



# DOCUMENTATION ISG-kernel

## Functional description Dynamic limitation of axis position

Short Description:  
FCT-C43

© Copyright  
ISG Industrielle Steuerungstechnik GmbH  
STEP, Gropiusplatz 10  
D-70563 Stuttgart  
All rights reserved  
[www.isg-stuttgart.de](http://www.isg-stuttgart.de)  
[support@isg-stuttgart.de](mailto:support@isg-stuttgart.de)

Documentation version: 1.04  
07/11/2024

# Preface

## Legal information

---

This documentation was produced with utmost care. The products and scope of functions described are under continuous development. We reserve the right to revise and amend the documentation at any time and without prior notice.

No claims may be made for products which have already been delivered if such claims are based on the specifications, figures and descriptions contained in this documentation.

## Personnel qualifications

---

This description is solely intended for skilled technicians who were trained in control, automation and drive systems and who are familiar with the applicable standards, the relevant documentation and the machining application.

It is absolutely vital to refer to this documentation, the instructions below and the explanations to carry out installation and commissioning work. Skilled technicians are under the obligation to use the documentation duly published for every installation and commissioning operation.

Skilled technicians must ensure that the application or use of the products described fulfil all safety requirements including all applicable laws, regulations, provisions and standards.

## Further information

---

Links below (DE)

<https://www.isg-stuttgart.de/produkte/softwareprodukte/isg-kernel/dokumente-und-downloads>

or (EN)

<https://www.isg-stuttgart.de/en/products/softwareproducts/isg-kernel/documents-and-downloads>

contains further information on messages generated in the NC kernel, online help, PLC libraries, tools, etc. in addition to the current documentation.

## Disclaimer

---

It is forbidden to make any changes to the software configuration which are not contained in the options described in this documentation.

## Trade marks and patents

---

The name ISG®, ISG kernel®, ISG virtuos®, ISG dirigent® and the associated logos are registered and licensed trade marks of ISG Industrielle Steuerungstechnik GmbH.

The use of other trade marks or logos contained in this documentation by third parties may result in a violation of the rights of the respective trade mark owners.

## Copyright

---

© ISG Industrielle Steuerungstechnik GmbH, Stuttgart, Germany.

No parts of this document may be reproduced, transmitted or exploited in any form without prior consent. Non-compliance may result in liability for damages. All rights reserved with regard to the registration of patents, utility models or industrial designs.

# 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

- 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.



### **Attention**

#### **Restriction or error**

This icon describes restrictions or warns of errors.



### **Notice**

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

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



### **Example**

#### **General example**

Example that clarifies the text.



### **Programming Example**

#### **NC programming example**

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



### **Release Note**

#### **Specific version information**

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

## Table of contents

<b>Preface</b> .....	<b>2</b>
<b>General and safety instructions</b> .....	<b>3</b>
<b>1 Overview</b> .....	<b>5</b>
<b>2 Description</b> .....	<b>6</b>
<b>3 Parameter</b> .....	<b>8</b>
3.1 PLC parameters.....	8
3.1.1 Monitoring axis positions.....	8
3.2 PLCopen blocks.....	10
3.2.1 MCV_DynPosLimitLow.....	10
3.2.2 MCV_DynPosLimitHigh.....	11
<b>4 Appendix</b> .....	<b>12</b>
4.1 Suggestions, corrections and the latest documentation.....	12
<b>Keyword index</b> .....	<b>13</b>

# 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.



### Release Note

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 [► 8].

## 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.

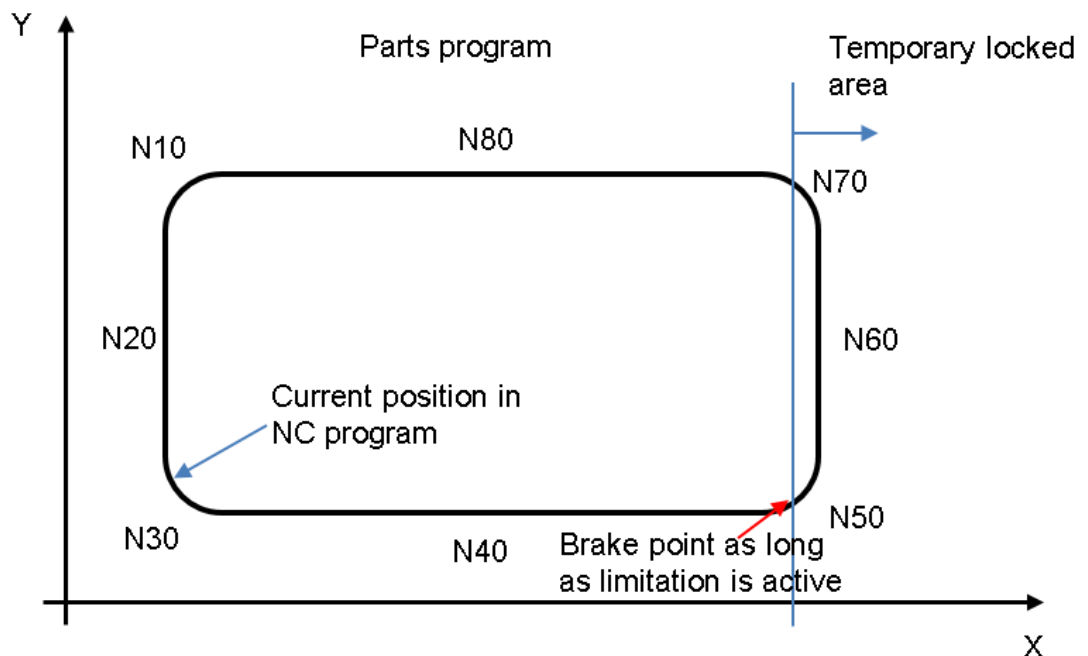
## 2 Description

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 [▶ 8]/ dyn\_pos\_limit\_high [▶ 9]
- Blocks of PLCopen Part 1: MCV\_DynPosLimitLow [▶ 10]/ MCV\_DynPosLimitHigh [▶ 11]

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

### Activation

The function must be activated by P-STUP-00070 [▶ 8].

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



### Attention

**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

<b>P-STUP-00070</b>	<b>Definition of interpolator functionalities</b>
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

<b>Monitoring lower position limit</b>	
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	<b>Available as of V3.01.3054.05</b>
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 $\mu\text{m}$ or $10^{-4}^\circ$ .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 Monitoring states of position limit [► 9] table with descriptions. This is the state of the monitoring process for the lower limit.
Redirection	
ST element	.enable_w



<b>Monitoring upper axis position limit</b>	
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 <code>command_w</code> and reads <code>request_r</code> and <code>state_r</code>
ST Path	<code>gpAx[axis_idx]^ipo_mc_control.dyn_pos_limit_high</code>
Peculiarities	<b>Available as of V3.01.3054.05</b>
Commanded, requested and return values	
ST Element	<code>.command_w</code> <code>.request_r</code> (not supported) <code>.state_r</code>
Peculiarities	Commanded and return values both have the same data type but different significances.
Data type	DINT
Unit	<code>.command_w</code> : 0.1 $\mu\text{m}$ or $10^{-4}^\circ$ <code>.state_r</code> : no unit
Value range	<code>.command_w</code> : [DINT_MIN, DINT_MAX] This is a position value and describes the upper limit of the position range which the axis should not exceed. <code>.state_r</code> : See Table 2-1 [▶ 8] with descriptions. This is the state of the monitoring process for the upper limit.
Redirection	
ST Element	<code>.enable_w</code>

## Values for the monitoring state of a position limit

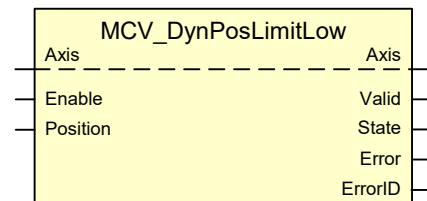
Global constant	Value	Description
HLI_DYNPL_STATE_INACTIVE	0	The position limit is not active.
HLI_DYNPL_STATE_ACTIVATION	1	This is the transition state after commanding the control unit until monitoring of axis position to the limit is activated.
HLI_DYNPL_STATE_ACTIVE	2	The position limit is active 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

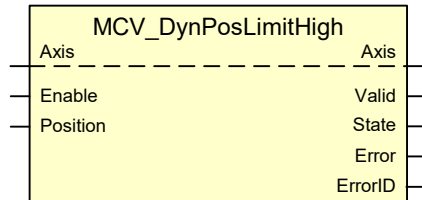
VAR_INPUT		
Variable name	Data type	Description
Enable	BOOL	If TRUE, the position limit is written to the PLC interface (HLI).
Position	DINT	Position limit specification

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

## 4 Appendix

### 4.1 Suggestions, corrections and the latest documentation

Did you find any errors? Do you have any suggestions or constructive criticism? Then please contact us at [documentation@isg-stuttgart.de](mailto:documentation@isg-stuttgart.de). The latest documentation is posted in our Online Help (DE/EN):



QR code link: <https://www.isg-stuttgart.de/documentation-kernel/>

The link above forwards you to:

<https://www.isg-stuttgart.de/fileadmin/kernel/kernel-html/index.html>



#### Notice

##### Change options for favourite links in your browser;

Technical changes to the website layout concerning folder paths or a change in the HTML framework and therefore the link structure cannot be excluded.

We recommend you to save the above "QR code link" as your primary favourite link.

##### PDFs for download:

DE:

<https://www.isg-stuttgart.de/produkte/softwareprodukte/isg-kernel/dokumente-und-downloads>

EN:

<https://www.isg-stuttgart.de/en/products/softwareproducts/isg-kernel/documents-and-downloads>

**E-Mail:** [documentation@isg-stuttgart.de](mailto:documentation@isg-stuttgart.de)

# Keyword index

## G

---

Grenzwert  
Position:Überwachung:oben ..... 9

## L

---

limit  
position:monitoring:lower..... 8

## M

---

MCV\_DynPosLimitHigh ..... 11  
MCV\_DynPosLimitLow ..... 10  
Monitoring  
position:limit:lower ..... 8

## P

---

P-STUP-00070 ..... 8  
Position  
monitoring:limit:lower..... 8  
Überwachung:Grenzwert:oben..... 9

## U

---

Überwachung  
Position:Grenzwert:oben ..... 9



© Copyright  
ISG Industrielle Steuerungstechnik GmbH  
STEP, Gropiusplatz 10  
D-70563 Stuttgart  
All rights reserved  
[www.isg-stuttgart.de](http://www.isg-stuttgart.de)  
[support@isg-stuttgart.de](mailto:support@isg-stuttgart.de)

