Transformation PathPlanning

ApplicationNote

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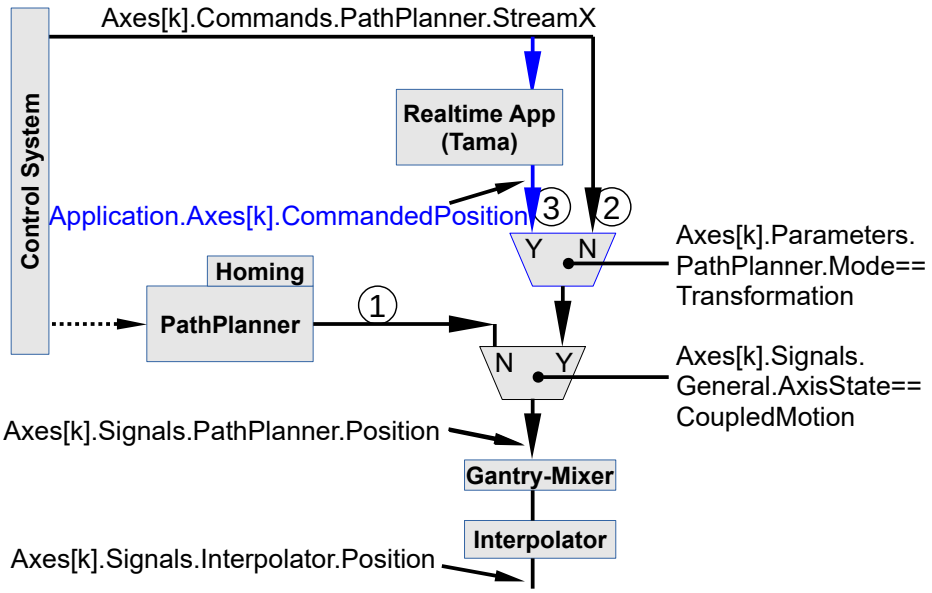
1 Target

In a standard application, positions are either controlled by the internal pathPlanner of the drive, or a control system streams position data through the bus to the drive. There is no coordinate transformation in the drive. This application note describes an additional mode of operation. A real time application (Tama) running in the drive can implement a coordinate transformation between positions fed from the control system and the interpolator.

This version is valid for TSD-drives with firmware 3.2.0 and newer. For migration from 3.1 see chapter 5.

2 Commanded Positions

We start with the axis of a standard application, see black lines in drawing 1. After enabling, the axis starts in the state „StandStill“ (i.e., not „*CoupledMotion*“). The Pathplanner of the drive controls the commanded position, which flows from the pathPlanner (①) to the Interpolator and from there to the position controller. The control system might start a drive controlled homing and when finished, it streams the target positions (②) and puts the axis into the mode „*CoupledMotion*“. Now the control system positions are fed to the interpolator.



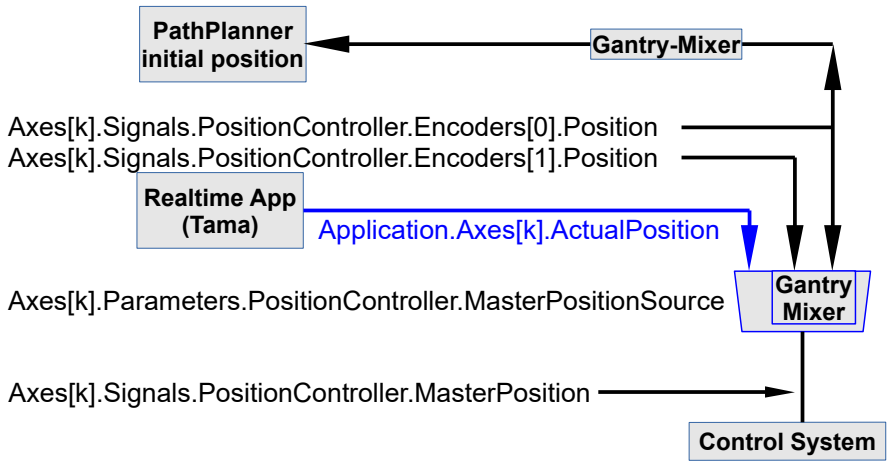
Drawing 1: Position Flow of an axis in standard mode (black) and with transformations (blue)

An extended mode allows a coordinate transformation. The mode is configured using the parameter ***Axes[k].Parameters.PathPlanner.Mode*** by choosing “***Transformation***”.

The axis starts as usual in the state StandStill where the PathPlanner (①) has control over the positions. The pathPlanner runs in the motor coordinate system and is used for example for homing. The real-time application (Tama) uses the stream positions to calculate the transformed positions (③) and safes them to an application register, where they are ignored at first. The coordinate transformation becomes active as soon as the axis is in the state *CoupledMotion*.

3 Actual Positions

The forward transformation is required to feed actual positions in the transformed coordinate system to the control system. In a standard application, one of the two encoders is specified as the master position source using the ***MasterPositionSource***. When implementing a coordinate transformation, the master position are fed using a real-time application register as shown in Drawing 2.



Drawing 2: Forward Transformation

Please note that the initial path planner position is always taken from Encoder[0].

4 Registers

Configuration

Register	Description
Axes[k].Parameters.PathPlanner.Mode	Set to ***Transformation***
Axes[k].Parameters.PositionController.MasterPositionSource	Set to ***Transformation***

The following registers are written by the real time application Tama

Register	Description
Application.Axes[k].ActualPosition Application.Axes[k].ActualVelocity Application.Axes[k].ActualError	These are actual values in the transformed coordinate system. They will be copied to the masterPosition etc., as shown in the previous chapters.
Application.Axes[k].CommandedPosition Application.Axes[k].CommandedVelocity Application.Axes[k].CommandedAcceleration	These are commanded values in the motor coordinate system. Will be copied to the axis controllers as shown in the previous chapters.

Please note that the tripplet {CommandedPosition, CommandedVelocity and CommandedAcceleration} is required for correct interpolation of the 100kHz target positions.

5 Migration from Firmware 3.1.x and older

Migration is done in two steps. Using the transformation mode with the new firmware 3.2.0 requires the new TAM SDK but it is possible to keep old Tama programs during the transition phase.

The commanded values were located at *Commands.PathPlanner.TrafoX* etc. before. We did not change their URI address. Therefore, Tama programs generated by an older SDK are still functional. In contrast to old firmware, the transformation mode must be specified by setting *Parameters.PathPlanner.Mode* to *Transformation* (which requires a TAM SDK newer than 7.3.0).

The concept of saving the actual values in transformation mode changed with the new firmware. To simplify migration, the old enum *Transformation* of *Parameters.PositionController.MasterPosition-Source* was changed to *Ignore*. This mode allows using old tama programs.

The new locations were introduced after TAM SDK 7.3.0. When compiling a Tama program with a higher SDK, the code must be adapted by using the names shown in chapter 4. Then the *MasterPositionMode* must be changed to *Transformation*.

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