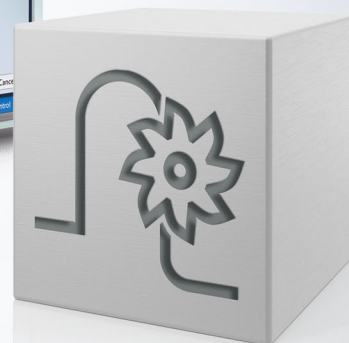
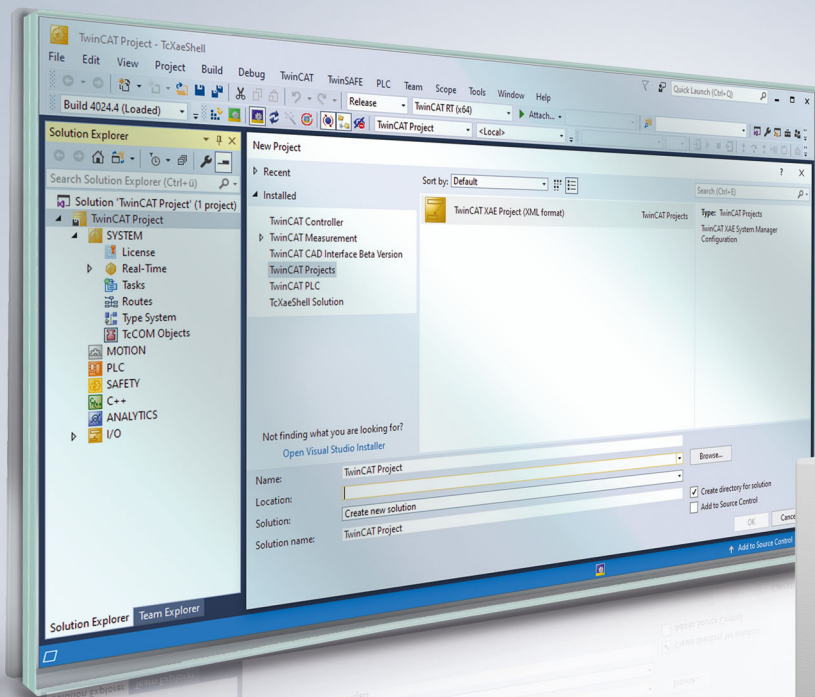


Manual | EN

## TF5240 | TwinCAT 3 CNC

PCS transformations





# Notes on the documentation

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

It is essential that the documentation and the following notes and explanations are followed when installing and commissioning the components.

It is the duty of the technical personnel to use the documentation published at the respective time of each installation and commissioning.

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

## Disclaimer

The documentation has been prepared with care. The products described are, however, constantly under development.

We reserve the right to revise and change the documentation at any time and without prior announcement.

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

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EP1590927, EP1789857, EP1456722, EP2137893, DE102015105702

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# General and safety instructions

## Icons used and their meanings

This documentation uses the following icons next to the safety instruction and the associated text. Please read the (safety) instructions carefully and comply with them at all times.

### Icons in explanatory text

1. Indicates an action.

⇒ Indicates an action statement.

#### **DANGER**

##### **Acute danger to life!**

If you fail to comply with the safety instruction next to this icon, there is immediate danger to human life and health.

#### **CAUTION**

##### **Personal injury and damage to machines!**

If you fail to comply with the safety instruction next to this icon, it may result in personal injury or damage to machines.

#### **NOTICE**

##### **Restriction or error**

This icon describes restrictions or warns of errors.

#### **Tips and other notes**



This icon indicates information to assist in general understanding or to provide additional information.

### General example

Example that clarifies the text.

### NC programming example

Programming example (complete NC program or program sequence) of the described function or NC command.



#### **Specific version information**

Optional or restricted function. The availability of this function depends on the configuration and the scope of the version.

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# 1 Introduction

## Transformation types

The transformations specified here are mathematical representations that act directly on programming coordinates before the Cartesian transformations.

These transformations simplify the programming of geometries or even allow the programming of more complex geometries (example: circle □ ellipse).



**Transformations are additional options and subject to the purchase of a license.**

---

## Further documentation concerning transformations

The integration of user-defined transformations is described in the description of the transformation interface [McCOM-TRAFO].

Descriptions of kinematic transformations are contained in the document Kinematic transformations [KITRA].

## ***Mandatory note on references to other documents***

For the sake of clarity, links to other documents and parameters are abbreviated, e.g. [PROG] for the Programming Manual or P-AXIS-00001 for an axis parameter.

For technical reasons, these links only function in the Online Help (HTML5, CHM) but not in pdf files since pdfs do not support cross-linking.

## 1.1 Specifying the transformation ID, type and parameters

In order to use a PCS transformation, it must be explicitly specified by its transformation ID (P-CHAN-00262) and its transformation type (P-CHAN-00829).

The purpose of the transformation ID is to explicitly identify a configured transformation from the list of all PCS transformations configured. A transformation may not be configured multiple times.

The transformation type determines the type and structure of the transformation as classified in the Overview.

### Specifying the transformation ID, type and parameters

The PCS transformation must be configured using the following channel parameters:

```
trafo_pcs[0].id          10   (any number)
trafo_pcs[0].type        212  (transformation type)
trafo_pcs[0].param[0]    3
trafo_pcs[0].param[1]    4
trafo_pcs[0].param[2]    1
```

If there is a further transformation, e.g. of the same type with different data blocks:

```
trafo_pcs[1].id          78   (any number)
trafo_pcs[1].type        212  (transformation type)
trafo_pcs[1].param[0]    3
trafo_pcs[1].param[1]    4
trafo_pcs[1].param[2]    1
```

## 2 PCS transformations

The following sections describe predefined PCS transformations.

You can also create and apply user-defined McCOM transformations. These types must be within the range of [500 - 999].

If types are used that do not belong to either the predefined or the McCOM transformations, error ID 22287 is output.

### 2.1 TRAFO\_TYP\_212 – Axis coupling

#### Transformation structure:

A transformation consists of a master and a slave axis. After the transformation is activated, the slave axis follows the motion of the master axis multiplied by a coupling factor.

The transformation with the ID 212 allows an axis coupling at PCS level. This transformation is comparable to the function #GEAR LINK.



**Function available as of V3.1.3110.3.**

#### The major differences are:

1. The coupling acts on the basis of the programming coordinates compared to the axis coordinates.
2. This coupling includes the coupling motion when the path dynamics are considered.

#### Restrictions of the transformation:

1. The slave axis may not be traversed while the coupling is active.
2. No CS or transformation may be changed while the coupling is active.
3. A modulo calculation may not be active with either of the axes.

CNC error ID 22274 is triggered with points 1 and 2.



**If the slave axis is defined in the #FGROUP, the motion is taken into consideration by the transformation.**

#### Parameters of the transformation

| param[i] | Description                            | Unit  |
|----------|--|-------|
| 0        | Logical axis number of the master axis | [ - ] |
| 1        | Logical number of the slave axis       | [ - ] |
| 2        | Coupling factor                        | [ - ] |

## 2.2 TRAFO\_TYP\_214 – Angle projection



Function available as of V3.1.3115.0.

### Transformation structure:

The transformation is defined by a PCS axis and a tilt angle.

The transformation with the ID 214 corresponds to a projection of a main plane onto a PCS axis tilted at an angle.

The figures below show the X axis tilted. The Y coordinate is projected onto the Z axis and added to the Z coordinate.

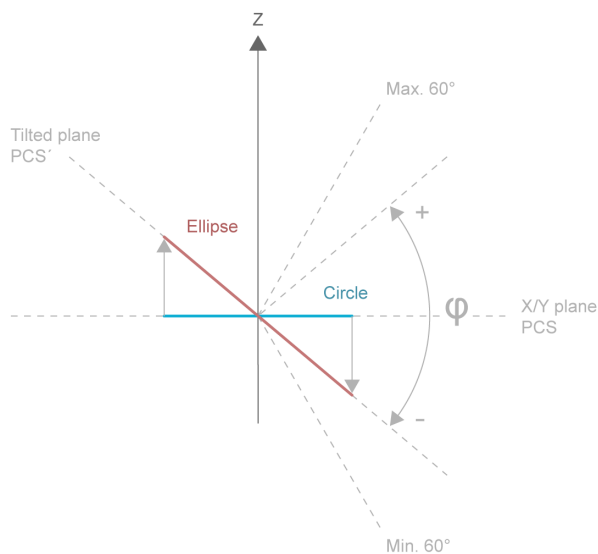


Fig. 1: Side view of an angle projection of TRAFO\_TYP\_214

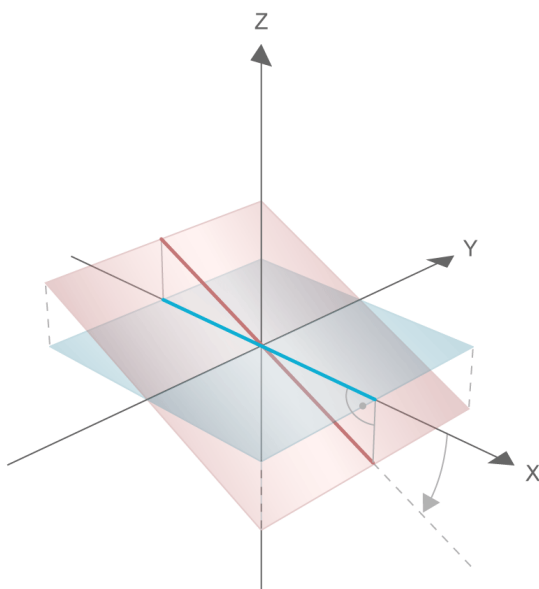


Fig. 2: Projection of a square with angle projection TRAFO\_TYP\_214

For example, a circle on the X/Y plane results in an ellipse in the transformed PCS' system tilted about the X axis.

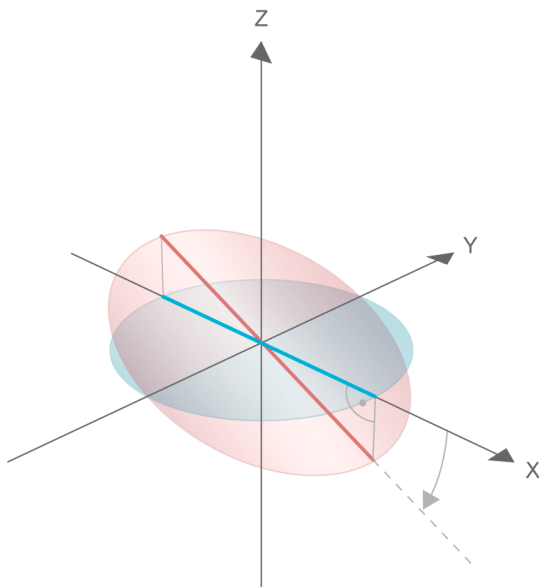


Fig. 3: Projection of a circle with angle projection TRAFO\_TYP\_214

When the Y axis is tilted, the Z coordinate is projected onto the X axis and added to the X coordinate.

When the Z axis is tilted, the X coordinate is projected onto the Y axis and added to the Y coordinate.



**The plane is tilted at the angle in the mathematically positive direction, i.e. anti-clockwise.**

#### Restrictions of the transformation:

1. The tilt angle must be between  $-60^\circ$  and  $+60^\circ$ ; tilt angles outside of the permissible range trigger the error ID 292010.
2. Tilting is only possible about one of the three axes X, Y or Z of the PCS system; permissible values are 1, 2 or 3. Other values will trigger error ID 22281.

#### Parameters of the transformation

| param[i] | Description  | Unit                    |
|----------|--|-------------------------|
| 0        | Tilt angle   | $1.0 \text{ E-}4^\circ$ |
| 1        | Logical axis number of the axis about which the tilt is performed.<br>$1 = X_{\text{PCS}}, 2 = Y_{\text{PCS}}, 3 = Z_{\text{PCS}}$ | [ - ]                   |

### 3 Definition of terms

**General:**

|      |  |
|------|--|
| ID   | Identifier; general identifier                     |
| MCS  | Machine coordinate system                          |
| MZP  | Machine zero point                                 |
| BT   | Backward transformation                            |
| SRP  | Slide reference point (tool slide reference point) |
| TCP  | Tool centre point; centre point of milling cutter  |
| Type | Kinematic structure with specific features         |
| FT   | Forward transformation                             |
| WCS  | Workpiece coordinate system                        |

**Other abbreviations:**

|    |  |
|----|--|
| HD | Kinematic offset value (head distance) |
|----|--|

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