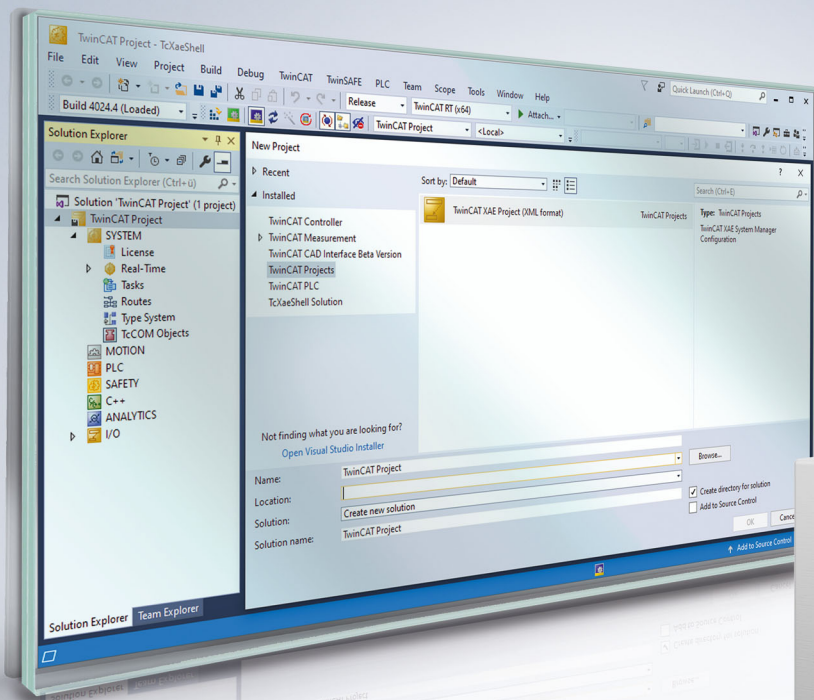


Functional description | EN

TF5200 | TwinCAT 3 CNC

Dynamic limitation of axis position



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.

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

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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 Overview

Task

Some applications may require that certain zones of an axis position may not be approached temporarily during machining. This function permits the dynamic limitation of axis positions.

Properties/possible application

One possible application is to limit the motion range of an axis because of an obstacle within the working space of the axis.



This function is available as of CNC Build V3.1.3054.05.

Programming/activation

The zone limits are activated and defined in the PLC.

Parameterisation

The function is activated by using the keyword FCT_DYN_POS_LIMIT of the parameter P-STUP-00070 [[▶ 11](#)].

Links 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.

2 Description

The CNC has the option of prechecking axis positions in the downstream active program. When axis limit violations are detected, machining can then be stopped by feedhold at the zone limit.

The function can also be regarded as a zone-specific feedhold. It prevents all entry to the blocked zone.

- If the current position at the time of zone activation is located within the blocked zone, the machine is stopped immediately. Deceleration takes place at the rate of feedhold acceleration.
- If the current position at the time of zone activation is located outside the blocked zone, the currently active acceleration is effective up to the braking point. The braking point is then located on the zone limit +/- 1 cycle.

The figure below illustrates the possible application:

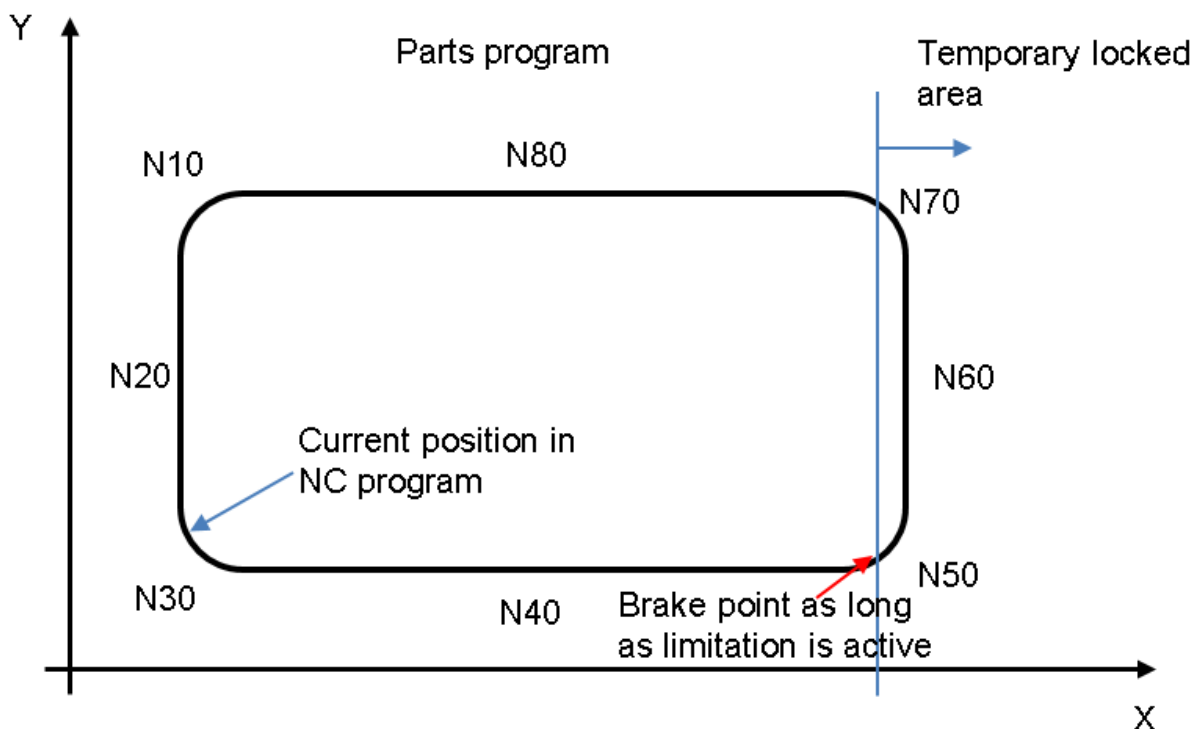


Fig. 1: Limit representation, braking point between N40 and N50.

The limitation of the axis position zone is executed by the PLC. The following options are available:

- Control Units [dyn_pos_limit_low \[► 11\]](#) / [dyn_pos_limit_high \[► 11\]](#)
- Blocks of PLCopen Part 1: [MCV_DynPosLimitLow \[► 13\]](#) / [MCV_DynPosLimitHigh \[► 14\]](#)

The machining program is continued after the PLC cancels the limit.

Activation

The function must be activated by [P-STUP-00070 \[► 11\]](#).

```
configuration.channel[0].interpolator.function FCT_LOOK_AHEAD_STANDARD | FCT_DYN_POS_LIMIT
```

NOTICE

This function may not be used to implement safety-related functions.

The function is designed to limit the axis position if

- unforeseeable or unplannable events occur during program flow, e.g. caused by a sensor, or
- the restriction is of limited duration.

Supported CNC functions

The function is combinable with the following CNC functions:

- Zero offsets, #ROTATION, #CS
- All slope types: #SLOPE[]
- Transformations: #TRAFO[]
- Contour smoothing: #CONTOUR MODE, #HSC, #SPLINE

Process limitations

The deceleration ramp is calculated in each cycle in order to stop accordingly. Based on the resulting deceleration duration, 20 random points on this deceleration ramp are checked for limit violation. In worst-case scenarios, e.g. a long deceleration distance and a very small contour element, it may mean that violations within the blocked area are overlooked.

This occurs in particular when a limit is changed while the program is running.

The following functions are not supported. Axis positions are not correctly monitored for the axes affected.

- Axis polynomial X[POLY L=... A0=...]
- Automatic tracking of the C axis (#CAXTRACK)
- Manual mode

3 Parameter

P-STUP-00070	Definition of interpolator functionalities
Description	This parameter defines individual functionalities and the size of the look-ahead buffer in the interpolator, i.e. it defines the number of blocks to calculate deceleration distance and dynamic planning.
Parameter	configuration.channel[i].interpolator.function
Data type	STRING
Data range	See Interpolation function table.
Dimension	----
Default value	FCT_IPO_DEFAULT
Remarks	

3.1 PLC parameters

3.1.1 Monitoring axis positions

Monitoring lower position limit	
Description	The control unit is used to specify the lower limit of a position range which the axis should not exceed.
Data type	MC_CONTROL_SGN32_UNIT, see description of Control Unit
Access	PLC writes command_w and reads request_r and state_r
ST Path	gpAx[axis_idx]^ipo_mc_control.dyn_pos_limit_low
Special features	Available as of V3.01.3054.05
Commanded, requested and return values	
ST Element	.command_w .request_r (currently not supported) .state_r
Special features	Commanded and return values both have the same data type but different significances.
Data type	DINT
Unit	.command_w: 0.1 μm or 10 ⁻⁴ ° .state_r: no unit
Value range	.command_w: [DINT_MIN, DINT_MAX] This is a position value and describes the lower limit of the position range which the axis should not exceed. .state_r: See the <u>Monitoring states of position limit</u> [▶ 12] table with descriptions. This is the state of the monitoring process for the lower limit.
Redirection	
ST element	.enable_w

Monitoring upper axis position limit	
Description	The control unit is used to set the upper limit of a position range which the axis should not exceed.
Data type	MC_CONTROL_SGN32_UNIT, see description of Control Unit
Access	PLC writes command_w and reads request_r and state_r
ST Path	gpAx[axis_idx]^ipo_mc_control.dyn_pos_limit_high
Peculiarities	Available as of V3.01.3054.05
Commanded, requested and return values	
ST Element	.command_w

	.request_r (not supported) .state_r
Peculiarities	Commanded and return values both have the same data type but different significances.
Data type	DINT
Unit	.command_w : 0.1 µm or 10 ⁻⁴ ° .state_r : no unit
Value range	.command_w : [DINT_MIN, DINT_MAX] This is a position value and describes the upper limit of the position range which the axis should not exceed. .state_r : See Table 2-1 [▶ 11] with descriptions. This is the state of the monitoring process for the upper limit.
Redirection	
ST Element	.enable_w

Values for the monitoring state of a position limit

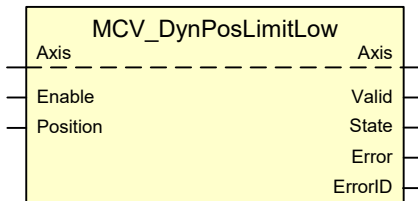
Global constant	Value	Description
HLI_DYNPL_STATE_INACTIVE	0	The position limit is not active.
HLI_DYNPL_STATE_ACTIVATION	1	This is the transition state after commanding the control unit until monitoring of axis position to the limit is activated.
HLI_DYNPL_STATE_ACTIVE	2	The position limit is active and the axis position limit is monitored.
HLI_DYNPL_STATE_ACTIVE_BRAKING	3	A braking operation was initiated down to standstill to prevent the axis from exceeding the position limit.
HLI_DYNPL_STATE_ACTIVE_BRAKE	4	Deceleration process to maintain the position limit completed, axis is at standstill.

3.2 PLCopen blocks

3.2.1 MCV_DynPosLimitLow

If an axis position should be prevented from undershooting a specific value, this function block specifies the limit that may not be undershot. If the axis moves towards the limit, the motion is controlled so that the axis stops within the limit range. The position limit may be crossed by the distance which is travelled in one controller cycle.

Block diagram



FB parameters

VAR_IN_OUT		
Variable name	Data type	Description
Axis	AXIS_REF	Axis reference

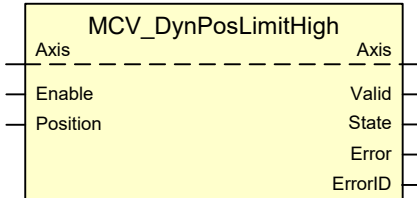
VAR_INPUT		
Variable name	Data type	Description
Enable	BOOL	If TRUE, the position limit is written to the PLC interface (HLI).
Position	DINT	Position limit specification

VAR_OUTPUT		
Variable name	Data type	Description
Valid	BOOL	Is TRUE when specified set value is activated.
State	DINT	Current position limit
Error	BOOL	Indicates whether an error has occurred in an FB.
ErrorID	WORD	Error identifier

3.2.2 MCV_DynPosLimitHigh

If an axis position should be prevented from overshooting a specific value, this function block specifies the limit that may not be overshoot. If the axis moves towards the limit, the motion is controlled so that the axis stops within the limit range. The position limit may be crossed by the distance which is travelled in one controller cycle.

Block diagram



FB parameters

VAR_IN_OUT		
Variable name	Data type	Description
Axis	AXIS_REF	Axis reference

VAR_INPUT		
Variable name	Data type	Description
Enable	BOOL	If TRUE, the position limit is written to the PLC interface (HLI).
Position	DINT	Position limit specification

VAR_OUTPUT		
Variable name	Data type	Description
Valid	BOOL	Is TRUE when specified set value is activated.
State	DINT	Current position limit
Error	BOOL	Indicates whether an error has occurred in an FB.
ErrorID	WORD	Error identifier

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