internal error.
423E	16958	Function	**Table is empty**
			Either the SVB table or the SAF table does not contain any entries.
423F	16959	Function	**Table is full**
			The SVB table or the SAF table has no more free lines.
4240	16960	Memory	**No memory available**
			The SVB memory allocation for the dynamic entry in SAF table has failed.
4241	16961	Function	**Table already contains an entry (internal error)**
			The SAF table entry was canceled because an entry already exists by mistake.
4242	16962	Function	**Stop is already active**
			The stop instruction is not forwarded, because it has already been activated.
4243	16963	Function	**Compensation has not been carried out over the full compensation section**
			The compensations start parameters do not permit compensation over the full section to be compensated. For this reason the compensation will be carried out over a smaller section.
4244	16964	Parameter	**Internal parameters for the compensation are invalid (internal error)**
			Invalid internal parameters or start parameters of the lower-level generator
4245	16965	Function	**Compensation active**
			The start of the compensation was refused, because the compensation is already active or the master/slave axis is not moved actively at all, which makes an execution of the compensation impossible.
4246	16966	Function	**Compensation not active**
			The stop of the compensation was denied because the compensation is not active.
4247	16967	Function	**Compensation type invalid**
			The type supplied for the section compensation is invalid. At the present time only compensation type 1 (trapezoidal velocity profile) is allowed.
4248	16968	Function	**Axis address for compensation invalid (internal error)**
			The address of the master of slave axis on which the section compensation is to act is invalid. This is an internal error.
4249	16969	Address	**Invalid slave address (internal error)**

Error(Hex)	Error(Dec)	Error type	Description
			The specified slave address for online coupling/decoupling is invalid.
424A	16970	Function	**Coupling velocities not allowed**
			The velocity of what is to become the master axis is 0, which means that online coupling is not possible.
424B	16971	Function	**Coupling velocities not constant**
			The velocity of what is to become the master axis and the velocity of what is to become the slave axis are not constant, so that on-line coupling is not possible.
424C	16972	Parameter	**Cycle time less than or equal to 0.0 is not allowed**
			A value less than or equal to 0.0 for the cycle time (Slave) is not allowed, since the cycle time is by definition strictly positive, and with a cycle time of 0.0, division will generate an FPU exception.
424D	16973	Function	**Decoupling task not allowed**
			The slave axis is of such a type (e.g. a table slave) or is in such a state (master velocity 0) that online decoupling is not possible.
424E	16974	Function	**Function not allowed**
			The function cannot logically be executed, e.g. some commands are not possible and not allowed for slave axes.
424F	16975	Parameter	**No valid table weighting has been set**
			The weighting factor of each table is 0, so that no table can be read.
4250	16976	Function	**Axis start type, actual position type or end position type not allowed**
			The start type for a positioning task in invalid. Valid start types are: ABSOLUTE (1), RELATIVE (2), ENDLESS POSITIVE (3), ENDLESS NEGATIVE (4), MODULO (5), , etc. Furthermore, it is possible that the types for setting a new actual position or moving to a new end position are invalid.
4251	16977	Function	**Function is not supported**
			An NC function has been activated that is currently not released for use, or which is not even implemented. This can be a command which is not possible or not allowed for master axes.
4252	16978	Monitoring	**State of state machine invalid (internal error)**
			The state for one of the internal state machines is invalid. This is an internal error.
4253	16979	Monitoring	**PLC reference cam became free too soon**
			During the referencing process for an axis it is moved in the direction of the PLC referencing cam, and is only stopped again when the cam signal is reached. After the axis has then also physically stopped, the referencing cam must remain occupied until the axis subsequently starts back down from the cam in the normal way.
4254	16980	Monitoring	**Distance monitoring between activation of the hardware latch and appearance of the I/O sync pulse**

Error(Hex)	Error(Dec)	Error type	Description
			When the distance monitoring is active, a check is kept on whether the number of increments between activation of the hardware latch and occurrence of the sync pulse (zero pulse) has become smaller than a pre-set value. If this case has occurred, this error will be generated (see parameters for the incremental encoder).
4255	16981	Memory	**No memory available** The dynamic memory allocation for the setpoint generator, the SVB table or the SAF table has failed.
4256	16982	Monitoring	**The table slave axis has no active table** Although the table slave axis has tables, none of the tables is designated as active. If this occurs during the runtime the whole master/slave group is stopped by a runtime error.
4257	16983	Function	**Function not allowed** The requested function or the requested task is not logically allowed. An example for such an error message would be "set an actual position" for an absolute encoder (M3000, KL5001, etc.).
4258	16984	Function	**Stopping compensation not allowed** It is not possible to stop the compensation, since compensation is already in the stopping phase.
4259	16985	Function	**Slave table is being used** The slave table cannot be activated, because it is currently being used.
425A	16986	Function	**Master or slave axis is processing a task (e.g. positioning command) while coupling is requested** A master/slave coupling of a certain slave type (e.g. linear coupling) cannot be executed, because either the master axis or the future slave axis is not at standstill, but executes a task (e.g. a positioning) at the coupling time. For this couple type this is not allowed.
425B	16987	Parameter	**Slave (start) parameter is incorrect** One of the slave start/coupling parameters is not allowed (Coupling factor is zero, the master position scaling of a cam plate is zero, etc.).
425C	16988	Parameter	**Slave type is wrong** The slave type does not match up to the (SVB) start type.
425D	16989	Function	**Axis stop is already active** The axis stop/Estop is not initiated, because the stop is already active.
425E	16990	Function	**Maximum number of tables per slave generator reached** The maximum number of tables per slave generator is reached (e.g. "MC_MultiCamIn" is limited to 4 tables).
425F	16991	Function	**The scaling mode is not allowed** The used scaling is invalid in this context. Either the mode is not defined or not yet implemented or it cannot be implemented in this constellation. For example, the MASTER-AUTOOFFSET mode cannot be used if relative coupling is performed, since there is a contradiction here. Furthermore, the MASTER-AUTOOFFSET mode cannot be used when coupling for the first time, since no reference to an existing reference table coupling (reference table) can be established here.

Error(Hex)	Error(Dec)	Error type	Description
4260	**16992**	Monitoring	**Controller enable**
			The controller enable for an axis or for a coupled slave axis is not present (see axis interface PlcToNc). This error occurs if the controller enable is withdrawn while an axis or a group of axes (also a master/slave group) is being actively positioned. The error also occurs if a PTP axis or a coupled slave axis is started without controller enable.
4261	**16993**	Function	**Table not found**
			No table exists with the ID prescribed or the table ID is not unique.
4262	**16994**	Function	**Incorrect table type**
			The table referred to in the function is of the incorrect type.
4263	**16995**	Function	**Single step mode**
			This error occurs if single step mode is selected for a group or axis and a new task is requested while one of the individual tasks is still being processed.
4264	**16996**	Function	**Group task unknown (asynchronous table entry)**
			The group has received a task whose type or sub-type is unknown. Valid tasks can be single or multi-dimensional positioning tasks (Geo 1D, Geo 3D), referencing tasks, etc.
4265	**16997**	Function	**Group function unknown (synchronous function)**
			The group has received a function whose type is unknown. Valid functions are "Reset", "Stop", "New end position", "Start/stop section compensation", "Set actual position", "Set/reset calibration state" etc.
4266	**16998**	Function	**Group task for slave not allowed**
			Group tasks are usually only possible for master axes, not for slave axes. A slave axis only moves as an indirect result of a positioning task given to its associated master axis. A slave cannot therefore receive an order directly. Exception: see axis parameter "Allow motion commands for slave axes"
4267	**16999**	Function	**Group function for slave not allowed**
			Group functions are in principle only possible for master axes, not for slave axes. The only exception is represented by the "Start/stop section compensation" function, which is possible both for masters and for slaves. A slave cannot directly execute any other functions beyond this.
4268	**17000**	Function	**NCI setpoint generator is inactive**
			An NCI command such as "StopAndKeep" is sent to a logically inactive DXD group or to a group with the channel override state zero. However, it is expected that the NCI group is actively in setpoint generation for the implementation of this command. This error can occur in connection with the functions "delete distance to go" and "measurement event (latch actual position)".
4269	**17001**	Parameter	**Start position = target position**
			Invalid position parameters.
426A	**17002**	Parameter	**Parameters of the delay-generator are invalid**
			Invalid external/internal parameters of the delay generator (delay time, cycle time, tics)
426B	**17003**	Parameter	**External parameters of the compensation are invalid**

Error(Hex)	Error(Dec)	Error type	Description
			Invalid external parameters of the superimposed functionality (acceleration, deceleration, velocity, process velocity, length)
426C	17004	Parameter	**Invalid override type**
			The selected override type is invalid.
426D	17005	Function	**Activation position under/overrun**
			The requested activation position is located in the past of the master (e.g. when exchanging a cam plate).
426E	17006	Function	**Activation impossible: Master at standstill**
			The required activation of the correction is impossible since the master axis is not moving. An accurate synchronization is not possible, because the master axis is at standstill and the slave axis is not yet synchronized.
426F	17007	Function	**Activation mode not possible**
			The requested activation mode is not possible when the slave axis is moving. Otherwise, the slave dynamics would be abruptly set to zero.
4270	17008	Parameter	**Start parameter of the compensation invalid**
			One of the dynamic parameters of the compensation is invalid (necessary condition): acceleration (>0) deceleration (>0) process velocity (>0)
4271	17009	Parameter	**Start parameter of the compensation invalid**
			Velocity overshoot is negative.
4272	17010	Parameter	**Start parameter of the compensation invalid**
			The section on which the compensation is to occur is not positive.
4273	17011	Monitoring	**Target position under/overrun (internal error)**
			The position (calculated from the modulo target position) where the axis should stand at end of oriented stop has been run over.
4274	17012	Monitoring	**Target position will be under/overrun (internal error)**
			The position designated for the end of the oriented stop (calculated from the modulo target position) is too close and will be overrun.
4275	17013	Parameter	**Group parameter is invalid**
			A group parameter is invalid. This can be, for example, a parameterized velocity, acceleration, deceleration, jerk or NC cycle time whose value has been parameterized to be less than or equal to zero.
4276	17014	Monitoring	**Group error at the start of the setpoint generation**
			When starting the setpoint generation, e.g. for the flying saw, different parameters or states can lead to this error. For example, dynamic parameters such as acceleration, deceleration and jerk may be invalid (less than or equal to zero), or the NC cycle time or the override value may be outside the range of 0-100 % at the start.
4277	17015	Monitoring	**Dynamic parameters not permitted (internal error)**
			The dynamic parameters resulting from internal calculation like acceleration, deceleration and jerk are not permitted.
4279	17017	Monitoring	**New target position is invalid or cannot be reached**

Error(Hex)	Error(Dec)	Error type	Description
			A newly commanded target position is invalid, since it has either already been passed over or is passed over during a stop with the momentarily acting dynamics.
427A	17018	Monitoring	**New travel velocity or final velocity is invalid**
			For a new command, either the required travel velocity or the required final velocity (target velocity in the target position) is invalid. The travel velocity must always be greater than zero and the final velocity must always be greater than or equal to zero (default case is zero).
427B	17019	Monitoring	**New final velocity or new target position is invalid**
			For a new command, either the requested final velocity (target velocity in the target position) or the requested target position is invalid. The final velocity must always be greater than or equal to zero (default case is zero).
427C	17020	Monitoring	**New travel velocity is invalid**
			A newly commanded travel velocity is invalid because it is either less than or equal to zero or other reasons do not allow this velocity.
427D	17021	Monitoring	**Internal start mode is invalid**
			The start mode is invalid for a new command or is not permitted in this travel situation. A user cannot directly influence the start mode.
427E	17022	Monitoring	**A requested movement command could not be realized (BISECTION)**
			A requested movement command could not be realized using the requested parameters. The movement command has been executed best possible and this message is therefore to be understood just as a warning. Examples: An axis start is requested in motion in an unfavorable dynamic situation (acceleration phase) in which the travel distance is too short or the velocity is significantly too high. Another possibility is a slave axis that is decoupled during movement in an unfavorable dynamic situation and then given a start command, as in the previous case.
427F	17023	Monitoring	**The new target position either has been overrun or will be overrun**
			The new target position either has been overrun or will be overrun, since until there it is impossible to stop. An internal stop command is commended.
4280	17024	Monitoring	**Group not ready / group not ready for new task" (internal error / information)**
			The group is being given a new task while it is still in the process of executing an existing task. This request is not allowed because it would interrupt the execution of the previous task. The new task could, for example, be a positioning command, or the "set actual position" function. Precisely the converse relationships apply for the "set new end position" function. In that case, the group/axis must still be actively moving in order to be able to cause a change in the end position.
4281	17025	Parameter	**Parameters of the oriented stop are not allowed.**
			The modulo target position must not be lower than zero and not greater than or equal to the encoder modulo period (e.g. in the interval [0.0,360.0]). **Even in case of an error, the axis is stopped safely, but then it is not at the desired oriented position afterwards.**

Error(Hex)	Error(Dec)	Error type	Description
4282	17026	Monitoring	**The modulo target position of the modulo-start is invalid.**
			The modulo target position is outside of the valid parameter range. So the position value should not be lower than zero and not greater or equal than the encoder modulo-period (e.g. in the interval [0.0,360.0] for the modulo start type "SHORTEST_WAY" (261)).
4283	17027	Parameter	**The activation mode is not allowed.**
			The activation mode may have been used for online change, scaling, as well as for online change of the motion function. However, the activation mode used is not valid in this context. Either the mode is not defined or not yet implemented or it cannot be implemented in this constellation (e.g. if linear tables with an illegal cyclic activation mode NEXTCYCLE or NEXTCYCLEONCE are used). In other cases the mode is valid in principle, but the command cannot be implemented because the function already executes a task.
4284	17028	Parameter	**The parameterized jerk rate is not allowed.**
			The jerk rate is smaller than the minimum jerk rate. The minimum jerk rate is 1.0 (e.g. mm/s^3).
4285	17029	Parameter	**The parameterized acceleration or deceleration is not permitted.**
			The parameterized acceleration or deceleration is lower than the permitted minimum acceleration. The value for minimum acceleration is calculated from minimum jerk rate and NC cycle time (minimum jerk rate multiplied with NC cycle time). The unit for example is mm/s^2.
4286	17030	Parameter	**The parameterized velocity is not permitted.**
			The parameterized target velocity is lower than the minimum velocity (but the value zero is permitted). The value for minimum velocity is calculated from the minimum jerk rate and the NC cycle time (minimum jerk rate multiplied with the square of the NC cycle time). The unit for example is mm/s.
4287	17031	Monitoring	**Activation cannot be executed due to a pending activation.**
			An activation, such as "CamIn", "CamScaling" or "WriteMotionFunction" cannot be executed due to a pending activation (e.g. "CamIn", "CamScaling", "WriteMotionFunction"). There can only be one activation at a time.
4288	17032	Monitoring	**Illegal combination of different cycle times within an axis group**
			Within a logical axis group, different cycle times have been recognized for the common setpoint generation or for the I/O processing of an axis. This situation can occur both when creating a master/slave coupling and when configuring a 3D or FIFO group (inserting main, additional or slave axes).
4289	17033	Monitoring	**Invalid axis motion reversal**
			Due to the current dynamic state (current velocity, acceleration and jerk) a motion reversal would be caused. To avoid this motion reversal the axis command is not performed and the previous system state restored.
428A	17034	Monitoring	**Illegal command timing, because another instruction with future activation position is active.**

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Error(Hex)	Error(Dec)	Error type	Description
			A command cannot be accepted because another command with a future activation position is already valid at this time (e.g. "Approaching a new velocity from an activation position" or "Reaching a new velocity at an activation position").
428B	17035	Monitoring	**Stop-calculation routine (internal error)**
			Due to an internal error in the stop-calculation routine the current commando cannot be performed. The previous system state is restored.
428C	17036	Monitoring	**A command with activation position cannot fully be performed because the remaining path is too short.**
			A command with activation position (threshold) like "approaching a new velocity at a position" can be just partially executed because the path from the actual position to the activation position is too short.
428D	17037	Monitoring	**Invalid decouple type**
			The command to release a slave coupling with subsequent restart command has been called with an invalid decoupling or restart type.
428E	17038	Monitoring	**Illegal target velocity when decoupling a slave axis**
			The command to release a slave coupling with subsequent restart command has been called with an impermissible target velocity [1 < V < Vmax].
428F	17039	Monitoring	**Activation new dynamic parameters cannot be performed.**
			The command to activate new dynamic parameters such as acceleration, deceleration and jerk cannot be executed, as this would require a new assigned travel velocity. This error situation can occur, for example, if the axis is close to the target position in the accelerated state and the dynamics parameters are reduced.
4290	17040	Monitoring	**A command with activation position cannot be executed because the axis is already in the brake phase.**
			A command with activation position (threshold) e.g. "approaching new velocity at position" cannot be executed because the axis is already in the brake phase and the remaining path from the actual position to the activation position is too short.
4291	17041	Monitoring	**Jerk scaling of the decouple routine when decoupling a slave axis cannot find a valid solution.**
			Internal jerk scaling of decouple routine cannot evaluate a valid solution (decoupling slave axis and transform to master axis). Otherwise, an unexpected velocity overshoot, motion reversal or exceeding of the target position could occur.
4292	17042	Monitoring	**Command cannot be executed because the command buffer is full.**
			The command is rejected because the command buffer is full filled.
4293	17043	Internal	**Command is rejected due to an internal error in the Look Ahead (internal error).**
			The command is rejected due to an internal error in the "look ahead".
4294	17044	Monitoring	**Command is rejected because the new travel velocity cannot be implemented.**

Error(Hex)	Error(Dec)	Error type	Description
			The command is rejected, because the new travel velocity (target velocity) *Vrequ* is not realizable and an internal optimizing is impossible.
4295	17045	Monitoring	**Successive commands have the same end position.** Successive commands have the same end position. So the travel path is zero.
4296	17046	Monitoring	**Logical direction of travel of the axis is inconsistent with the parameterized direction of travel of the buffer command.** In the extended buffer mode, where the actual end position is replaced by the new buffer start position, the logical positioning direction is inconsistent with the direction of the buffer command (=> contradiction). A buffered command (*BufferMode, BlendingLow, BlendingPrevious, BlendingNext, BlendingHigh*) is rejected with error 0x4296 if the command is using the Beckhoff specific *optional BlendingPosition* but the blending position is located beyond the target position of the previous motion command.
4297	17047	Monitoring	**Command is rejected because the remaining distance in the current segment is too short.** The remaining distance for positioning is not sufficient, therefore the command cannot be executed. This can be the case, for example, in the BufferMode (BlendingMode), if the remaining distance in the current segment is not sufficient to travel without acceleration and to have reached a specified velocity at the segment change (depending on the BufferMode).
429A	17050	Function	**Restart failed.** There is already a motion command in the PTP command buffer and another new motion command, which should modify the existing command by a restart, has failed.
429B	17051	Monitoring	**Group error for invalid start parameters** This error refers to a wrong parameterization of the user (group error). For example, dynamic parameters such as Velo, Acc or Dec could be less than or equal to zero. Other error cases: - BaseFrequence < 0.0 - StartFrequence < 1.0 - StepCount < 1, StepCount > 200 - BaseAmplitude <= 0.0 - StepDuration <= 0.0 - StopFrequence >= 1/(2*CycleTime)
429C	17052	Monitoring	**PLC referencing cam is not found.** During the referencing process for an axis it is moved in the direction of the PLC referencing cam. This referencing cam, however, was not found as expected (=> leads to the abortion of the referencing procedure).
429D	17053	Monitoring	**PLC referencing cam has not been released again.** During the referencing process for an axis it is moved in the direction of the PLC referencing cam, and is only stopped again when the cam signal is reached. After the axis has also come to a physical standstill, the axis is subsequently started regularly from the cam again. In this case, the reference cam did not become free again as expected when driving down (=> leads to the abortion of the referencing procedure).

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Error(Hex)	Error(Dec)	Error type	Description
429E	17054	Monitoring	**I/O sync pulse was not found (only when using hardware latch).**
			If the hardware latch is activated, a sync pulse (zero pulse) is expected to be found and a sync event triggered following the expiry of a certain time or a certain distance. If this is not the case, the reaction is an error and the abortion of the referencing procedure.
429F	17055	Function	**The used buffer mode is unknown or not supported in this context.**
			The buffer mode used for a PTP command (e.g. ABORTING, etc.) is unknown or not supported in this context.
42A0	17056	Internal	**Group/axis consequential error**
			Consequential error resulting from another causative error related to another axis within the group. Group/axis consequential errors can occur in relation to master/slave couplings or with multiple axis interpolating DXD groups. If, for example, it is detected that the lag error limit of a master axis has been exceeded, then this consequential error is assigned to all the other master axes and slave axes in this group.
42A1	17057	Parameter	**Velocity reduction factor for C0/C1 transition is not allowed**
			A C0 transition describes two geometries which, while they are themselves continuous, no not have either continuous first or second differentials. The velocity reduction factor C0 acts on such transitions. **A C1 transition is characterized by the fact that the two geometries have a continuous course, but are continuously differentiable only once. The velocity reduction factor C1 acts on such transitions.**
			Value range: [0.0 ... 1.0] Unit: 1
42A2	17058	Parameter	**Critical angle at segment transition not allowed**
			The angle at the segment transition is not allowed.
			Value range: (0.0 ... 180.0) Unit: degrees
42A3	17059	Parameter	**Radius of the tolerance sphere**
			The radius of the tolerance sphere is outside the permitted range of values.
			Value range: [0.0 ... 100.0] Unit: e.g. mm
42A4	17060	Parameter	**Reserved**
			Reserved, not currently used
42A5	17061	Parameter	**Start type**
			Value range: [0,1] Unit: 1
42A6	17062	Parameter	**Reserved**
			Reserved, not currently used
42A7	17063	Parameter	**Blending**
			Blending is not possible with the given parameters.
42A8	17064	Parameter	**Reserved**
			Reserved, not currently used
42A9	17065	Parameter	**Curve velocity reduction method not allowed (internal error)**
			The curve velocity reduction method does not exist.

Error(Hex)	Error(Dec)	Error type	Description
42AA	17066	Parameter	**Minimum velocity not allowed**
			The minimum velocity that has been entered is less than 0.0.
42AB	17067	Parameter	**Power function input not allowed (internal error)**
			The input parameters in the power_() function lead to an FPU exception.
42AC	17068	Parameter	**Dynamic change parameter not allowed**
			A parameter that regulates the change of dynamics is invalid. Parameter: 1. Absolute path dynamics change: all parameters must be strictly positive. 2. Relative reduction c_f: 0.0 < c_f <= 1.0
42AD	17069	Memory	**Memory allocation error (internal error)**
			An error occurred during memory allocation.
42AE	17070	Function	**End position (internal error).**
			The calculated end position differs from the end position in the NC block
42AF	17071	Parameter	**Calculate remaining path length**
			invalid value Value range: [0,1]
42B0	17072	Function	**Setpoint generator SVB active**
			Starting the setpoint generator (SVB, SAF) has been refused, since the SVB task is already active.
42B1	17073	Parameter	**SVB parameter not allowed (internal error)**
			A parameter related to the internal structure of the setpoint generator (SVB) results in logical errors and/or to an FPU exception. Affects these parameters: Minimum velocity (>0.0), TimeMode, ModeDyn, ModeGeo, StartType, DistanceToEnd, TBallRadius.
42B2	17074	Parameter	**Velocity reduction factor not allowed**
			A parameter that regulates the reduction of velocity at segment transitions is invalid. Parameter: 1. Once continuously differentiable transitions: VeloVertexFactorC1 2. Not continuously differentiable transitions: VeloVertexFactorC0 CriticalVertexAngleLow, CriticalVertexAngleHigh.
42B3	17075	Parameter	**Helix is a circle**
			The helix has degenerated to a circle, and should be entered as such.
42B4	17076	Parameter	**Helix is a straight line**
			The helix has degenerated to a straight line, and should be entered as such.
42B5	17077	Parameter	**Guider parameter not allowed**
			One of the guider's parameters leads to logical errors and/or to an FPU exception.
42B6	17078	Address	**Invalid segment address (internal error)**
			The geometry segment does not have a valid geometry structure address or does not have a valid dynamic structure address.
42B7	17079	Parameter	**Not parameterized generator (internal error)**

Error(Hex)	Error(Dec)	Error type	Description
			The SVB generator is not yet parameterized and is therefore unable to operate.
42B8	17080	Address	**Not parameterized table (internal error)**
			The table has no information concerning the address of the corresponding dynamic generator.
42BA	17082	Internal	**Arc length of the smoothed path (internal error)**
			The calculation of the arc length of the smoothed path.
42BB	17083	Parameter	**Tolerance sphere**
			The radius of the tolerance sphere is too small (smaller than 0.1 mm).
42BC	17084	Internal	**DXD software end positions (internal error)**
			An error has occurred in the calculation of the DXD software end positions.
42BD	17085	Function	**NC block violates software end positions of the group.**
			At least one path axis with active software end position monitoring has violated the limit switches. Therefore the geometric entry is denied with an error.
42BE	17086	Parameter	**A path axis violates the end position.**
			At least one path axis with active position limit monitoring violates the limit switches.
42BF	17087	Parameter	**Reference velocity type is invalid.**
42C0	17088	Internal	**Interpolating group contains axes of an incorrect axis type.**
			An interpolating 3D group may only contain continuously guided axes of axis type 1 (SERVO).
42C1	17089	Internal	**Scalar product cannot be calculated**
			The length of one of the given vectors is 0.0.
42C2	17090	Internal	**Inverse cosine cannot be calculated**
			The length of one of the given vectors is 0.0.
42C3	17091	Parameter	**Table entry type invalid**
			The given table entry type is unknown.
42C4	17092	Parameter	**Invalid DIN66025 information type (internal error)**
			The given DIN66025 information type is unknown. Known types: G0, G1, G2, G3, G17, G18, G19.
42C5	17093	Parameter	**Dimension invalid (internal error)**
			The CNC dimension is unknown. Known dimensions: 1, 2, 3. Or: The CNC dimension is invalid for the given geometrical object. For a circle the dimension must be 2 or 3, while for a helix it must be 3.
42C6	17094	Parameter	**Geometrical object is not a straight line.**
			The given object, interpreted as a straight line, has a length of 0.0.
42C7	17095	Parameter	**Geometrical object is not a circle.**
			Interpreted as a circular arc, the given object has a length of 0.0, or an angle of 0.0 or a radius of 0.0.
42C8	17096	Parameter	**Geometrical object is not a helix.**
			Interpreted as a circular arc, the given object has a length of 0.0, an angle of 0.0, a radius of 0.0 or a height of 0.0.
42C9	17097	Parameter	**Target velocity less than or equal to 0.0 is invalid.**

Error(Hex)	Error(Dec)	Error type	Description
			A value less than or equal to 0.0 for the target velocity (CNC) is not allowed, since the target velocity is positive by definition, and a target velocity of 0.0 cannot generate any motion.
42CA	17098	Address	**Address for look-ahead invalid (internal error)** The address supplied for the look-ahead is invalid.
42CB	17099	Function	**SAF setpoint generator already active** Starting the setpoint generator (SAF) has been refused, since the SAF task is already active.
42CC	17100	Function	**CNC setpoint generation not active** The stop or override change was denied because the setpoint generation is not active.
42CD	17101	Function	**CNC setpoint generation in the stop phase** The stop or override change was denied because the setpoint generation is in the stop phase.
42CE	17102	Parameter	**Override not allowed** An override of less than 0.0 % or more than 100.0 % is invalid.
42CF	17103	Address	**Table address invalid (internal error)** The table address given for the initialization of the setpoint generator is invalid, or no valid logger connection (report file) is present.
42D0	17104	Parameter	**Table entry type invalid** The given table entry type is unknown.
42D1	17105	Memory	**Memory allocation failed** The memory allocation for a table failed.
42D2	17106	Memory	**Memory allocation failed** The memory allocation for a filter failed.
42D3	17107	Parameter	**Parameter invalid** Filter parameter is not allowed.
42D4	17108	Function	**Delete Distance to go not possible** Delete Distance to go (only interpolation) failed. This error occurred, if e.g. the command 'DelDTG' was not programmed in the actual movement of the NC program.
42D5	17109	Internal	**The setpoint generator of the flying saw generates incompatible values (internal error).**
42D6	17110	Function	**Axis will be stopped since otherwise it will overrun its target position (old PTP setpoint generator).** If, for example, in case of a slave to master transformation for the new master a target position is commanded that will be overrun because of the actual dynamics the axis will be stopped internally to guarantee that the target position will not be overrun (old PTP setpoint generator).
42D7	17111	Function	**Internal error in the transformation from slave to master**
42D8	17112	Function	**Wrong direction in the transformation of slave to master**
42DA	17114	Parameter	**Parameters of Motion Function (MF) table incorrect.**

Error(Hex)	Error(Dec)	Error type	Description
			The parameters of the Motion Function (MF) are invalid. This may refer to the first time created data set or to online changed data.
42DB	17115	Parameter	**Parameters of Motion Function (MF) table incorrect**
			The parameters of the Motion Function (MF) are invalid. This can refer to the data set created for the first time or to data changed online. The cause of the error may be that, for example, an active MF point (i.e. not an IGNORE point) points to a passive MF point (i.e. IGNORE point).
42DC	17116	Monitoring	**Internal error by using Motion Function (MF)**
			An internal error occurs by using the Function (MF). This error cannot be solved by the user. Please ask the TwinCAT Support.
42DD	17117	Function	**Axis coupling with synchronization generator declined because of incorrect axis dynamic values**
			The axis coupling with the synchronization generator has been declined, because one of the slave dynamic parameter (machine data) is incorrect. Either the maximum velocity, the acceleration, the deceleration or the jerk is smaller or equal to zero, or the expected synchronous velocity of the slave axis is higher as the maximum allowed slave velocity.
42DE	17118	Function	**Coupling conditions of synchronization generator not allowed.**
			If the direction of travel of the master axis is positive, the master synchronous position must be greater than the master coupling position ("i.e. lie in the future"). With negative master travel direction, the master synchronous position must be smaller than the master coupling position.
42DF	17119	Monitoring	**Motion profile of synchronization generator declines dynamic limit of slave axis or required characteristic of profile.**
			One of the parameterized checks has detected an exceeding of the dynamic limits (max. velocity, max. acceleration, max. deceleration or max. jerk) of the slave axis or a profile property (e.g. overshoot or undershoot in position or velocity) is not allowed. See also additional/further messages in the Windows Event Viewer and in the message window of the TwinCAT development environment.
42E0	17120	Parameter	**Parameter invalid**
			The encoder generator parameter is not allowed.
42E1	17121	Parameter	**Parameter invalid**
			The external (FIFO) generator parameter is not allowed.
42E2	17122	Function	**External generator is active.**
			The external generator cannot be started, as it is already active.
42E3	17123	Function	**External generator is not active.**
			The external generator cannot be stopped, as it is not active.
42E4	17124	Function	**NC block with auxiliary axis violates software limit switches of the group.**
			At least one auxiliary axis with active software end position monitoring has violated the limit switches. Therefore the geometric entry is denied with an error.

Error(Hex)	Error(Dec)	Error type	Description
42E5	17125	Function	**NC block of Bezier curve (Bezier spline) type contains a singularity**
			The Bezier curve (Bezier spline) has a peak, i.e. at an inner point both the curvature and the magnitude of the velocity strive towards zero in such a way that the radius of curvature is infinite. **The Bezier curve should be divided at exactly this point according to the "Casteljau algorithm". This preserves the geometry and eliminates the interior singularity.**
42E7	17127	Parameter	**Value for dead time compensation not allowed**
			The value for the dead time compensation in seconds for a slave coupling to an encoder axis (virtual axis) is not allowed.
			Value range: [0.0 ... 60.0] — Unit: s
42E8	17128	Parameter	**Internal error**
			GROUPERR_RANGE_NOMOTIONWINDOW
			Value range: [0.0 ... 1000.0] — Unit: e.g. mm/s
42E9	17129	Parameter	**Internal error**
			GROUPERR_RANGE_NOMOTIONFILTERTIME
			Value range: [0.0 ... 60.0] — Unit: s
42EA	17130	Parameter	**Internal error**
			GROUPERR_RANGE_TIMEUNITFIFO
			Value range: (0.0 ... 1000.0] — Unit: s
42EB	17131	Parameter	**Internal error**
			GROUPERR_RANGE_OVERRIDETYPE
			Value range: [1, 2] — Unit: 1
42EC	17132	Parameter	**Internal error**
			GROUPERR_RANGE_OVERRIDECHANGETIME
			Value range: (0.0 ... 1000.0] — Unit: s
42ED	17133	Parameter	**Internal error**
			GROUPERR_FIFO_INVALIDDIMENSIO
			The FIFO dimension (number of axes) has been increased from 8 to 16 from TwinCAT 2.11 Build 1547.
			Value range: [1 ... 8] resp. [1 ... 16] — Unit: 1 (number of axes)
42EE	17134	Address	**Internal error**
			GROUPERR_ADDR_FIFOTABLE
42EF	17135	Monitoring	**Axis is locked for motion commands because a stop command is still active.**
			The axis/group is locked for motion commands because a stop command is still active. This lock can be released by calling the stop command with Execute=FALSE or by an axis reset (see also *MC_Stop* and *MC_Reset* in *TcMC2.Lib*).
42F0	17136	Parameter	**Number of auxiliary axes invalid**
			The local number of auxiliary axes does not tally with the global number of auxiliary axes.
42F1	17137	Parameter	**Reduction parameter for auxiliary axes invalid**
			The velocity reduction parameters for the auxiliary axes are inconsistent.

Error(Hex)	Error(Dec)	Error type	Description	
42F2	17138	Parameter	**Dynamic parameters for auxiliary axes invalid**	
			The dynamic parameters for the auxiliary axes are inconsistent.	
42F3	17139	Parameter	**Coupling parameters for auxiliary axes invalid**	
			The coupling parameters for the auxiliary axes are inconsistent.	
42F4	17140	Parameter	**Auxiliary axis entry invalid**	
			The auxiliary axis entry is empty (no axis motion).	
42F6	17142	Parameter	**Parameter invalid**	
			The limit for velocity reduction of the auxiliary axes is invalid. It has to be in the interval [0..1].	
42F8	17144	Parameter	**BlockSearch - segment not found**	
			The segment specified as parameter could not be found until the end of the NC program. Possible cause: - nBlockId is not specified in the mode described by eBlockSearchMode. - 0 is not a valid nBlockId.	
42F9	17145	Parameter	**Blocksearch - Invalid remaining segment length**	
			The remaining distance in the fLength parameter is incorrectly parameterized.	
42FB	17147	Internal	**Internal error in connection with coupled axes (slave axes)**	
			Internal fatal error when using coupled axes (slave axes). Inconsistent internal state. Please contact our Support.	
42FC	17148	Parameter	**Parameter for maximum number of jobs (entries) to be transferred is invalid**	
			The parameter describing the maximum number of entries to be transferred from the SVB to the SAF table per NC cycle is invalid.	
			Value range: [1, 20]	Unit: 1
42FF	17151	Monitoring	**Customer-specific error**	
			This is a customer-specific monitoring function.	

6.2.4   Axis Errors

Error(Hex)	Error(Dec)	Error type	Description	
4300	17152	Parameter	**Axis ID not allowed**	
			The value for the axis ID is not allowed, e.g. because it has already been assigned, is less than or equal to zero, is greater than 255, or does not exist in the current configuration.	
			Value range: [1 ... 255]	Unit: 1
4301	17153	Parameter	**Axis type not allowed**	
			The value for the axis type is not allowed because it is not defined. Type 1: servo Type 2: fast/creep Type 3: stepper motor	
			Value range: [1 ... 3]	Unit: 1

Error(Hex)	Error(Dec)	Error type	Description	
4306	17158	Parameter	**Slow manual velocity not allowed**	
			The value for the slow manual velocity is not allowed.	
			Value range: [0.0, 10000.0]	Unit: e.g. m/min
4307	17159	Parameter	**Fast manual velocity not allowed**	
			The value for the fast manual velocity is not allowed.	
			Value range: [0.0, 10000.0]	Unit: e.g. m/min
4308	17160	Parameter	**Rapid traverse velocity not allowed**	
			The value for the rapid traverse velocity is not allowed.	
			Value range: [0.0, 10000.0]	Unit: e.g. m/min
4309	17161	Parameter	**Axis acceleration not allowed**	
			The value for the axis acceleration is not allowed.	
			Value range: [0.0, 1000000.0]	Unit: e.g. m/s/s
430A	17162	Parameter	**Axis deceleration not allowed**	
			The value for the axis deceleration is not allowed.	
			Value range: [0.0, 1000000.0]	Unit: e.g. m/s/s
430B	17163	Parameter	**Axis jerk not allowed**	
			The value for the axis jerk is not allowed.	
			Value range: [0.0, 1000000.0]	Unit: e.g. m/s/s/s
430C	17164	Parameter	**Delay time between position and velocity is not allowed (dead time compensation).**	
			The value for the delay time between position and velocity ("dead time compensation") is not allowed.	
			Value range: [0, 0.1]	Unit: s
430D	17165	Parameter	**Override type not allowed**	
			The value for the velocity override type is not allowed as it is not defined. Type 1: Related to internal reduced velocity (default value) Type 2: Related to original external start velocity	
			Value range: [1 ... 4]	Unit: 1
430E	17166	Parameter	**NCI: Velo-Jump-Factor not allowed**	
			The value for the velo-jump-factor ("VeloJumpFactor") is not allowed. This parameter only works for TwinCAT NCI.	
			Value range: [0, 1000000]	Unit: 1
430F	17167	Parameter	**NCI: Radius of tolerance sphere for the auxiliary axis is invalid**	
			It was tried to enter an invalid value for the size of the tolerance sphere. This sphere affects only auxiliary axes!	
			Value range: [0, 1000]	Unit: e.g. mm
4310	17168	Parameter	**NCI: Value for maximum deviation for the auxiliary axis is invalid**	
			It was tried to enter an invalid value for the maximum allowed deviation. This parameter affects only auxiliary axes!	
			Value range: [0, 10000]	Unit: e.g. mm
4312	17170	Parameter	**Referencing velocity in direction of cam not allowed**	
			The value for the referencing velocity in the direction of the referencing cam is not allowed.	
			Value range: [0.0, 10000.0]	Unit: e.g. m/min

Error(Hex)	Error(Dec)	Error type	Description
4313	17171	Parameter	**Referencing velocity in sync direction not allowed**
			The value for the referencing velocity in the direction of the sync pulse (zero track) is not allowed.
			Value range: [0.0, 10000.0] · Unit: e.g. m/min
4314	17172	Parameter	**Pulse width in positive direction not allowed**
			The value for the pulse width in the positive direction is not allowed (pulsed operation). The use of the pulse width for positioning is chosen implicitly through the axis start type. Pulsed operation corresponds to positioning with a relative travel path that corresponds precisely to the pulse width.
			Value range: [0.0, 1000000.0] · Unit: e.g. mm
4315	17173	Parameter	**Pulse width in negative direction not allowed**
			The value for the pulse width in the negative direction is not allowed (pulsed operation). The use of the pulse width for positioning is chosen implicitly through the axis start type. Pulsed operation corresponds to positioning with a relative travel path that corresponds precisely to the pulse width.
			Value range: [0.0, 1000000.0 · Unit: e.g. mm
4316	17174	Parameter	**Pulse time in positive direction not allowed**
			The value for the pulse width in the positive direction is not allowed (pulsed operation).
			Value range: [0.0, 600.0] · Unit: s
4317	17175	Parameter	**Pulse time in negative direction not allowed**
			The value for the pulse width in the negative direction is not allowed (pulsed operation).
			Value range: [0.0, 600.0] · Unit: s
4318	17176	Parameter	**Creep distance in positive direction not allowed**
			The value for the creep distance in the positive direction is not allowed.
			Value range: [0.0, 100000.0] · Unit: e.g. mm
4319	17177	Parameter	**Creep distance in negative direction not allowed**
			The value for the creep distance in the negative direction is not allowed.
			Value range: [0.0, 100000.0] · Unit: e.g. mm
431A	17178	Parameter	**Braking distance in positive direction not allowed**
			The value for the braking distance in the positive direction is not allowed.
			Value range: [0.0, 100000.0] · Unit: e.g. mm
431B	17179	Parameter	**Braking distance in negative direction not allowed**
			The value for the braking distance in the negative direction is not allowed.
			Value range: [0.0, 100000.0] · Unit: e.g. mm
431C	17180	Parameter	**Deceleration time in positive direction not allowed**
			The value for the deceleration time in the positive direction is not allowed.
			Value range: [0.0, 60.0] · Unit: s
431D	17181	Parameter	**Deceleration time in negative direction not allowed**
			The value for the deceleration time in the negative direction is not allowed.
			Value range: [0.0, 60.0] · Unit: s

Error(Hex)	Error(Dec)	Error type	Description	
431E	17182	Parameter	**Switching time from rapid to slow traverse not allowed**	
			The value for the time to switch from rapid to slow traverse is not allowed.	
			Value range: [0.0, 60.0]	Unit: s
431F	17183	Parameter	**Creep distance for stop not allowed**	
			The value for the creep distance for an explicit stop is not allowed.	
			Value range: [0.0, 100000.0]	Unit: e.g. mm
4320	17184	Parameter	**Motion monitoring not allowed**	
			The value for the activation of the motion monitoring is not allowed.	
			Value range: [0, 1]	Unit: 1
4321	17185	Parameter	**Position window monitoring not allowed**	
			The value for the activation of the position window monitoring is not allowed.	
			Value range: [0, 1]	Unit: 1
4322	17186	Parameter	**Target window monitoring not allowed**	
			The value for the activation of target window monitoring is not allowed.	
			Value range: [0, 1]	Unit: 1
4323	17187	Parameter	**Loop not allowed**	
			The value for the activation of loop movement is not allowed.	
			Value range: [0, 1]	Unit: 1
4324	17188	Parameter	**Motion monitoring time not allowed**	
			The value for the motion monitoring time is not allowed.	
			Value range: [0.0, 600.0]	Unit: s
4325	17189	Parameter	**Target window range not allowed**	
			The value for the target window is not allowed.	
			Value range: [0.0, 10000.0]	Unit: e.g. mm
4326	17190	Parameter	**Position window range not allowed**	
			The value for the position window is not allowed.	
			Value range: [0.0, 10000.0]	Unit: e.g. mm
4327	17191	Parameter	**Position window monitoring time not allowed**	
			The value for the position window monitoring time is not allowed.	
			Value range: [0.0, 600.0]	Unit: s
4328	17192	Parameter	**Looping distance not allowed**	
			The value for the looping distance is not allowed.	
			Value range: [0.0, 10000.0]	Unit: e.g. mm
4329	17193	Parameter	**Axis cycle time not allowed**	
			The value for the axis cycle time is not allowed.	
			Value range: [0.001, 0.1]	Unit: s
432A	17194	Parameter	**Operation mode stepper motor not allowed**	
			The value for the stepper motor operating mode is not allowed.	
			Value range: [1, 2]	Unit: 1

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Error(Hex)	Error(Dec)	Error type	Description
432B	17195	Parameter	**Displacement per stepper motor step not allowed**
			The value for the displacement associated with one step of the stepper motor is not allowed (step scaling).
			Value range: [0.000001, 1000.0] — Unit: e.g. mm/STEP
432C	17196	Parameter	**Minimum velocity for stepper motor set value profile not allowed**
			The value for the minimum velocity of the stepper motor velocity profile is not allowed.
			Value range: [0.0, 1000.0] — Unit: e.g. m/min
432D	17197	Parameter	**Stepper motor stages for one velocity level not allowed**
			The value for the number of steps for each velocity level in the setpoint generation is not allowed.
			Value range: [0, 100] — Unit: 1
432E	17198	Parameter	**DWORD for the interpretation of the axis units not allowed**
			The value that contains the flags for the interpretation of the position and velocity units is not allowed.
			Value range: [0, 0xFFFFFFFF] — Unit: 1
432F	17199	Parameter	**Maximum velocity not allowed**
			The value for the maximum permitted velocity is not allowed.
			Value range: [0.0, 10000.0] — Unit: e.g. m/min
4330	17200	Parameter	**Motion monitoring window not allowed**
			The value for the motion monitoring window is not allowed.
			Value range: [0.0, 10000.0] — Unit: e.g. mm
4331	17201	Parameter	**PEH time monitoring not allowed**
			The value for the activation of the PEH time monitoring is not allowed (PEH: positioning end and halt).
			Value range: [0, 1] — Unit: 1
4332	17202	Parameter	**PEH monitoring time not allowed**
			The value for the PEH monitoring time (timeout) is not allowed (PEH: positioning end and halt). Default value: 5 s
			Value range: [0.0, 600.0] — Unit: s
4333	17203	Parameter	**Parameter "Brake Release Delay" is invalid**
			The parameter for the brake release delay of a rapid/slow traverse axis is invalid.
			Value range: [0.0, 60.0] — Unit: s
4334	17204	Parameter	**Parameter NC Data Persistence is invalid**
			The boolean parameter NC Data Persistence of an axis is invalid.
			Value range: [0, 1] — Unit: 1
4335	17205	Parameter	**Parameter for the error reaction mode is invalid.**
			The parameter for the error reaction mode of the axis is invalid (instantaneous, delayed).
			Value range: [0, 1] — Unit: 1

Error(Hex)	Error(Dec)	Error type	Description
4336	17206	Parameter	**Parameter for the error reaction delay is invalid**
			The parameter for the error reaction delay of the axis is invalid.
			Value range: [0.0, 1000.0] — Unit: s
4337	17207	Parameter	**Parameter "Use actual values in deactivated state" is invalid.**
			The parameter "Use actual values in deactivated state" is invalid.
			Value range: [0, 1] — Unit: 1
4338	17208	Parameter	**Parameter "Allow motion commands for slave axes" is invalid.**
			The boolean parameter "Allow motion commands for slave axes" is invalid. This parameter determines whether a motion command may be sent to a slave axis or whether this is rejected with an NC error 0x4266 or 0x4267.
			Value range: [0, 1] — Unit: 1
4339	17209	Parameter	**Parameter "Allow motion commands for axis in external setpoint generation" is invalid.**
			The boolean parameter "Allow motion commands for axis in external setpoint generation" is invalid. This parameter determines whether a motion command may be sent to an axis in the external setpoint generation state or whether this is rejected with an error 0x4257.
			Value range: [0, 1] — Unit: 1
433A	17210	Parameter	**Parameter "Fading Acceleration" is invalid.**
			The "Fading Acceleration" parameter for the fading profile from SET to ACTUAL values is invalid. This parameter defines how to fade from a setpoint based axis coupling to an actual value based coupling (indirectly results in a time for the fading).
			The value 0.0 causes the minimum of the default acceleration and default deceleration to be used internally in the NC as the fading acceleration.
			Value range: [0; 0.01 .. 1.0e+20] — Unit: e.g. mm/s^2

Error(Hex)	Error(Dec)	Error type	Description
433B	17211	Parameter	**Fast Axis Stop signal type not allowed**
			The value for the Signal Type of the 'Fast Axis Stop' is not allowed [0...5].
433C	17212	Parameter	**ADS index offset not allowed**
			New value for the 'ADS offset (axis state) ' for user-defined parameter named 'UserData' in AxisRef is invalid.
4340	17216	Initialization	**Axis initialization**
			The axis has not been initialized. Although the axis has been created, the rest of the initialization has not been performed (1. Initialization of axis I/O, 2. Initialization of axis, 3. Reset axis).
4341	17217	Address	**Group address**
			The axis does not have a group, or the group address has not been initialized (group contains the setpoint generation).

Error(Hex)	Error(Dec)	Error type	Description
4342	17218	Address	**Encoder address**
			The axis does not have an encoder, or the encoder address has not been initialized.
4343	17219	Address	**Controller address**
			The axis does not have a controller, or the controller address has not been initialized.
4344	17220	Address	**Drive address**
			The axis does not have a drive, or the drive address has not been initialized.
4345	17221	Address	**Axis interface PLC to NC address**
			The axis has no axis interface from the PLC to the NC (PlcToNc) or the axis interface address has not been initialized.
4346	17222	Address	**Axis interface NC to PLC address**
			The axis has no axis interface from the NC to the PLC (NcToPlc) or the axis interface address has not been initialized.
4347	17223	Address	**Size of the axis interface NC to PLC is not allowed (internal error)**
			The size of the axis interface from NC to PLC (NcToPlc) is not allowed.
4348	17224	Address	**Size of the axis interface PLC to NC is not allowed (internal error)**
			The size of the axis interface from PLC to NC (PlcToNc) is not allowed.
4356	17238	Monitoring	**Controller enable**
			The controller enable for the axis is not available (see axis interface PlcToNc). This enable is required, for instance, for an axis positioning task.
4357	17239	Monitoring	**Feed enable minus**
			A feed enable for movement in the negative direction is not available (see axis interface PlcToNc). This enable is required, for instance, for an axis positioning task in the negative direction.
4358	17240	Monitoring	**Feed enable plus**
			A feed enable for movement in the positive direction is not present (see axis interface PlcToNc). This enable is required, for instance, for an axis positioning task in the positive direction.
4359	17241	Monitoring	**Target velocity not allowed**
			The target velocity requested for a positioning task is not allowed. This can happen if the velocity is less than or equal to zero, larger than the maximum permitted axis velocity, or, in the case of servo drives, is larger than the reference velocity of the axis (see axis and drive parameters).
435A	17242	Monitoring	**Movement smaller than one encoder increment (internal error)**
			The movement required of an axis is, in relation to a positioning task, smaller than one encoder increment (see scaling factor). This information is, however, handled internally in such a way that the positioning is considered to have been completed without an error message being returned.

Error(Hex)	Error(Dec)	Error type	Description
435B	17243	Monitoring	**Set acceleration monitoring (internal error)** The set acceleration has exceeded the maximum permitted acceleration or deceleration parameters of the axis.
435C	17244	Monitoring	**PEH time monitoring** The PEH time monitoring has detected that, after the PEH monitoring time that follows a positioning has elapsed, the target position window has not been reached. The following points must be checked: Is the PEH monitoring time, in the sense of timeout monitoring, set to a sufficiently large value (e.g. 1-5 s)? The PEH monitoring time must be chosen to be significantly larger than the target position monitoring time. Have the criteria for the target position monitoring (range window and time) been set too strictly? **The PEH time monitoring only functions when target position monitoring is active!**
435D	17245	Monitoring	**Motion Monitoring** The actual position of the axis has not changed or has changed only slightly during the motion monitoring time. To avoid an error, the axis must change by more than the parameterized motion monitoring window in at least one NC cycle during the monitoring time. => Check, whether axis is mechanically blocked, or the encoder system failed.
435E	17246	Monitoring	**Looping distance smaller than braking distance** The absolute value of the looping distance is less or equal than the positive or negative braking distance. This is not allowed.
435F	17247	Monitoring	**Starting velocity not allowed** The required starting velocity for a positioning task is not allowed (normally the starting velocity is zero). This can happen if the velocity is less than or equal to zero, larger than the maximum permitted axis velocity, or, in the case of servo drives, is larger than the reference velocity of the axis (see axis and drive parameters).
4360	17248	Monitoring	**Final velocity not allowed** The required final velocity for a positioning task is not allowed (normally the final velocity is zero). This can happen if the velocity is less than or equal to zero, larger than the maximum permitted axis velocity, or, in the case of servo drives, is larger than the reference velocity of the axis (see axis and drive parameters).
4361	17249	Monitoring	**Time range exceeded (future)** The calculated position lies too far in the future (e.g. when converting from a position to an associated DC time).
4362	17250	Monitoring	**Time range exceeded (past)** The calculated position lies too far in the past (e.g. when converting from a position to an associated DC time).

Error(Hex)	Error(Dec)	Error type	Description
4363	17251	Monitoring	**Position cannot be determined**
			The requested position cannot be determined mathematically because a) it has never been reached in the past or b) it will never be reached in the future (e.g. if the axis velocity is zero or if a motion reversal occurs due to an acceleration).
4364	17252	Monitoring	**Position cannot be determined (conflicting direction of travel)**
			The direction of travel expected by the caller of the function deviates from the actual direction of travel (conflict between PLC and NC view, for example when converting a position to a DC time).
4365	17253	Monitoring	**Position not convertible**
			When converting the position to the incremental position, the maximum range of the encoder is violated.
4370	17264	Monitoring	**No slave coupling possible (velocity violation)**
			A slave coupling to a master axis (e.g. by a universal flying saw) is rejected because otherwise the maximum velocity of the slave axis would be exceeded (a velocity monitoring has been selected).
4371	17265	Monitoring	**No slave coupling possible (acceleration violation)**
			A slave coupling to a master axis (e.g. by a universal flying saw) is rejected because otherwise the maximum acceleration of the slave axis would be exceeded (an acceleration monitoring has been selected).
4372 - 438B	17266 - 17291		See TF5055 NC Flying Saw - Error Codes
43A0	17312	Internal	**Axis consequential error**
			Consequential error resulting from another causative error related to another axis. Axis consequential errors can occur in relation to master/slave-couplings or with multiple axis interpolating DXD groups.

6.2.5 Encoder Errors

Error(Hex)	Error(Dec)	Error type	Description	
4400	17408	Parameter	**Encoder ID not allowed**	
			The value for the encoder ID is not allowed, e.g. because it has already been assigned, is less than or equal to zero, or is greater than 255.	
			Value range: [1 ... 255]	Unit: 1
4401	17409	Parameter	**Encoder type not allowed**	
			The value for the encoder type is not allowed as it is not defined. Type 1: Simulation (incremental) Type 2: M3000 (24 bit absolute) Type 3: M31x0 (24 bit incremental) Type 4: KL5101 (16 bit incremental) Type 5: KL5001 (24 bit absolute SSI) Type 6: KL5051 (16 bit BISSI)	
			Value range: [1 ... 6]	Unit: 1

Error(Hex)	Error(Dec)	Error type	Description
4402	**17410**	Parameter	**Encoder mode**
			The value for the encoder mode (operation mode) is invalid. Mode 1: Determination of actual position Mode 2: Determination of actual position and actual velocity (filter)
			Value range: [1, 2] Unit: 1
4403	**17411**	Parameter	**Encoder count direction**
			The flag for the encoder counting direction is not allowed. Flag 0: Positive encoder count direction Flag 1: Negative encoder count direction
			Value range: [0, 1] Unit: 1
4404	**17412**	Initialization	**Calibration state**
			The flag for the calibration state is not allowed. Flag 0: Axis has is not referenced. Flag 1: Axis is referenced.
			Value range: [0, 1] Unit: 1
4405	**17413**	Parameter	**Encoder increments per physical encoder revolution**
			The value for the number of encoder increments for each physical rotation of the encoder is not allowed. This value is used by the software for the calculation of encoder overruns and underruns.
			Value range: [255, 0xFFFFFFFF] Unit: INC
4406	**17414**	Parameter	**Scaling factor**
			The value for the scaling factor is not allowed. This scaling factor provides the weighting for the conversion of an encoder increment (INC) to a physical unit such as millimeters or degrees.
			Value range: [0.000001, 100.0] Unit: e.g. mm/INC
4407	**17415**	Parameter	**Position offset (zero point offset)**
			The value for the position offset of the encoder is not allowed. This value is added to the calculated encoder position, and is interpreted in the physical units of the encoder.
			Value range: [-1000000.0, 1000000.0] Unit: e.g. mm
4408	**17416**	Parameter	**Modulo factor**
			The value for the encoder's modulo factor is not allowed.
			Value range: [1.0, 1.0E+9] Unit: e.g. mm or degrees

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Error(Hex)	Error(Dec)	Error type	Description
4409	**17417**	Parameter	**Position filter time**
			The value for the actual position filter time is not allowed (P-T1 filter).
			Value range: [0.0, 60.0] · Unit: s
440A	**17418**	Parameter	**Velocity filter time**
			The value for the actual velocity filter time is not allowed (P-T1 filter).
			Value range: [0.0, 60.0] · Unit: s
440B	**17419**	Parameter	**Acceleration filter time**
			The value for the actual acceleration filter time is not allowed (P-T1 filter).
			Value range: [0.0, 60.0] · Unit: s
440C	**17420**	Initialization	**Cycle time not allowed (internal error)**
			The value of the SAF cycle time for the calculation of actual values is not allowed (e.g. is less than or equal to zero).
440D	**17421**	Initialization	**Setting of the selected units is invalid**
			Settings for modulo position, velocity etc. lead to an error.
440E	**17422**	Parameter	**Actual position correction / measurement system error correction**
			The value for the activation of the actual position correction ("measuring system error correction") is not allowed.
			Value range: [0, 1]
440F	**17423**	Parameter	**Filter time actual position correction**
			The value for the actual position correction filter time is not allowed (P-T1 filter).
			Value range: [0.0, 60.0] · Unit: 1
4410	**17424**	Parameter	**Search direction for referencing cam inverted**
			The value of the search direction of the referencing cam in a referencing procedure is not allowed. Value 0: Positive direction Value 1: Negative direction
			Value range: [0, 1] · Unit: 1
4411	**17425**	Parameter	**Search direction for sync pulse (zero pulse) inverted**
			The value of the search direction of the sync pulse (zero pulse) in a referencing procedure is not allowed. Value 0: Positive direction Value 1: Negative direction
			Value range: [0, 1] · Unit: 1

Error(Hex)	Error(Dec)	Error type	Description
4412	17426	Parameter	**Reference position**
			The value of the reference position in a referencing procedure is not allowed.
			Value range: [-1000000.0, 1000000.0] — Unit: e.g. mm
4413	17427	Parameter	**Distance monitoring between activation of the hardware latch and occurrence of the sync pulse (obsolete)**
			The flag for the distance monitoring between activation of the hardware latch and occurrence of the sync/zero pulse ("latch valid") is not allowed. Value 0: Passive Value 1: Active
			Value range: [0, 1] — Unit: 1
4414	17428	Parameter	**Minimum gap between activation of the hardware latch and occurrence of the sync pulse (obsolete)**
			The value for the minimum gap in increments between activation of the hardware latch and occurrence of the sync/zero pulse ("latch valid") during a referencing procedure is not allowed.
			Value range: [0, 65536] — Unit: INC
4415	17429	Parameter	**External sync pulse (obsolete)**
			The value of the activation or deactivation of the external sync pulse in a referencing procedure is not allowed. Value 0: Passive Value 1: Active
			Value range: [0, 1] — Unit: 1
4416	17430	Parameter	**Scaling of the noise rate is not allowed**
			The value of the scaling (weighting) of the synthetic noise rate is not allowed. This parameter exists only in the simulation encoder and serves to produce a realistic simulation.
			Value range: [0, 1000000] — Unit: 1
4417	17431	Parameter	**Tolerance window for modulo-start**
			The value for the tolerance window for the modulo-axis-start is invalid. The value must be greater or equal than zero and smaller than the half encoder modulo-period (e.g. in the interval [0.0,180.0]).
			Value range: [0.0, 180.0], Max: 0.5*modulo period — Unit: e.g. mm or degrees

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Error(Hex)	Error(Dec)	Error type	Description
4418	17432	Parameter	**Encoder referencing mode**
			The value for the encoder reference mode is not allowed, resp. is not supported for this encoder type.
			Value range: [0, 5] Unit: 1
4419	17433	Parameter	**Encoder evaluation direction**
			The value for the encoder evaluation direction (log. counting direction) is not allowed.
			Value range: [0, 3] Unit: 1
441A	17434	Parameter	**Encoder absolute dimensioning system**
			The value for the encoder reference system is invalid: 0: INCREMENTAL 1: ABSOLUTE 2: ABSOLUTE+MODULO
			Value range: [0, 2] Unit: 1
441B	17435	Parameter	**Encoder position initialization mode**
			When starting the TC system the value for the encoder position initialization mode is invalid.
			Value range: [0, 1] Unit: 1
441C	17436	Parameter	**Encoder sign interpretation (UNSIGNED / SIGNED data type)**
			The value for the encoder sign interpretation (data type) for the encoder the actual increment calculation is invalid: 0: default/not defined 1: UNSIGNED 2: SIGNED
			Value range: [0, 2] Unit: 1
441D	17437	Parameter	**Homing Sensor Source**
			The value for the Encoder Homing Sensor Source is invalid or not supported for this encoder type.
			Value range: [0, 16] Unit: 1
4420	17440	Parameter	**Software end position monitoring minimum not allowed**
			The value for the activation of the software end position monitoring minimum is not allowed.
			Value range: [0, 1] Unit: 1
4421	17441	Parameter	**Software end position monitoring maximum not allowed**
			The value for the activation of the software end position monitoring maximum is not allowed.
			Value range: [0, 1] Unit: 1

Error(Hex)	Error(Dec)	Error type	Description	
4422	**17442**	Function	**Actual value setting is outside the value range.**	
			The "Set actual value" function cannot be executed because the new actual position is outside the intended value range.	
			Value range: [-1.0E10, 1.0E10]	Unit: e.g. mm
4423	**17443**	Parameter	**Software end position minimum not allowed**	
			The value for the software end position minimum is not allowed.	
			Value range: [-1000000000.0, 1000000000.0]	Unit: e.g. mm
4424	**17444**	Parameter	**Software end position maximum not allowed**	
			The value for the software end position maximum is not allowed.	
			Value range: [-1000000000.0, 1000000000.0]	Unit: e.g. mm
4425	**17445**	Parameter	**Filter mask for the encoder raw value not allowed**	
			The value for the filter mask of the encoder raw value in increments is not allowed.	
			Value range: [0x0, 0xFFFFFFFF]	Unit: 1
4426	**17446**	Parameter	**Reference mask for the encoder raw value not allowed**	
			The value for the reference mask (increments per encoder revolution, absolute resolution) of the encoder raw value in increments is not allowed. This value is used, for example, for referencing an axis with the "Software Sync" referencing mode.	
			Value range: [0x0000000F, 0xFFFFFFFF]	Unit: 1
4427	**17447**	Parameter	**Parameter "Dead time compensation mode" (encoder) is invalid.**	
			The parameter for the dead time compensation mode on the NC encoder is invalid (OFF, ON with velocity, ON with velocity and acceleration).	
			Value range: [0, 1, 2]	Unit: 1

Error(Hex)	Error(Dec)	Error type	Description
4428	**17448**	Parameter	**Parameter 'Control bits of the dead time compensation' (encoder) is invalid.**
			The parameter for the control bits of the dead time compensation at the encoder is invalid (e.g. relative or absolute time interpretation).
			Value range: [>0] Unit: 1
4429	**17449**	Parameter	**Parameter 'time shift of dead time compensation mode' (encoder) is invalid.**
			The parameter for the time shift of the dead time compensation (Time Shift in nanoseconds) at the encoder is invalid.
			Value range: [-1.0E9 .. 1.0E9] Unit: ns
4430	**17456**	Function	**Hardware latch activation (encoder)**
			Activation of the encoder hardware latch was implicitly initiated by the referencing procedure. If this function has already been activated but a latch value has not yet become valid ("latch valid"), another call to the function is refused with this error.
4431	**17457**	Function	**Activation of external hardware latch / touch probe function (encoder)**
			The activation of the external hardware latch (only available for KL5101, SERCOS, AX2xxx) is initiated explicitly by an ADS command (called from the PLC program of the Visual Basic interface). If this function has already been activated, but the latch value has not yet been made valid by an external signal ("external latch valid" or "touch probe latched" or "real-time status bit"), another call to the function is refused with this error. It is also possible that this function cannot be executed because of another simultaneous function, such as referencing an incremental encoder axis.
4432	**17458**	Function	**External hardware latch activation (encoder)**
			If a referencing procedure has previously been initiated and the hardware still signals a valid latch value ("latch valid"), this function must not be called. However, this error can never actually occur in practice.

Error(Hex)	Error(Dec)	Error type	Description
4433	**17459**	Function	**Activation of external hardware latch / touch probe function (encoder)** This function has been activated before and has not been finished since (the internal handshake communication between NC and I/O device is still active). In the meantime, a renewed activation is not allowed and is therefore rejected with an error. (If this function has already been triggered before and the hardware still signals that the external latch value is already valid ("external latch valid" or "touch probe" or "real-time status bit"), a renewed activation must not be executed. In this case, the validity of the external hardware latch would be signaled immediately by mistake (but still with an old latch value).
4434	**17460**	Monitoring	**Encoder function is not supported** An encoder function has been activated that is currently not released for use, or which is not even implemented.
4435	**17461**	Monitoring	**Encoder function is already active** An encoder function cannot been activated because this functionality is already active.
4440	**17472**	Initialization	**Encoder initialization** Encoder has not been initialized. Although the axis has been created, the rest of the initialization has not been performed: 1. Initialization of axis I/O 2. Initialization of axis 3. Reset axis
4441	**17473**	Address	**Axis address** The encoder does not have an axis, or the axis address has not been initialized.
4442	**17474**	Address	**Address I/O input structure** Drive has no valid I/O input address in the process image.
4443	**17475**	Address	**Address I/O output structure** The encoder does not have a valid I/O output address in the process image.
4450	**17488**	Monitoring	**Encoder counter underflow monitoring** The encoder's incremental counter has underflowed.
4451	**17489**	Monitoring	**Encoder counter overflow monitoring** The encoder's incremental counter has overflowed.

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Error(Hex)	Error(Dec)	Error type	Description
4460	**17504**	Monitoring	**Minimum software position limit (axis start)** While monitoring for the minimum software position limit is active, an axis start has been performed on a position that is below the minimum software position limit.
4461	**17505**	Monitoring	**Maximum software position limit (axis start)** While monitoring for the maximum software position limit is active, an axis start has been performed on a position that is above the maximum software position limit.
4462	**17506**	Monitoring	**Minimum software position limit (positioning process)** While monitoring for the minimum software position limit is active, the actual position has fallen below the minimum software position limit. For servo axes - they are continuously guided - this limit is extended by the amount of the parameterized lag error window.
4463	**17507**	Monitoring	**Maximum software position limit (positioning process)** While monitoring for the maximum software position limit is active, the actual position has exceeded the maximum software position limit. For servo axes - they are continuously guided - this limit is extended by the amount of the parameterized lag error window.
4464	**17508**	Monitoring	**Encoder hardware error** The drive resp. the encoder system reports a hardware error of the encoder. An optional error code can probably be found in the message in the event display.
4465	**17509**	Monitoring	**Position initialization error at system startup** When the actual position was initialized for the first time, it was outside the minimum and maximum end positions for all three initialization attempts (without overflow/underflow, with underflow/overflow).

Error(Hex)	Error(Dec)	Error type	Description
4466	**17510**	Monitoring	**Invalid I/O data for more than n continuous NC cycles (encoder)**
			The axis (encoder) has detected invalid encoder I/O data for more than n continuous NC cycles (NC SAF task) (e.g. n=3). Typically, an EtherCAT device is a "Working Counter Error" (WcState), which shows that the data transmission between I/O device and controller is disturbed.
			If this error is continuously present for a longer period of time, then this can lead to the loss of the referencing of the axis (the "Homed" flag is reset and the encoder gets the state "unreferenced").
			Possible reasons for this error: An EtherCAT slave may have left its OP state, the real-time load on the controller is too high or the real-time jitter is too high.
4467	**17511**	Monitoring	**Invalid actual position (encoder)**
			The I/O device returns an invalid actual position (for CANopen/CoE see bit 13 of encoder state "TxPDO data invalid" or "invalid actual position value").
4468	**17512**	Monitoring	**Invalid I/O input data (error type 1)**
			The monitoring of the "cyclic I/O input counter" (2-bit counter) has detected an error. The input data has not been updated for at least 3 NC-SAF cycles (the 2-bit counter shows a constant value for several NC-SAF cycles instead of increasing by exactly 1 from cycle to cycle).
4469	**17513**	Monitoring	**Invalid I/O input data (error type 2)**
			The monitoring of the "cyclic I/O input counter" (2-bit counter) has detected an error. The quality of the input data, based on the 2-bit counter, is not sufficient (there is a simple statistical evaluation here that evaluates both GOOD cases and BAD cases and leads to an error if a specific threshold value is exceeded).
4470	**17520**	Monitoring	**SSI transformation faulty or not finished**
			The SSI transformation of the FOX 50 module was faulty for some NC-cycles or did not finished respectively.
44A2	**17570**	Monitoring	**Internal error**
			ENCERR_ADDR_CONTROLLER
44A3	**17571**	Monitoring	**Internal error**
			ENCERR_INVALID_CONTROLLERTYPE

6.2.6   Controller Errors

Error(Hex)	Error(Dec)	Error type	Description
4500	17664	Parameter	**Controller ID not allowed**
			The value for the controller ID is not allowed, e.g. because it has already been assigned, is less than or equal to zero, or is greater than 255.
			Value range: [1 ... 255] — Unit: 1
4501	17665	Parameter	**Controller type not allowed**
			The value for the controller type is unacceptable because it is not defined. Type 1: P-controller (position) Type 7: Fast/creep controller Type 8: Stepper motor controller Type 9: Sercos controller
			Value range: [1 ... 9] — Unit: 1
4502	17666	Parameter	**Operation mode controller not allowed**
			The value for the controller operating mode is not allowed.
			Value range: [1] — Unit: 1
4503	17667	Parameter	**Weighting of the velocity pre-control not allowed**
			The value for the percentage weighting of the velocity pre-control is not allowed. The parameter is pre-set to 1.0 (100%) as standard.
			Value range: [0.0 ... 1.0] — Unit: %
4504	17668	Parameter	**Lag error monitor (position) not allowed**
			The value for the activation of the lag error monitor is not allowed.
			Value range: [0, 1] — Unit: 1
4505	17669	Parameter	**Lag monitoring (velocity) not allowed**
			The value for the activation of the lag error monitoring (velocity) is not allowed.
			Value range: [0, 1] — Unit: 1
4506	17670	Parameter	**Lag error window (position) not allowed**
			The value for the lag error window (maximum allowable lag error) is not allowed.
			Value range: [0.0, 10000.0] — Unit: e.g. mm
4507	17671	Parameter	**Lag error filter time (position) not allowed**
			The value for the lag error filter time (position) is not allowed.
			Value range: [0.0, 600.0] — Unit: s

Error(Hex)	Error(Dec)	Error type	Description
4508	17672	Parameter	**Lag error window (velocity) not allowed**
			The value for the lag error window (velocity) is not allowed.
			Value range: [0.0, 10000.0] · Unit: e.g. m/min
4509	17673	Parameter	**Lag error filter time (velocity) not allowed**
			The value for the lag error filter time (velocity) is not allowed.
			Value range: [0.0, 600.0] · Unit: s
450A	17674	Parameter	**Controller output limitation (output limitation) not allowed**
			The value for the output limitation of the controller at the total manipulated variable is invalid. The default setting is 0.5 (50 percent). Typically, this parameter is effective if the velocity interface has been parameterized for the drive unit and the NC executes the position control of the position on the controller.
			Value range: [0.0, 1.0] · Unit: %
4510	17680	Parameter	**Proportional gain Kv or Kp (controller) not allowed**
			Position The value for the proportional gain (Kv factor or Kp factor) is not allowed.
			Value range: [0.0, 10000.0] · Unit: e.g. mm/s/mm
4511	17681	Parameter	**Integral action time Tn (controller) not allowed**
			Position The value for the integral action time is not allowed (I part of the PID T1 controller).
			Value range: [0.0, 60.0] · Unit: s
4512	17682	Parameter	**Rate time Tv (controller) not allowed**
			Position The value for the derivative action time is not allowed (D part of the PID T1 controller).
			Value range: [0.0, 60.0] · Unit: s
4513	17683	Parameter	**Damping time Td (controller) not allowed**
			Position The value for the damping time is not allowed (D part of the PID T1 controller).
			Value range: [0.0, 60.0] · Unit: s

Error(Hex)	Error(Dec)	Error type	Description
4514	17684	Function	**Activation of the automatic offset calibration not allowed**
			Activation of the automatic offset calibration is only possible for certain types of controller (with no I component).
4515	17685	Parameter	**Additional proportional gain Kv or Kp (controller) not allowed**
			Position The value for the second term of the proportional gain (Kv factor or Kp factor) is not allowed.
			Value range: [0.0, 10000.0] / Unit: e.g. mm/s/mm
4516	17686	Parameter	**Reference velocity for additional proportional gain Kv or Kp (controller) not allowed**
			Position The value for the reference velocity percentage data entry, to which the additional proportional gain is applied, is not allowed. The standard setting for the parameter is 0.5 (50%).
			Value range: [0.0 ... 1.0] / Unit: %
4517	17687	Parameter	**Proportional gain Pa (proportion) not allowed**
			Acceleration The value for the proportional gain (Pa factor) is not allowed.
			Value range: [0.0, 1000000.0] / Unit: s
4518	17688	Parameter	**Proportional gain Kv (controller) not allowed**
			Velocity The value for the proportional gain (Kv factor) is not allowed.
			Value range: [0.0, 10000.0] / Unit: 1
4519	17689	Parameter	**Integral action time Tn (controller) not allowed**
			Velocity The value for the integral action time is not allowed (I part of the PID T1 controller).
			Value range: [0.0, 60.0] / Unit: s
451A	17690	Parameter	**Reserved**
			Reserved, currently not used.
451B	17691	Parameter	**Reserved**
			Reserved, currently not used.

Error(Hex)	Error(Dec)	Error type	Description
451C	**17692**	Parameter	**Velocity filter time not allowed**
			The parameter for the velocity filter time in seconds is invalid (`P-T1` filter). This filter can be used in the `NC` for filtering an actual velocity or a velocity difference (`Geschwindigkeitsfehler = Soll-Geschwindigkeit - Ist-Geschwindigkeit`) in special `NC` controllers (e.g. in the torque interface).
			Value range: [0.0, 60.0] / Unit: s
451D	**17693**	Parameter	**Dead range not allowed**
			The value for the dead range (neutral zone) of the position error or the velocity error (control deviation) is not allowed (applies to more complex controllers with velocity or torque interface).
			Value range: [0.0, 10000.0] / Unit: mm or mm/s
451F	**17695**	Parameter	**Proportional gain Kcp not allowed**
			The parameter for the proportional gain `Kcp` of the slave coupling difference control is invalid.
			Value range: [0.0, 10000.0] / Unit: e.g. mm^2/mm
4520	**17696**	Parameter	**Rate time Tv (controller) not allowed**
			Velocity The value for the derivative action time is not allowed (D part of the PID T1 controller).
			Value range: [0.0, 60.0] / Unit: s
4521	**17697**	Parameter	**Damping time Td (controller) not allowed**
			Velocity The value for the damping time is not allowed (D part of the PID T1 controller). Suggested value: 0.1 * Tv
			Value range: [0.0.. 60.0] / Unit: s
4522	**17698**	Parameter	**Limitation of the I part not allowed**
			The parameter for limiting the `I`-part of a `PI`- or `PID`-controller is not allowed. This internal state variable can be limited in percentage (`1.0` corresponds to `100` percent).
			Value range: [0.0 .. 1.0] / Unit: %

Error(Hex)	Error(Dec)	Error type	Description
4523	**17699**	Parameter	**Limitation of the D part not allowed**
			The parameter for limiting the D-part of a `PI`- or `PID`-controller is not allowed. This internal state variable can be limited in percentage (`1.0` corresponds to `100` percent).
			Value range: [0.0 .. 1.0] Unit: %
4524	**17700**	Parameter	**Parameter 'Deactivation of the I part during travel' not allowed**
			The boolean parameter for switching off the `I`-part during active positioning is invalid.
			Value range: [0, 1] Unit: 1
4525	**17701**	Parameter	**Parameter 'Filter time for P-T2 filter' not allowed**
			The time `T0` in seconds is not permissible as a filter time for the `P-T2` element of the velocity controller. The filter time must be less than twice the NC SEC cycle time.
			Value range: [0.0, 60.0] Unit: s
4526	**17702**	Parameter	**Velocity observer: 'Parameterized mode' is not allowed**
			The parameterized mode (`0=OFF`, `1=LUENBERGER`) for the velocity observer of the special `NC` controller in the torque interface is not permitted.
			Value range: [0, 1] Unit: 1
4527	**17703**	Parameter	**Velocity observer: 'Motor torque constant Kt or Kf' is not allowed**
			The parameter for the motor torque constant `Kt` (rotary motor) or `Kf` (linear motor) of the velocity observer of the special NC controller in the torque interface is invalid.
			Value range: [0.0 .. 100000.0] Unit: Nm/A or N/A
4528	**17704**	Parameter	**Velocity observer: 'Motor moment of inertia JM' is not allowed**
			The parameter for the motor moment of inertia J_M of the velocity observer of the special NC controller in the torque interface is invalid.
			Value range: [0.0001 .. 100000.0] Unit: kg cm^2

Error(Hex)	Error(Dec)	Error type	Description
4529	17705	Parameter	**Velocity observer: 'Bandwidth f0' is not allowed**
			The parameter for the bandwidth f_0 of the velocity observer of the special NC controller in the torque interface is invalid. The bandwidth must be less than the reciprocal of 6 times the NC cycle time ($f_0 < 1/(6*T)$).
			Value range: [0.0 .. 10000.0] · Unit: Hz
452A	17706	Parameter	**Velocity observer: 'Correction factor kc' is not allowed**
			The parameter for the correction factor k_c of the velocity observer of the special NC controller in the torque interface is invalid. The correction factor k_c establishes the relationship between current and acceleration or angular acceleration.
			Value range: [0.0 .. 100.0] · Unit: s
452B	17707	Parameter	**Velocity observer: 'Time constant T for 1st order filter' is not allowed**
			The time constant T for the 1st order velocity filter (PID-T_2 or "Lead Lag") of the velocity observer of the special NC controller in the torque interface is not allowed. The correction factor k_c establishes the relationship between current and acceleration or angular acceleration.
			Value range: [0.0 .. 100.0] · Unit: s
452C	17708	Parameter	**Velocity observer: 'Amplitude damping d for 2nd order filter' is not allowed**
			The high-pass/low-pass amplitude attenuation d_{HP} or d_{TP} for the 2nd order velocity filter ("bi-quad") of the velocity observer of the special NC controller in the torque interface is not allowed.
			Value range: [0.2 .. 10.0] · Unit: 1
452D	17709	Parameter	**Velocity observer: 'Frequency fHP or fTP for 2nd order filter' is not allowed**
			The high-pass/low-pass frequency f_{HP} or f_{TP} for the 2nd order velocity filter ("bi-quad") of the velocity observer of the special NC controller in the torque interface is not allowed.
			Value range: [0.0, ... 10000.0] · Unit: Hz

Error(Hex)	Error(Dec)	Error type	Description
4540	**17728**	Initialization	**Controller initialization**
			The controller has not been initialized. Although the controller has been created, the rest of the initialization has not been performed (1. Initialization of controller, 2. Reset of controller).
4541	**17729**	Address	**Axis address**
			The controller does not know its axis, or the axis address has not been initialized.
4542	**17730**	Address	**Drive address**
			The controller does not know its drive, or the drive address has not been initialized.
4550	**17744**	Monitoring	**Lag error monitor (position)**
			While the lag error monitor was active (position), the lag error was exceeded by an amount greater than the lag error window and which lasting longer than the parameterized lag error filter time.
4551	**17745**	Monitoring	**Lag monitoring (velocity)**
			With active lag error monitoring (velocity) a velocity lag error exceedance has occurred, whose magnitude is greater than the lag error window, and whose duration is longer than the parameterized lag error filter time.
45A0	**17824**	Monitoring	**Internal error**
			CONTROLERR_RANGE_AREA_ASIDE
45A1	**17825**	Monitoring	**Internal error**
			CONTROLERR_RANGE_AREA_BSIDE
45A2	**17826**	Monitoring	**Internal error**
			CONTROLERR_RANGE_QNENN
45A3	**17827**	Monitoring	**Internal error**
			CONTROLERR_RANGE_PNENN
45A4	**17828**	Monitoring	**Internal error**
			CONTROLERR_RANGE_AXISIDPRESP0

6.2.7 Drive error

Error(Hex)	Error(Dec)	Error type	Description
4600	**17920**	Parameter	**Drive ID not allowed**
			The value for the drive ID is not allowed, e.g. because it has already been assigned, is less than or equal to zero, or is bigger than 255.
			Value range: [1 ... 255] Unit: 1

Error(Hex)	Error(Dec)	Error type	Description
4601	**17921**	Parameter	**Drive type not allowed**
			The value for the drive type is not allowed as it is not defined.
			Value range: [1, 20] — Unit: 1
4602	**17922**	Parameter	**Drive operation mode not allowed**
			The value for the drive operation mode is not allowed (mode 1: default).
			Value range: [1] — Unit: 1
4603	**17923**	Parameter	**Motor polarity not allowed**
			The flag for the motor polarity is invalid. Flag 0: Positive motor polarity Flag 1: Negative motor polarity
			Value range: [0, 1] — Unit: 1
4604	**17924**	Parameter	**Drift compensation/velocity offset (DAC offset)**
			The value for the drift compensation (DAC offset) is impermissible.
			Value range: [-100.0, 100.0] — Unit: e.g. m/min
4605	**17925**	Parameter	**Reference velocity (velocity pre-control)**
			The value for the reference velocity (also called velocity pre-control) is impermissible.
			Value range: [0.0, 10000.0] — Unit: e.g. m/min
4606	**17926**	Parameter	**Reference output in percent**
			The value for the reference output in percent is impermissible. The value 1.0 (100 %) usually corresponds to a voltage of 10.0 V.
			Value range: [0.0, 5.0] — Unit: %
4607	**17927**	Parameter	**Quadrant compensation factor not allowed**
			The value for the quadrant compensation factor is impermissible.
			Value range: [0.0, 100.0] — Unit: 1
4608	**17928**	Parameter	**Velocity reference point in percent**
			The value for the velocity reference point in percent is impermissible. The value 1.0 corresponds to 100 percent.
			Value range: [0.01, 1.0] — Unit: %
4609	**17929**	Parameter	**Output reference point**
			The value for the output reference point in percent is impermissible. The value 1.0 corresponds to 100 percent.
			Value range: [0.01, 1.0] — Unit: %
460A	**17930**	Parameter	**Minimum or maximum output limits (output limitation)**
			The value for the minimum and/or maximum output limit is impermissible. This will happen if the value range is exceeded, the maximum limit is smaller than the minimum limit, or the distance between the minimum and maximum limits is zero. The minimum limit is initially set to −1.0 (-100 percent) and the maximum limit to 1.0 (100 percent).
			Value range: [-1.0, 1.0] — Unit: %

Error(Hex)	Error(Dec)	Error type	Description
460B	17931	Parameter	**Parameter 'Maximum value for output' is not allowed**
			The value for the maximum number of output digits of the drive (maximum output value) is not allowed. Depending on the interface used (e.g. position, velocity or torque/current). For a velocity interface this is often a signed 16 bit output value (± 32767).
			Value range: [0x000000FF .. 0xFFFFFFFF] Unit: INC or Digits
460C	17932	Parameter	**Parameter 'Internal Drive Control Word' is not allowed**
			The value as internal Drive Control Word for the NC is not allowed. This contains information from the development environment to the NC, which is evaluated by the NC at the TC start.
			Value range: [>0] Unit: 1
460D	17933	Parameter	**Parameter 'Internal timer for RESET behavior Drive' is not allowed**
			The special parameter that influences the internal time behavior between NC Drive and the IO Drive (servo drive) is not allowed.
			Value range: [>5] Unit: 1 (NC SEC cycles)
460E	17934	Parameter	**Parameter 'Master Motion Controller ID' is not allowed**
			The "Master Motion Controller ID" parameter is not allowed for a further NC Motion Controller in slave mode. An additional NC Motion Controller in slave mode can be used if it is one and the same drive device to which different NC information for different operation modes is connected (e.g. velocity mode and torque mode).
			This parameter is not directly accessible by the user, but can only be influenced indirectly by configuring additional NC motion controllers underneath the NC axis.
			Value range: [0 .. 255] Unit: 1
460F	17935	Parameter	**Drive torque output scaling is not allowed**
			The value is shown as Drive torque output scaling (rotary motor) or as force output scaling (linear motor).
			Value range: [0, 1000000] Unit: 1
4610	17936	Parameter	**Drive velocity output scaling is not allowed**
			The value for the drive velocity output scaling is not allowed.
			Value range: [0, 1000000] Unit: 1
4611	17937	Parameter	**Profi Drive DSC proportional gain Kpc (controller) not allowed**
			Position The value for the Profi Drive DSC position control gain (Kpc factor) is impermissible.
			Value range: [0, 0xFFFFFF] Unit: 0.001 * 1/s
4612	17938	Parameter	**Table ID is not allowed**
			The value for the table ID is impermissible.
			Value range: [0, 255] Unit: 1
4613	17939	Parameter	**Table interpolation type is not allowed**
			The value is impermissible as the table interpolation type.
			Value range: 0 (LINEAR), 2 (SPLINE) Unit: 1

Error(Hex)	Error(Dec)	Error type	Description
4614	17940	Parameter	**Output offset in percent is not allowed**
			The value is impermissible as an output offset in percent (+/- 1.0).
			Value range: [-1.0, 1.0] — Unit: %
4615	17941	Parameter	**Profi Drive DSC scaling for calculation of 'Xerr' (controller) not allowed**
			Position The value is impermissible as Profi Drive DSC scaling for the calculation of 'Xerr'.
			Value range: [0, 1000000] — Unit: 1
4616	17942	Parameter	**Drive acceleration output scaling not allowed**
			The value is impermissible as drive acceleration/deceleration output scaling.
			Value range: [0, 1000000] — Unit: 1
4617	17943	Parameter	**Drive position output scaling not allowed**
			The value is impermissible as drive position output scaling.
			Value range: [0, 1000000] — Unit: 1
4618	17944	Parameter	**Parameter 'Dead time compensation mode' (Motion Controller) is invalid**
			The parameter for the dead time compensation mode of the NC Motion Controller is invalid (OFF, ON with velocity, ON with velocity and acceleration).
			Value range: [0, 1, 2] — Unit: 1
4619	17945	Parameter	**Parameter 'Control bits of dead time compensation' (motion controller) is invalid**
			The parameter for the "Control bits of the dead time compensation" of the NC motion controller is invalid (e.g. relative or absolute time interpretation).
			Value range: [>0] — Unit: 1
461A	17946	Parameter	**Parameter 'Time shift of dead time compensation mode' (motion controller) is invalid**
			The parameter for the time shift of the dead time compensation (Time Shift in nanoseconds) of the NC Motion Controller is invalid.
			Value range: [-1.0E9 .. 1.0E9] — Unit: ns
461B	17947	Parameter	**Parameter 'Output delay velocity interface Motion Controller' is invalid**
			The parameter for an optional output delay in the velocity interface to the Motion Controller is invalid (Delay Generator Velocity). The maximum permitted delay time must be less than 100 times the NC SEC cycle time.
			Value range: [0.0 .. 0.1] — Unit: s
461C	17948	Parameter	**Drive filter type not allowed for command variable filter for the output position**
			The value is impermissible as a drive filter type for the smoothing of the output position (command variable filter for the setpoint position).
			Value range: [0, 2] — Unit: 1
461D	17949	Parameter	**Drive filter time not allowed for command variable filter for the output position**
			The value is impermissible as a drive filter time for the smoothing of the output position (command variable filter for the setpoint position).
			Value range: [0.0, 1.0] — Unit: s

Error(Hex)	Error(Dec)	Error type	Description
461E	17950	Parameter	**Drive filter order not allowed for command variable filter for the output position**
			The value is impermissible as a drive filter order (P-Tn) for the smoothing of the output position (command variable filter for the setpoint position).
			Value range: [0, 10] Unit: 1
4620	17952	Parameter	**Bit mask for stepper motor cycle not allowed**
			A value of the different stepper motor masks is impermissible for the respective cycle.
			Value range: [0, 255] Unit: 1
4621	17953	Parameter	**Bit mask for stepper motor holding current not allowed**
			The value for the stepper motor holding mask is impermissible.
			Value range: [0, 255] Unit: 1
4622	17954	Parameter	**Scaling factor for actual torque (actual current) not allowed**
			The value is impermissible as a scaling factor for the actual torque (or actual current).
			Value range: [0, 1E+30] Unit:
4623	17955	Parameter	**Filter time for actual torque not allowed**
			The value is impermissible as a filter time for the actual torque (or the actual current) (P-T1 filter).
			Value range: [0.0, 60.0] Unit: s
4624	17956	Parameter	**Filter time for the time derivative of the actual torque not allowed**
			The value as filter time for the time derivative of the actual torque (or the actual current) is not allowed (P-T1 filter).
			Value range: [0.0, 60.0] Unit: s
4625	17957	Parameter	**Parameter 'Drive operation mode' invalid**
			The parameter for the drive operation mode (motion controller operation mode: position mode, velocity mode, torque mode, ...) is invalid. It is possible that an NC operation mode changeover has been attempted or that an attempt was made to activate a preconfigured operation mode during the TC system startup.
			The generic operation modes defined in the NC are implemented by the NC in a drive-specific manner, i.e. in particular for the SERCOS/ SoE and CANopen/ CoE (DS402) protocols. Here, protocol-specific, drive-specific or even vendor-specific features must be taken into account (e.g. with SERCOS/ SoE, predefined operation modes can only be activated at runtime in the SERCOS parameters S-0-0032 to S-0-0035). Furthermore, not every generic NC operation mode can be converted into a drive-specific operation mode (there may be gaps in the specification here).
			The generic NC operation mode 0 is a special case. This value is used as an identifier to activate an NC default mode (if this identifier is known to the NC).
			Value range: [0, >=1] Unit: 1

Error(Hex)	Error(Dec)	Error type	Description
4626	17958	Monitoring	**Motion Controller function is not supported.** A Motion Controller functionality has been triggered that is not enabled for use or is not implemented (e.g. writing or reading a drive operation mode that is not supported by certain Motion Controllers). It is also possible that this functionality is only temporarily unavailable (e.g. because the drive device is in error state or a drive enable is missing).
4627	17959	Function	**DRIVEOPERATIONMODEBUSY** The activation of the drive operation mode failed, because another object with OID… is already using this interface.
4628	17960	Monitoring	**Drive operation mode changeover is not configured or the desired drive operation mode cannot be found.** No drive operation mode changeover has been configured, and in this respect no reading or writing of a drive operation mode is possible. Or the desired drive operation mode has not been found in the list of predefined drive operation modes (e.g. for SoE/ SERCOS). Note for CoE Motion Controllers: Reading or writing the CoE Motion Controller operation mode is only possible if the CoE objects 0x6060 "Modes of operation" and 0x6061 "Modes of operation display" are in the cyclic process data (PDO list) and a valid default operation mode has been configured. Note for SoE Motion Controllers: Reading or writing the current SoE Motion Controller operation mode is only possible if this operation mode has been predefined in one of the SoE parameters S-0-0032 to S-0-0035.
4629	17961	Monitoring	**Feedback drive operation mode changeover** During drive operation mode changeover, the requested operation mode was not consistently reported back within the monitoring time of 8 cycles. **CoE-Motion Controllers:** Reading or writing the CoE Motion Controller operation mode is only possible if the CoE objects 0x6060 "Modes of operation" and 0x6061 "Modes of operation display" are in the cyclic process data (PDO list) and a valid default operation mode has been configured. **SoE-Motion Controllers:** Reading or writing the current SoE Motion Controller operation mode is only possible if this operation mode has been predefined in one of the SoE parameters S-0-0032 to S-0-0035.
0x4630 … 0x463F: Error codes are reserved for external drive errors (e.g. stepper motor terminal or MC_PowerStepper function block).			
4630	17968	Monitoring	**Overtemperature** Overtemperature was detected or reported in the drive or terminal.
4631	17969	Monitoring	**Undervoltage** Undervoltage was detected or reported in the drive or terminal.
4632	17970	Monitoring	**Wire break in phase A** A wire break in phase A was detected or reported in the drive or terminal.
4633	17971	Monitoring	**Wire break in phase B** A wire break in phase B was detected or reported in the drive or terminal.

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Error(Hex)	Error(Dec)	Error type	Description
4634	17972	Monitoring	**Overcurrent in phase A**
			Overcurrent was detected or reported in phase A in the drive or terminal.
4635	17973	Monitoring	**Overcurrent in phase B**
			Overcurrent was detected or reported in phase B in the drive or terminal.
4636	17974	Monitoring	**Torque overload (stall)**
			A torque overload (stall) was detected or reported in the drive or terminal.
4640	17984	Initialization	**Drive initialization**
			Drive has not been initialized. Although the drive has been created, the rest of the initialization has not been performed: 1. Initialization drive I/O 2. Initialization drive 3. Reset drive
4641	17985	Address	**Axis address**
			The drive does not know its axis, or the axis address has not been initialized.
4642	17986	Address	**Address I/O input structure**
			The drive has no valid I/O input address in the process image.
4643	17987	Address	**Address I/O output structure**
			The drive has no valid I/O output address in the process image.
4650	18000	Monitoring	**Drive hardware not ready to operate**
			The drive hardware is not ready for operation. This can be caused by the following reasons: - the drive is in error state (hardware error) - the drive is in the start-up phase (e.g. after an axis reset preceded by a hardware error) - the drive lacks the controller enable (ENABLE). **The time required for the "start-up" of a drive after a hardware error can be in the range of several seconds.**
4651	18001	Monitoring	**Error in the cyclic communication of the drive (Life Counter)**
			Reasons for this could be an interrupted fieldbus or a drive that is in the error state.
4652	18002	Monitoring	**Changing the table ID with active controller enable not allowed**
			Changing (deselecting, selecting) the characteristic curve table ID is not permissible when the controller enable for the axis is active.
4655	18005	Monitoring	**I/O data for more than 'n' continuous NC cycles invalid**
			The axis (encoder or drive) has detected invalid I/O data for more than 'n' continuous NC cycles (NC SAF task) (e.g. n=3). As a consequence it is possible that the encoder referencing flag is reset to FALSE (i.e. the encoder gets the state "unreferenced"). EtherCAT fieldbus: "working counter error ('WCState')" Lightbus fieldbus: "CDL state error ('CdlState')"

6.2.8 Table Errors

Error(Hex)	Error(Dec)	Error type	Description	
4A00	18944	Parameter	**Table ID not allowed**	
			The value for the table ID is not allowed, e.g. because it has already been assigned - is less than or equal to zero - or is greater than 255.	
			Value range: [1 ... 255]	Unit: 1
4A01	18945	Parameter	**Table type not permitted**	
			The value for the table type is not allowed as it is not defined.	
			Value range: [1]	Unit: 1
4A02	18946	Parameter	**Number of lines in the table not allowed**	
			The value of the number of lines in the table is not allowed, because, for example, it is smaller than two at linear interpolation and smaller than four at spline interpolation.	
			Value range: [2, 0xFFFF]	Unit: 1
4A03	18947	Parameter	**Number of columns in the table is not allowed**	
			The value of the number of columns in the table is not allowed, because, for example, it is less than or equal to zero (depends upon the type of table or slave).	
			Value range: [1, 0xFFFF]	Unit: 1
4A04	18948	Parameter	**Step size (position delta) not allowed**	
			The value for the step size between two lines (position delta) is not allowed, because, for example, it is less than or equal to zero.	
			Value range: [0.001, 1.0E+6]	Unit: e.g. mm
4A05	18949	Parameter	**Period not allowed**	
			The value for the period is not allowed, because, for example, it is less than or equal to zero.	
			Value range: [0.001, 1.0E+9]	Unit: e.g. mm
4A06	18950	Parameter	**Table is not monotonic.**	
			The value for the step size is not allowed, because, for example, it is less than or equal to zero.	
4A07	18951	Initialization	**Table sub type not allowed**	
			The value for the table sub-type is unacceptable because it is not defined. Or the table sub-type and the table class (slave type) do not match. Table sub-types: (1) equidistant linear position table, (2) equidistant cyclic position table, (3) non-equidistant linear position table, (4) non-equidistant cyclic position table	
			Value range: [1, 4]	Unit: 1
4A08	18952	Initialization	**Table interpolation type not allowed**	
			The value for the table interpolation type is invalid because it is not defined. Table interpolation types: (0) linear interpolation, (1) 4-point interpolation, (2) spline interpolation	
			Value range: [0, 2]	Unit: 1

Error(Hex)	Error(Dec)	Error type	Description
4A09	18953	Initialization	**Incorrect table main type**
			The table main type is not allowed because it is not defined. Or the table main type and the table class (slave type) do not match. Table main types: (1) cam plate table (camming), (10) characteristic table, (16) 'motion function' table (MF)
4A10	18960	Initialization	**Table initialization**
			The table has not been initialized. Although the table has been created, the rest of the initialization has not been performed. For instance, the number of lines or columns may be less than or equal to zero.
4A11	18961	Initialization	**Not enough memory**
			The table could not be created, since there is not enough memory.
4A12	18962	Function	**Function not executed, function not available**
			The function has not been implemented, or cannot be executed, for the present type of table.
4A13	18963	Function	**Line index not allowed**
			The start line index or the stop line index to be used for read or write access to the table is not allowed. For instance, the line index is greater than the total number of lines in the table.
4A14	18964	Function	**Column index not allowed**
			The start column index or the stop column index to be used for read or write access to the table in not allowed. For instance, the column index is greater than the total number of columns in the table.
4A15	18965	Function	**Number of lines not allowed**
			The number of lines to be read from or written to the table is not allowed. The number of lines must be an integer multiple of the number of elements in a line (n * number of columns).
4A16	18966	Function	**Number of columns not allowed**
			The number of columns to be read from or written to the table is not allowed. The number of columns must be an integer multiple of the number of elements in a column (n * number of lines).
4A17	18967	Function	**Error in scaling or in range entry**
			The entries in the table header are inconsistent, e.g. the scope is empty. If the error is generated during the runtime it is a runtime error and stops the master/slave group.
4A18	18968	Function	**Multi table slave out of range**
			The slave master position is outside the table values for the master. The error is a runtime error, and stops the master/slave group.
4A19	18969	Function	**Solo table underflow**
			The slave master position is outside the table values for the master. The master value of the equidistant table, to be processed linearly, lies under the first table value. The error is a runtime error, and stops the master/slave group.

Error(Hex)	Error(Dec)	Error type	Description
4A1A	18970	Function	**Solo table overflow**
			The slave master position is outside the table values for the master. The master value of the equidistant table, to be processed linearly, lies above the first table value. The error is a runtime error, and stops the master/slave group.
4A1B	18971	Parameter	**Incorrect execution mode**
			The cyclic execution mode can only be "TRUE" or "FALSE".
4A1C	18972	Parameter	**Invalid parameter**
			The Fifo parameter is not allowed.
4A1D	18973	Parameter	**Fifo is empty**
			The Fifo of the external generator is empty. This can signify an end of track or a runtime error.
4A1E	18974	Parameter	**Fifo is full**
			The Fifo of the external generator is full. It is the user's task to continue to attempt to fill the Fifo with the rejected values.
4A1F	18975	Parameter	**Point index of the motion function is invalid.**
			The point index of a Motion Function Point of a Motion Function Table is invalid. First, the point index must firstly be greater than zero and secondly, it must be numerically consecutive for a column of a Motion Function Table (e.g. 1,2,3,... or 10,11,12,...). **Note: The point index must not be changed online, but must be kept constant.**
4A20	18976	Initialization	**No diagonalization of matrix**
			The spline cannot be calculated. The master positions are not correct.
4A21	18977	Initialization	**Number of spline points to small**
			The number of points of a cubic spline must be at least three. Therefore, the number of lines must be at least three.
4A22	18978	Initialization	**Fifo must not be overwritten.**
			The Fifo of the external generator must not be overwritten, otherwise it would be written over the active processing line. It is up to the user to make sure that no changes or deletions are requested across the active line.
4A23	18979	Function	**Motion Function has too few points**
			The number of valid points defining a Motion Function is less than two. Either the total number is too low or the point type of many points is set to *Ignore Point*.
4A25	18981	Initialization	**Master start position of the table is invalid.**
			For a periodic position table, it is mandatory that the master position of the table starts at zero. For a periodic motion function, the first master position must be greater than zero but not greater than the period of the table.

6.2.9 NC-PLC Errors

Error(Hex)	Error(dec)	Error type	Description
4B00	19200	Parameter	**Axis was stopped.**
			The axis was stopped during travel to the target position. The axis may have been stopped with a PLC command via ADS, a call via AXFNC, or by the TwinCAT development environment.
4B01	19201	Parameter	**The axis cannot be started.**

Error(Hex)	Error(dec)	Error type	Description
			The axis cannot be started because:
			• the axis is in error state,
			• the axis is executing another command,
			• the axis is in protected mode,
			• the axis is not ready for operation.
4B02	19202	Parameter	**Control mode not permitted** No target position control, and no position area control.
4B03	19203	Parameter	**Axis is not moving.** The position and velocity can only be restarted while the axis is physically in motion.
4B04	19204	Parameter	**Mode invalid** Examples: Invalid Direction with MC_MoveModulo. Inactive axis parameter Position correction with MC_BacklashCompensation.
4B05	19205	Parameter	**Command not permitted** • Continuous motion in an unspecified direction • Read/Write parameter: unsuitable type
4B06	19206	Parameter	**Parameter is not correct** • Incorrect override: > 100 % or < 0 % • Incorrect gear ratio: RatioDenominator = 0
4B07	19207	Parameter	**Timeout axis function block** After positioning all "MC_Move..."function blocks, check whether positioning was completed successfully. In the simplest case, the "AxisHasJob" flag of the NC axis is checked, which initially signifies that positioning was logically completed. Depending on the parameterization of the NC axis, further checks (quality criteria) are used: • "Position range monitoring": If position range monitoring is active, the system waits for feedback from the NC. After positioning, the axis must be within the specified positioning range window. If necessary, the position controller ensures that the axis is moved to the target position. If the position controller is switched off (Kv=0) or weak, the target may not be reached. • "Target position monitoring": If target position monitoring is active, the system waits for feedback from the NC. After positioning, the axis must be within the specified target position window for at least the specified time. If necessary, the position controller ensures that the axis is moved to the target position. If the position controller is switched off (Kv=0) or weak, the target may not be reached. Floating position control may lead to the axis oscillating around the window but not remaining inside the window. If the axis is logically at the target position (logical standstill) but the parameterized position window has not been reached, monitoring of the above-mentioned NC feedback is aborted with error 19207 (0x4B07) after a constant timeout of 6 seconds.
4B08	19208	Parameter	**Axis is in protected mode.** The axis is in protected mode (e.g. coupled) and cannot be moved.

Error(Hex)	Error(dec)	Error type	Description
4B09	19209	Parameter	**Axis is not ready.**
			The axis is not ready and cannot be moved.
4B0A	19210	Parameter	**Error during referencing**
			Referencing (homing) of the axis could not be started or was not successful.
4B0B	19211	Parameter	**Incorrect definition of the trigger input**
			The definition of the trigger signal for function block MC_TouchProbe is incorrect. The defined encoder-ID, the trigger signal or the trigger edge are invalid.
4B0C	19212	Function	**Position latch was disabled.**
			The function block MC_TouchProbe has detected that a touch probe cycle it had started was disabled. The reason may be an axis reset, for example.
4B0D	19213	Function	**NC state feedback timeout**
			A function was successfully sent from the PLC to the NC. An expected feedback in the axis status word has not arrived.
4B0E	19214	Function	**Additional product not installed.**
			The function is available as a supplement but is not installed on the system.
4B0F	19215	Function	**No NC Cycle Counter Update**
			The NcToPlc Interface or the NC Cycle Counter in the NcToPlc Interface was not updated.
Error numbers 0x4B10 .. 0x4B2F are used in *TwinCAT NCI* context:			
4B10	19216	Function	**M-function query missing.**
			This error occurs if the M-function was confirmed, but the request bit was not set.
4B11	19217	Parameter	**Zero shift index is outside the range.**
			The index of the zero offset shift is invalid.
4B12	19218	Parameter	**R parameter index or size is invalid.**
			This error occurs if the R parameters are written or read but the index or size are outside the range.
4B13	19219	Parameter	**Index for tool description is invalid.**
			The index for the tool description is invalid.
4B14	19220	Function	**Version of the cyclic channel interface does not match the requested function or the function block.**
			This error occurs if an older TwinCAT version is used to call new functions of a later TcNci.lib version.
4B15	19221	Function	**Channel is not ready for the requested function.**
			The requested function cannot be executed, because the channel is in the wrong state. This error occurs during reverse travel, for example, if the axis was not stopped with ItpEStop first.
4B16	19222	Function	**Requested function is not activated.**
			The requested function requires explicit activation.
4B17	19223	Function	**Axis is already in another group**
			The axis has already been added to another group.
4B18	19224	Function	**Block search could not be executed successfully.**
			The block search has failed.
			Possible causes:

Error(Hex)	Error(dec)	Error type	Description
			• Invalid block number
4B19	**19225**	Parameter	**Blocksearch parameter invalid**
			This error occurs if the function block ItpBlocksearch is called with invalid parameters (e.g. E_ItpDryRunMode, E_ItpBlockSearchMode).
4B20	**19232**	Function	**Cannot add all axes**
			This error occurs if an auxiliary axis is to be added to an interpolation group, but the function fails. It is likely that a preceding instruction of an auxiliary axis was skipped.
Error numbers 0x4B30 .. 0x4B3F are used in the *TcMcCam-Lib* (MC_NC_TableErrorCodes):			
4B30	**19248**	Parameter	**Pointer is invalid.**
			A pointer to a data structure is invalid, e.g. Null.
			• Data structure MC_CAM_REF was not initialized.
4B31	**19249**	Parameter	**Memory size invalid**
			The specification of the memory size (SIZE) for a data structure is invalid.
			• Memory size is 0 or smaller than an element of the addressed data structure.
			• Memory size is smaller than the requested amount of data.
			• Memory size does not match other parameters, such as number of points, number of rows or number of columns.
4B32	**19250**	Parameter	**Cam plate ID is invalid.**
			The ID of a cam plate is not between 1 and 255.
4B33	**19251**	Parameter	**Point ID is invalid.**
			The ID of a point (interpolation point) of a motion function is less than 1.
4B34	**19252**	Parameter	**Number of points is invalid.**
			The number of points (interpolation points) of a cam plate to be read or written is less than 1.
4B35	**19253**	Parameter	**MC table type is invalid.**
			The type of a cam plate does not match the definition *MC_TableType*.
4B36	**19254**	Parameter	**Number of rows invalid**
			The number of rows (interpolation points) of a cam plate is less than 1.
4B37	**19255**	Parameter	**Number of columns invalid**
			The number of columns of a cam plate is invalid.
			• The number of columns of a motion function is not equal 1.
			• The number of columns of a standard cam plate is not equal 2.
			• The number of columns does not match another parameter (ValueSelectMask).
4B38	**19256**	Parameter	**Step size invalid**
			The step size for the interpolation is invalid, e.g. less than or equal to zero.
Error numbers 0x4B0F, 0x4B40 .. 0x4B4F are used in several libraries (*TcNc-Lib / Tc2_MC2_XFC-Lib***):**			
4B40	**19264**	Monitoring	**Terminal type not supported**
			The terminal used is not supported by this function block.

Error(Hex)	Error(dec)	Error type	Description
4B41	19265	Monitoring	**Register read/write error** This error implies a validity error.
4B42	19266	Monitoring	**Axis is enabled.** The axis is enabled but should not be enabled for this process.
4B43	19267	Parameter	**Incorrect size of the compensation table** The specified table size (in bytes) does not match the actual size.
4B44	19268	Parameter	**Positional deviation** The minimum/maximum position in the compensation table does not match the position in the table description (ST_CompensationDesc).
4B45	19269	Parameter	**Not implemented** The requested function is not implemented in this combination.
4B46	19270	Parameter	**Window not in the specified modulo range** The parameterized min or max position is not in the specified modulo range.
4B47	19271	Monitoring	**Buffer overflow** The number of events has led to an overflow of the buffer and not all events could be acquired.
Error numbers 0x4B50 .. 0x4B5F are used in the *TcMcCam-Lib* :			
Error numbers 0x4B60 .. 0x4B6F are used in the *TcMc2-Lib* in the *buffered commands* context:			
4B60	19296	Monitoring	**Motion command did not become active.** A motion command has been started and has been buffered and confirmed by the NC. Nevertheless, the motion command did not become active (possibly due to a termination condition or an internal NC error).
4B61	19297	Monitoring	**Motion command could not be monitored by the PLC.** A motion command has been started and has been buffered and confirmed by the NC. The PLC has not been able to monitor the execution of this command and the execution status is unclear since the NC is already executing a more recent command. The execution state is unclear. This error may come up with very short buffered motion commands which are executed during one PLC cycle.
4B62	19298	Monitoring	**Buffered command was terminated with an error.** A buffered command was terminated with an error. The error number is not available, because a new command is already being executed.
4B63	19299	Monitoring	**Buffered command was completed without feedback** A buffered command was completed but there was no feedback to indicate success or failure.
4B64	19300	Monitoring	**'BufferMode' is not supported by the command.** The 'BufferMode' is not supported by this command.
4B65	19301	Monitoring	**Command number is zero.** The command number for queued commands managed by the system unexpectedly has the value 0.
4B66	19302	Monitoring	**Function block was not called cyclically.**

Error(Hex)	Error(dec)	Error type	Description
			The function block was not called cyclically. The command execution could not be monitored by the PLC, because the NC was already executing a subsequent command. The execution state is unclear.
Error numbers 0x4B70 .. 0x4B8F are used in the *TcPlcInterpolation-Lib* :			
4B71	19313	Parameter	**NCI Entry type invalid** The FB FB_NciFeedTablePreparation was called with an unknown nEntryType.
4B72	19314	Function	**NCI feed table full** The table is full and therefore the entry is not accepted. Remedy: Transfer the contents to the NC kernel with the function block FB_NciFeedTable. If bFeedingDone = TRUE, the table can be reset in FB_NciFeedTablePreparation with bResetTable and then filled with new entries.
4B73	19315	Function	**Internal error**
4B74	19316	Parameter	**ST_NciTangentialFollowingDesc: Tangential axis is not an auxiliary axis.** The entry for tangential following contains a tangential axis that is not an auxiliary axis.
4B75	19317	Parameter	**ST_NciTangentialFollowingDesc** nPathAxis1 or nPathAxis2 is not a path axis. It is therefore not possible to determine the plane.
4B76	19318	Parameter	**ST_NciTangentialFollwoingDesc** nPathAxis1 and nPathAxis2 are the same. It is therefore not possible to determine the plane.
4B77	19319	Parameter	**ST_NciGeoCirclePlane** Circle incorrectly parameterized
4B78	19320	Function	**Internal error** An internal error has occurred in the calculation of the tangential following.
4B79	19321	Monitoring	**Tangential following** Monitoring of the deviation angle was activated during activation of tangential following (E_TfErrorOnCritical1), and an excessively large deviation angle was detected in the current segment.
4B7A	19322	Function	**Reserved** Reserved, currently not used.
4B7B	19323	Parameter	**Tangential following** The radius of the current arc is too small.
4B7C	19324	Parameter	**FB_NciFeedTablePreparation** pEntry is NULL
4B7D	19325	Parameter	**FB_NciFeedTablePreparation** The specified nEntryType does not match the structure type.
4B7E	19326	Parameter	**ST_NciMFuncFast and ST_NciMFuncHsk** The requested M-function is not between 0 and 159.
4B7F	19327	Parameter	**ST_NciDynOvr** The requested value for the dynamic override is not between 0.01 and 1

Error(Hex)	Error(dec)	Error type	Description
4B80	19328	Parameter	**ST_NciVertexSmoothing** Invalid parameter. This error is generated if a negative smoothing radius or an unknown smoothing type is encountered.
4B81	19329	Parameter	**FB_NciFeedTablePrepartion** The requested velocity is not in the valid range.
4B82	19330	Parameter	**ST_Nci*** Invalid parameter
Error numbers 0x4B90 .. 0x4B9F are used in the *Tc3_MC2_AdvancedHoming-Lib* **(PLCopen Part 5: Homing Procedures):**			
4B90	19344	Parameter	**Drive type** The determined drive type is not supported.
4B91	19345	Parameter	**Direction** The direction is impermissible.
4B92	19346		**SwitchMode** The SwitchMode is impermissible.
4B93	19347		**Mode** The mode for the parameter handling is impermissible.
4B94	19348		**Torque limits** The parameterization of the torque limits is inconsistent.
4B95	19349		**Lag error limit** The parameterization of the position lag limit is impermissible (<=0).
4B96	19350		**Distance limit** The parameterization of the distance limit is impermissible (<0).
4B97	19351		**Saving parameters** An attempt was made to back up parameters again, although they have already been backed up.
4B98	19352		**Restoring parameters** An attempt was made to restore parameters, although none have been backed up.
4B9F	19359		**Cancellation of a homing** The abortion of a homing has failed.
Error numbers 0x4BA0 .. 0x4BAF are used in the *TcNcKinematicTransformation-Lib* **:**			
4BA0	19360	Function	**KinGroup error** The kinematic group is in an error state. This error may occur if the kinematic group is in an error state or an unexpected state when it is called (e.g., simultaneous call via several function block instances).
4BA1	19361	Function	**KinGroup timeout** Timeout during call of a kinematic block
Error numbers 0x4BB0 .. 0x4BBF are used in the *Tc2_MC2_Drive-Lib* **:**			
4BB0	19376	Function	**Invalid axis position** The current axis position or the axis position resulting from the new position offset exceeds the valid range of values.
4BB1	19377	Function	**Position offset invalid** The new position offset exceeds the valid range of values [AX5000: 2^31].

Error(Hex)	Error(dec)	Error type	Description
4BB2	19378	Function	**Invalid axis position**
			The current axis position or the axis position resulting from the new position offset falls below the valid range of values.
4BB3	19379	Function	**Position offset invalid**
			The new position offset falls below the valid range of values [AX5000: -2^31].
4BB4	19380	Function	**Deviation of the activated feedback and/or storage location**
			The activated feedback and/or storage location (AX5000: P-0-0275) differ from the parameterization on the function block.
4BB5	19381	Function	**Reinitialization of the NC actual position has failed.**
			The reinitialization of the actual NC position has failed, e.g., reference system = "ABSOLUTE (with single overflow)" & software end position monitoring is disabled.
4BB6	19382	Function	**The setting or deletion of a position offset was rejected.**
			The command to set or delete a position offset was rejected without feedback data, e.g., if the drive controller's firmware does not support the corresponding command.
4BB7	19383	Function	**The setting or deletion of a position offset was rejected.**
			The command to set or delete a position offset was rejected with feedback data. The information in the feedback data may contain further clues to the cause, e.g. if the firmware of the drive controller does not support the corresponding command.
4BB8	19384	Function	**Firmware version invalid**
			A firmware version >= 19 is required for the servo terminal.
4BB9	19385	Function	**Different modulo settings**
			The modulo settings on the drive controller and in the NC are different.
4BBA	19386	Function	**Brake test failed**
			The brake test has failed.
4BBB	19387	Function	**Drive type not supported**
			The determined drive or axis type is not supported.
4BBC	19388	Function	**Command was aborted.**
			The command was aborted by another command.
4BBD	19389	Function	**Timeout**
			The command was aborted due to timeout.
Error numbers 0x4BC0 .. 0x4BCF are used in the *Tc3_DriveMotionControl-Lib* :			
4BC2	19394		**Position offset invalid**
			The new position offset exceeds the valid value range.
4BC3	19395		**I/O data invalid**
			I/O data are invalid or the terminal is in an error state.
4BC4	19396		**ADS port not linked in the interface**
			The ADS port variable of the terminal was not linked to the axis interface of the PLC and parameters of the terminal are to be changed.

6.2.10   Kinematic Transformation

Error(Hex)	Error(Dec)	Error type	Description
4C00	19456		**Transformation failed** The calculation of the transformation failed.
4C01	19457		**Ambiguous solution** The solution for the transformation is not unique.
4C02	19458		**Invalid axis position** The transformation cannot be calculated with the current position data. Possible causes: • The position is outside the working area of the kinematics.
4C03	19459	Configuration	**Invalid dimension** The dimension of the parameterized input parameter does not match the dimension expected by the kinematic object. Possible causes: • Too many position values are supplied for this configuration. Check the number of parameterized axes.
4C04	19460		**Internal error** NCERR_KINTRAFO_REGISTRATION
4C05	19461	Internal	**Newton iteration failed** The Newton iteration does not converge.
4C06	19462	Internal	**Jacobi matrix cannot be inverted** The Jacobi matrix cannot be inverted.
4C07	19463	Configuration	**Invalid cascade** This kinematic configuration is not permitted.
4C08	19464	Programming	**Singularity** The machine configuration results in singular axis velocities.
4C0B	19467	Internal	**No metainfo** The metainfo pointer is null.
4C13	19475	Internal	**NCERR_RBTFRAME_INVALIDWCSTOMCS** The WcsToMcs component used leads to positions that the selected kinematics cannot assume. It is necessary to adjust the WcsToMcs parameters.
4C20	19488	Internal	**Transformation failed** The call of the extended kinematics model has failed.
4C30	19504	Programming	**Invalid input frame** The programmed Cartesian position cannot be approached in the ACS configuration.
4C50	19536	Internal	**Invalid offset** An access violation was detected in the observer.

6.2.11   Bode Return Codes

The following bode plot specific error codes are used in the bode plot server:

Code (Hex)	Code (Dec)	Symbol	Description
0x8100	33024	INTERNAL	Internal error
0x8101	33025	NOTINITIALIZED	Not initialized (e.g. no nc axis)
0x8102	33026	INVALIDPARAM	Invalid parameter
0x8103	33027	INVALIDOFFSET	Invalid index offset
0x8104	33028	INVALIDSIZE	Invalid parameter size
0x8105	33029	INVALIDSTARTPARAM	Invalid start parameter (set point generator)
0x8106	33030	NOTSUPPORTED	Not supported
0x8107	33031	AXISNOTENABLED	Nc axis not enabled
0x8108	33032	AXISINERRORSTATE	Nc axis in error state
0x8109	33033	DRIVEINERRORSTATE	IO drive in error state
0x810A	33034	AXISANDDRIVEINERROR-STATE	Nc axis AND IO drive in error state
0x810B	33035	INVALIDDRIVEOPMODE	Invalid drive operation mode active or requested (no bode plot mode)
0x810C	33036	INVALIDCONTEXT	Invalid context for this command (mandatory task or windows context needed)
0x810D	33037	NOAXISINTERFACE	**Missing TCom axis interface (axis null pointer).** There is no connection to the NC axis. Either no axis (or axis ID) has been parameterized, or the parameterized axis does not exist.
0x810E	33038	INPUTCYCLECOUNTER	**Invalid input cycle counter from IO drive (e.g. frozen).** The cyclic drive data are backed up by an 'InputCycleCounter' during the bode plot recording. This allows firstly the detection of an unexpected communication loss (keyword: LifeCounter) and secondly a check for temporal data consistency to be performed. **Example 1:** This error can occur if the cycle time of the calling task is larger than the assumed drive cycle time (in this case, however, the error occurs right at the start of the recording). **Example 2:** This error can occur if the calling task has real-time errors (e.g. the "Exceed Counter" of the task increments or the task has a lower priority, as is often the case, for example, with the PLC). In this case the error can also occur at any time during the recording. **Example 3:** This error can occur more frequently if the real-time load on the computer is quite high (>50 %). **Note:** Refer also to the corresponding AX5000 drive error code F440.
0x810F	33039	POSITION MONITORING (=> NC Runtime Error)	**Position monitoring: Axis position is outside of the maximum allowed moving range.**

Code (Hex)	Code (Dec)	Symbol	Description
			The axis has left the parameterized position range window, whereupon the recording was aborted and the NC axis was placed in the error state 0x810F (with standard NC error handling).
			The position range window acts symmetrically around the start position of the axis (see also parameter description *Position Monitoring Window*).
			Typical error message in the logger: *"BodePlot: 'Position Monitoring' error 0x%x because the actual position %f is above the maximum limit %f of the allowed position range (StartPos=%f, Window=%f)"*
0x8110	33040	DRIVELIMITATIONDETECTED	**Driver limitations detected (current or velocity limitations) which causes a nonlinear behavior and invalid results of the bode plot.**
			A bode plot recording requires an approximately linear transmission link. If the velocity or current is limited in the drive device, however, this non-linear behavior is detected and the bode plot recording is aborted. Reasons for these limitations can be: choosing too large an amplitude for the position, velocity or torque interface, or an unsuitable choice of amplitude scaling mode (see also parameter description *Amplitude Scaling Mode, Base Amplitude, Signal Amplitude*).
			Typical error message in the logger: *"BodePlot: Sequence aborted with error 0x%x because the current limit of the drive has been exceeded (%d times) which causes a nonlinear behavior and invalid results of the bode plot"*
0x8111	33041	LIFECOUNTERMONITORING (=> NC Runtime Error)	**Life counter monitoring (heartbeat): Lost of communication to GUI detected after watchdog timeout is elapsed.**
			The graphical user interface from which the bode plot recording was started is no longer communicating with the bode plot driver in the expected rhythm (keyword: 'Life Counter'). Therefore the recording is terminated immediately and the NC axes are placed in the error state 0x8111 (with standard NC error handling). Possible reasons for this can be an user interface crash or a major malfunction of the Windows context.
			Typical error message in the logger: *"BodePlot: Sequence aborted with GUI Life Counter error 0x%x because the WatchDog timeout of %f s elapsed ('%s')"*
0x8112	33042	NCERR_BODEPLOT_WCSTATE	**WC state error (IO data working counter)**

Code (Hex)	Code (Dec)	Symbol	Description
			IO working counter error (WC state), for example due to real-time errors, EtherCAT CRC errors or telegram failures, EtherCAT device not communicating (OP state), etc.
0x8113-0x811F	33043-33055	RESERVED	**Reserved range**

6.2.12   Further Error Codes

Error(Hex)	Error(Dec)	ErrorType	Description
0x8120	33056	Environment	**Invalid configuration for Object (e.g. in TwinCAT 3 Engineering (XAE))**
0x8121	33057	Environment	**Invalid environment for Object (e.g. TcCom-Object's Hierarchy or missing/faulty Objects)**
0x8122	33058	Environment	**Incompatible Driver or Object**
0x8124	33060	Function Block	**Command execution does not terminate (e. g. MC_Reset does not signal DONE)**
0x8130	33072	Communication	**Invalid ObjectID of Communication Target**
0x8131	33073	Communication	**Communication Target expects Call in different Context.**
0x8132	33074	Communication	**Invalid State of Communication Target**
0x8134	33076	Communication	**Communication with Communication Target cannot be established.**
0x813b	33083	Parameter	**Transition Mode is invalid.**
0x813c	33084	Parameter	**BufferMode is invalid.**
0x813d	33085	Function Block	**Only one active Instance of Function Block per Group is allowed.**
0x813e	33086	State	**Command is not allowed in current group state.**
0x813f	33087	Function Block	**Slave cannot synchronize.** The slave cannot reach the SlaveSyncPosition with the given dynamics.
0x8140	33088	Parameter	**Invalid value for one or more of the dynamic parameters (Acceleration, Deceleration, Jerk)**
0x8141	33089	Parameter	**IdentInGroup is invalid.**
0x8142	33090	Parameter	**The number of axes in the group is incompatible with the axes convention.**
0x8143	33091	Communication	**Function Block or respective Command is not supported by Target.**
0x8144	33092	State	**Command queue full.** Command queue is completely filled up and cannot accept additional commands until some commands are fully processed.
0x8145	33093	Function Block	**Mapping of Cyclic Interface between NC and PLC is missing (e.g. AXIS_REF, AXES_GROUP_REF, ...).**
0x8146	33094	Function Block	**Invalid Velocity Value.** The velocity was not set or the entered value is invalid
0x8147	33095	Parameter	**Invalid Coordinate Dimension.** The dimension of the set coordinate interpretation does not meet the requirements.

Error(Hex)	Error(Dec)	ErrorType	Description
0x8148	33096	Function Block	**Invalid Input Value**
0x8149	33097	Parameter	**Unsupported Dynamics for selected Group Kernel**
0x814a	33098	Parameter	**The programmed position dimension incompatible with the axes convention.**
0x814b	33099	Function Block	**Path buffer is invalid. For example because provided buffer has invalid address or is not big enough.**
0x814c	33100	Function Block	**Path does not contain any element.**
0x814d	33101	Function Block	**Provided Path buffer is too small to store more Path Elements.**
0x814e	33102	Parameter	**Dimension or at least one Value of Transition Parameters is invalid.**
0x814f	33103	Function Block	**Invalid or Incomplete Input Array**
0x8150	33104	Function Block	**Path length is zero.**
0x8151	33105	State	**Command is not allowed in current axis state.**
0x8152	33106	State	**TwinCAT System is shutting down and cannot complete request.**
0x8153	33107	Parameter	**Configured axes convention and configured axes do not match.**
0x8154	33108	Initialization	**Invalid Number of ACS Axes.** The number of ACS input axes does not match the number of ACS input axes expected by the kinematic transformation.
0x8155	33109	Initialization	**Invalid Number of MCS Data.** The number of MCS input data does not match the number expected by the kinematic transformation.
0x8156	33110	Initialization	**Invalid Value Set for Kinematic Parameters.** The numeric value set for the parameter does not reside within the respective definition range.
0x8158	33112	NC Programming	**The Given ACS Values Cannot be Reached.** The given ACS values result in an invalid machine configuration.
0x8159	33113	NC Programming	**The Set Target Positions Cannot be Reached.** The set target positions reside outside the admissible working space.
0x815d	33117	NC Programming	**Discontinuity in ACS axes detected.**
0x8160	33120	NC Programming	**Circle Specification in Path is invalid.** The specification of a circle segment in the programmed interpolated path (e.g. via MC_MovePath) has an invalid or ambiguous description. Probably its center cannot be determined reliably.
0x8161	33121	NC Programming	**Maximum stream lines reached.** The maximum number of stream lines is limited. Please refer to function block documentation for details.
0x8163	33123	Function Block	**Invalid First Segment.** The corresponding element can only be analyzed with a well-defined start point.
0x8164	33124	Function Block	**Invalid auxiliary point.** The auxiliary point is not well-defined.

Error(Hex)	Error(Dec)	ErrorType	Description
0x8166	33126	Function Block	**Invalid parameter for GapControlMode.** Invalid parameter for GapControlMode, most likely in combination with the group parameter GapControlDirection.
0x8167	33127	External	**Group got unsupported Axis Event (e.g. State Change).** Group got unsupported Axis Event (e.g. State Change e.g. triggered by a Single Axis Reset).
0x8168	33128	Parameter	**Unsupported Compensation Type.** The compensation type was either not set or is not supported by the addressed object.
0x8169	33129	Function Block	**Master axis does not exist or cannot be used.**
0x816a	33130	External	**Invalid or Missing Tracking Transformation.** This error occurs at MC_TrackConveyorBelt if at the CoordTransform input an invalid object ID is used or the object ID points to an object that is not supported as coordinate transformation.
0x816b	33131	Function Block	**Position is not on Track.** Either Track cannot be activated because Actual Position is not on Track, or Target Position is not on Active Track or TrackPart
0x816c	33132	Function Block	**Axis does not have an activated track.**
0x816d	33133	NC Programming	**Invalid Compensation ObjectId.** An Object with this ObjectId does not exist or it is not of the right type (has to be a compensation).
0x816e	33134	Monitoring	**Axis is in error because axis was not in Target when InTargetAlarm Timer expired.**
0x816f	33135	State	**Coupling would cause a cyclic dependency of axis (e.g. via MC_GearInPos).**
0x8170	33136	Function Block	**Axis was not added to an axes group. The command is not valid.**
0x817f	33151	State	**Drive has invalid State.**
0x8181	33153	Function Block	**Parameter for gap control are invalid with the current configuration.** Function block with gap control was issued to an axis that is not in a CA group
0x8182	33154	Monitoring	**Software position limit violation.** Software position limits of at least one axis have been or would have been violated by a command.
0x8183	33155	NC Programming	**Target position is not reachable.** There is no path available to the target position or target position is unreachable in general.
0x8185	33157	NC Programming	**The mover or one of its relevant coordinates is busy.** Either the whole mover or at least of its coordinates relevant to the command are busy.
0x8186	33158	NC Programming	**A collision has occurred or would occur.** Either a collision has occurred or would occur if the command was executed.
0x8187	33159	NC Programming	**Invalid Track Specification.** The geometric extension of this track is incompatible with the already existing geometry of this or the other tracks.
0x8188	33160	NC Programming	**Command not allowed in track state.**
0x8189	33161	Function Block	**Invalid Reference passed to Function Block.** An invalid reference (or pointer) was used in a function block call. This can happen if a reference type is used before it was initialized.

Error(Hex)	Error(Dec)	ErrorType	Description
0x818a	33162	NC Programming	**Path is locked against modifications.** The path was locked to further changes. However, it might be resettable.
0x818c	33164	Parameter	**Position out of modulo range.** Position must be larger or equal to zero and less or equal to the modulus when using modulo positioning. When using modulo positioning, the target position is interpreted in consideration of the AdditionalTurns variable at the Options input.
0x818d	33165	Parameter	**The specified value AdditionalTurns at the Options input is not allowed.** The parameter AdditionalTurns must be zero for the specified value of the parameter Direction
0x818e	33166	Function Block	**Master/Slave sync position incompatible with sync direction.** The given sync positions require the slave moving in a direction which is not allowed while in synchronization phase.
0x8191	33169	State	**Unexpected axis state.** At least one axis has an unexpected state. This may occur if a group reset is active and an axis error occurs after the respective axis was successfully reset.
0x8192	33170	State	**Invalid reference system.** The reference system is unknown or invalid for this application.
0x8193	33171	State	**Position not in reference system.** The position is outside of the specified reference system.
0x8194	33172	State	**A previous command is blocking execution.** A previous command is still ongoing and simultaneous execution of both commands is impossible.
0x8198	33176	Parameter	**Invalid index.** The used index does not exist or is invalid.
0x8199	33177	Function Block	**Command not allowed.** The command is not allowed in the current configuration.
0x8f2f - 0x8f50	36655 - 36688	Internal	**Internal Error.**
0x8f56	36694	Internal	**Internal Error.**
0x8f59	36697	Internal	**Internal Error.**
0x8f5c - 0x8f62	36700 - 36706	Internal	**Internal Error.**
0x8f65	36709	Internal	**Internal Error.**
0x8f68 - 0x8fce	36712 - 36814	Internal	**Internal Error.**
0x8fd0 - 0x8fff	36816 - 36863	Internal	**Internal Error.**

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