DOCUMENTATION ISG-kernel

Functional description
Single step mode

Short Description:
FCT-M2

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.

Programing 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

List of figures

1 Overview

Task

When single-step mode is active, the machine operator has the option to execute an NC program step by step. The operator releases every NC line one by one. Comment lines or comment blocks and skipped blocks are skipped.

Properties

Execution of the NC program at the block boundaries is interrupted in the interpolator. The sequence during decoding or in look-ahead mode is not affected. As a result, contour-correcting functions such as spline or tool radius compensation can also be active in single-step mode.

However, contour-changing functions can move block boundaries. For single-step mode, the shifted block boundaries are active, if applicable, but not the programmed block boundaries.

Parameterisation

The behaviour of single-step mode is influenced by the channel parameter P-CHAN-00015 and the commanded operating mode [▶ 7]. When single-step mode is activated, a stop is executed before NC blocks depending on these parameters and depending on a number of criteria.

Programming

The NC command #SINGLE STEP [DISABLE | ENABLE] [▶ 8] can block whole program areas for single-step mode. This program area is then skipped in a complete single step.

The NC command #SINGLE STEP [RESOLUTION..] [▶ 10] defines a block number dependent resolution for a single step.

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.

2 Commandable operating modes

Selection

The single step and its operating modes can be set at any time via Operation (HMI) or the PLC via the "Single-Step Mode" CNC object [▶ 15].

Depending on the channel parameter P-CHAN-00015, the selected operating mode of the single step affects the corresponding NC lines. The following operation modes are available:

0 : Step into

The "Step into" operating mode is active by default for the single step. This means that program execution is interrupted again when subroutines are invoked at the first block in the subroutine.

1 : Step over

The "Step over" mode can be set if the NC lines contained in a subroutine are not to be executed in single steps. This means that any subroutine invocation which may exist in the next step does not result in a stop.

Program execution is continued without stopping until the subroutine is terminated.

This characteristic also applies to nested subroutines.

2 : Return from function

All subsequent instructions do not result in a stop. Only a return from the current program level again results in a stop of the NC program.

If the current interrupt point is already at the topmost level, i.e. the main program, this mode acts in the same way as "Step into".

3 : Step to next movement

Single-step mode only affects NC blocks with axis movements. All other NC lines do not result in a stop.

3   Disable program areas for single step

Selection

Individual program areas can be disabled in single step mode by the command #SINGLE STEP [DISABLE / ENABLE]. This continues the complete area using single step. No stop is executed within the grey area.

Syntax:

#SINGLE STEP [DISABLE | ENABLE]   modal

Programing Example

The program area N40–N100 written in italics and the subroutine invocation are not executed in single step mode.

```
%SINGLE_STEP
N10 X0 Y0 Z0
N20 X10
N30 Y10
N40 #SINGLE STEP [DISABLE]
N50 X20
N60 Y20
N65 L GSP.nc
N70 Z20
N80 X30
N90 Z30
N100 #SINGLE STEP [ENABLE]
N110 Y30
N120 X40
N130 Z40
N999 M30
```

Nested disable/enable

When disable/enable commands are nested, the single step disable includes the area beginning from the first disable to the first enable (see example below)

Programing Example

In the following nested areas, single step mode in the area displayed in italics is disabled between N40-N75.

```
%SINGLE_STEP
N10 X0 Y0 Z0
N20 X10
N30 Y10
N40 #SINGLE STEP [DISABLE]
N50 X20
N55 #SINGLE STEP [DISABLE]
N60 Y20
N65 L GSP.nc
N70 Z20
N75 #SINGLE STEP [ENABLE]
N80 X30
N90 Z30
N100 #SINGLE STEP [ENABLE]
N110 Y30
N120 X40
N130 Z40
N999 M30
```

4 Single step mode on block numbers

Block number

When single-step mode is enabled, the CNC stops **before** each new motion block (see P-CHAN-00015 [▶ 14]) and waits for an acknowledgement from the PLC.

If the NC program was automatically generated by a post-processor based on CAD/CAM data, the original geometry information may result in several NC motion blocks. In this case a single step should correlate with the original granularity of CAD/CAM data and only stop at the original geometric resolution.

Another possible application case may be to explicitly disable single-step mode for individual blocks.

Syntax:

#SINGLE STEP [RESOLUTION<*value*> **]**   modal

GEOMETRY
N10 Z40
...
N20 F= V.E.Feedrate
N30 G91 Z60
N40 F= V.E.Feedrate
...
M30

CAD/CAM-System
program-generator

%program
N10 G01 F1 Z40
...
N20 F= V.E.Feedrate
N30 G91 Z20
N31 G91 Z20
N32 G91 Z20
N40 F= V.E.Feedrate
...

CNC-
Channel

IPO

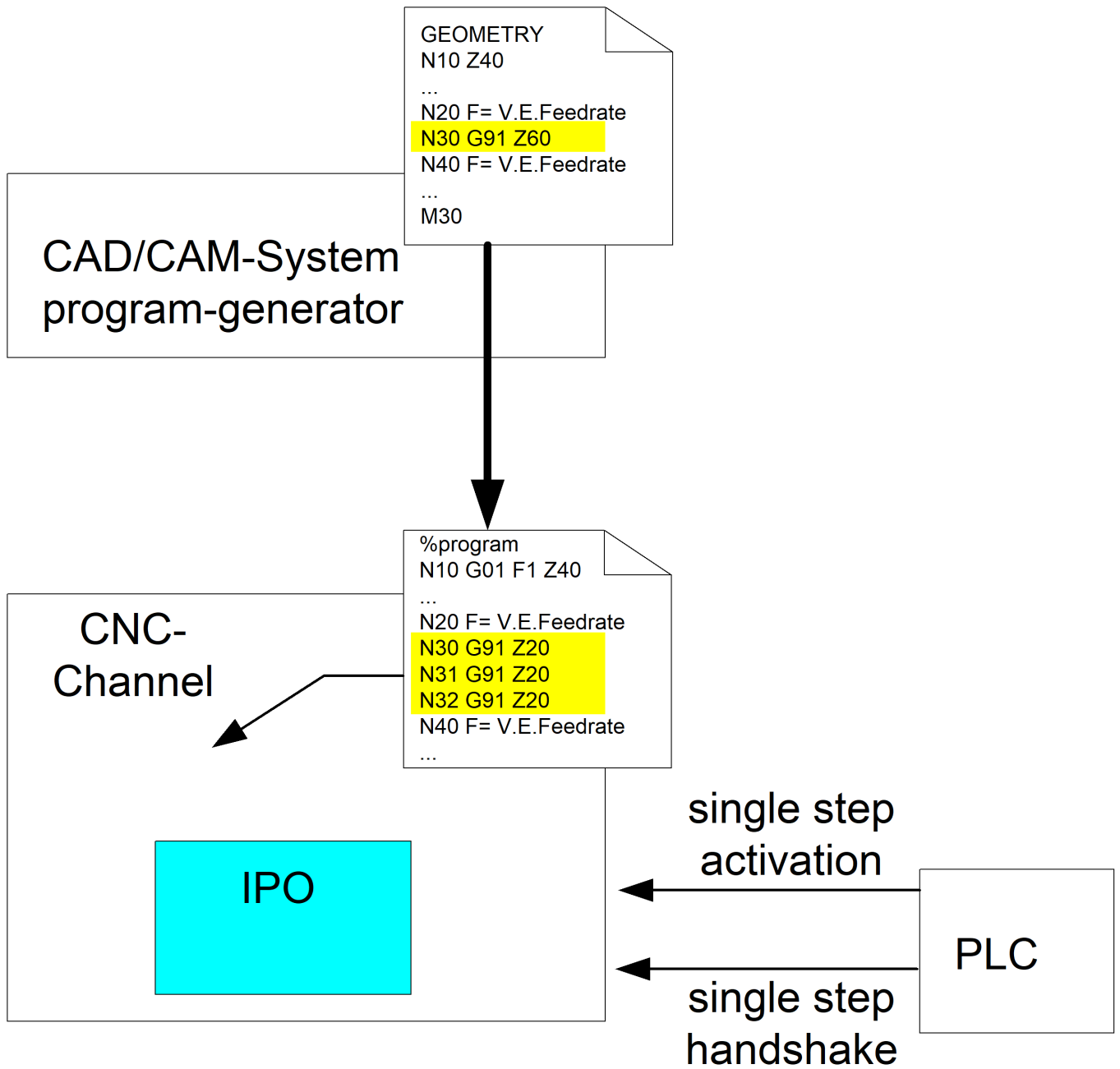single step
activation

single step
handshake

PLC

Fig. 1: A single item of geometric information may result in multiple NC motion blocks.

Block number related single-step resolution

Use the RESOLUTION option to define a block number-related single-step resolution:

0:    Off, no single step related to block numbers,

Stop before each NC line

1:    Single step stops before each new programmed NC block number

> 1: A stop is executed before each block which can be divided into an integer

with no remainder.

<Ganzzahliges Ergebnis> = <Satznummer> / <Auflösung>

< 0: Impermissible value for single-step resolution, an error message

is output.

Programing Example

Single-step resolution RESOLUTION to block numbers was set to 10.

In this case a stop is executed before each block can be divided by 10 into an integer with no remainder.

No stop is executed in the area displayed in *italics* in single-step mode. The black lines show the single-step stop.

```
%single_step

N000 #SINGLE STEP [RESOLUTION = 10]
_____
N000 X0
_____
N010 X1
N011 X1.1
N012 X1.2
_____
N020 X2
_____
N030 X3
…
_____
N090 X9
N091 Y0
N092 Y1
N093 Y2
N094 Y3
N095 Y4
_____
N100 Y5
N101 Y6
N102 Y7
_____
N110 Y8
…
```

Notice

To ensure effective diagnosis, all NC lines should always be provided with a unique block number.

Programing Example

Block numbering with user resolution (steps of ten) and internal numbering (single-step width).

```
%single_step

N010 #SINGLE STEP [RESOLUTION = 10]
_____
N090 Y0
N091 Y1
N092 Y2
N093 Y3
N094 Y4
_____
N100 Y5
N101 Y6
N102 Y7
_____
N110 Y8
...
```

5 Parameter

5.1 Overview

ID	Parameter	Description
P-CHAN-00015	Single-step mode	Define single-step operating mode

5.2 Description

P-CHAN-00015	Define single-step operating mode
Description	This parameter defines the basic behaviour of single-step mode after it is activated in the HMI.
	All operating modes have in common that they stop before NC blocks with axis movements. In addition, you can define the behaviour with regard to further NC blocks.
	If motion blocks are inserted by specific NC functions (TRC, SPLINE, polynomial contouring, etc.) and block boundaries are altered, these new block boundaries also determine stopping in single-step mode.
Parameter	einzelschrittmodus
Data type	SGN16
Data range	-1: Single-step mode for • NC motion blocks 0: (Default) - Single-step mode for • NC motion blocks and • relevant control blocks 1: Single-step mode for • NC motion blocks and • relevant control blocks and • all other NC blocks *
Dimension	----
Default value	0
Remarks	* No stop is executed with comment lines, comment areas and hidden NC blocks (Skip).

6 Interfacing

6.1 Select via CNC object

The single-step operation mode is set by the PLC writing the modifier before the next step.

The operation mode is modal.

Name	Single Step Mode	
Description	This CNC object selects the function of the single-step mode. Data range: 0 - Step into 1 - Step over 2 - Return from Function 3 - Step to next movement See [FCT-M2// Commandable operating modes [▶ 7]]	
Task	GEO (Port 551)	
Index group	0x12130<C_{ID}>	**Index offset**	0x1A
Data type	UNS32	**Length**	4
Attributes	read/ write	**Unit**	[-]
Remarks		

7 Appendix

7.1 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. 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
i	**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

Keyword index

P