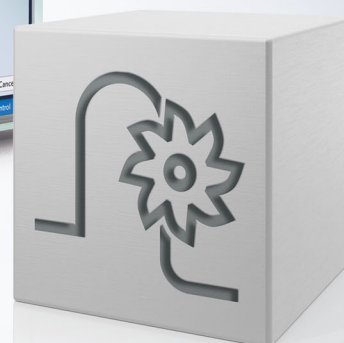
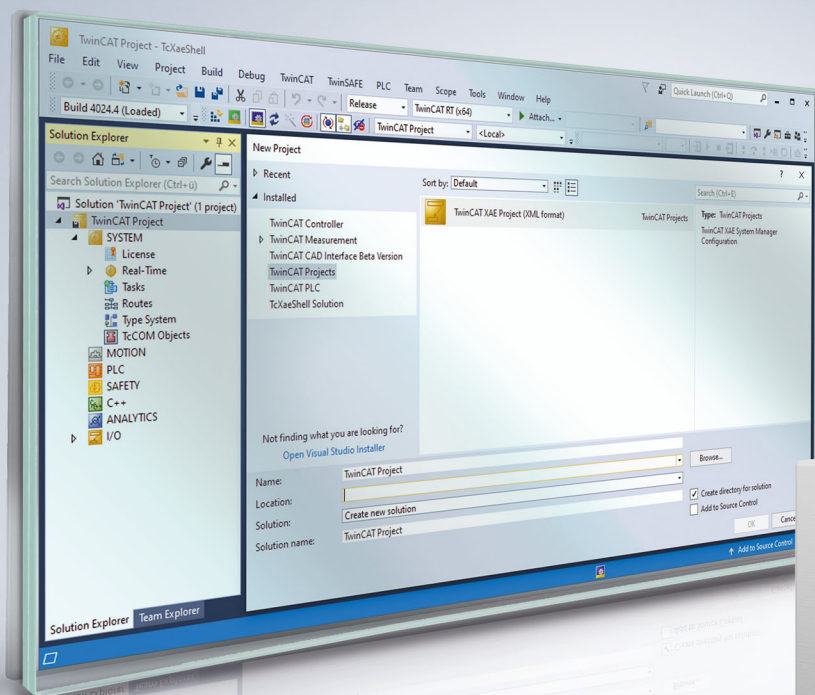


Functional description | EN

TF5200 | TwinCAT 3 CNC

Single step mode



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.

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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 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](#) [► 9]. 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]` [► 10] 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..]` [► 12] 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 [► 16].

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

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)

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](#) [[▶ 15](#)]) 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

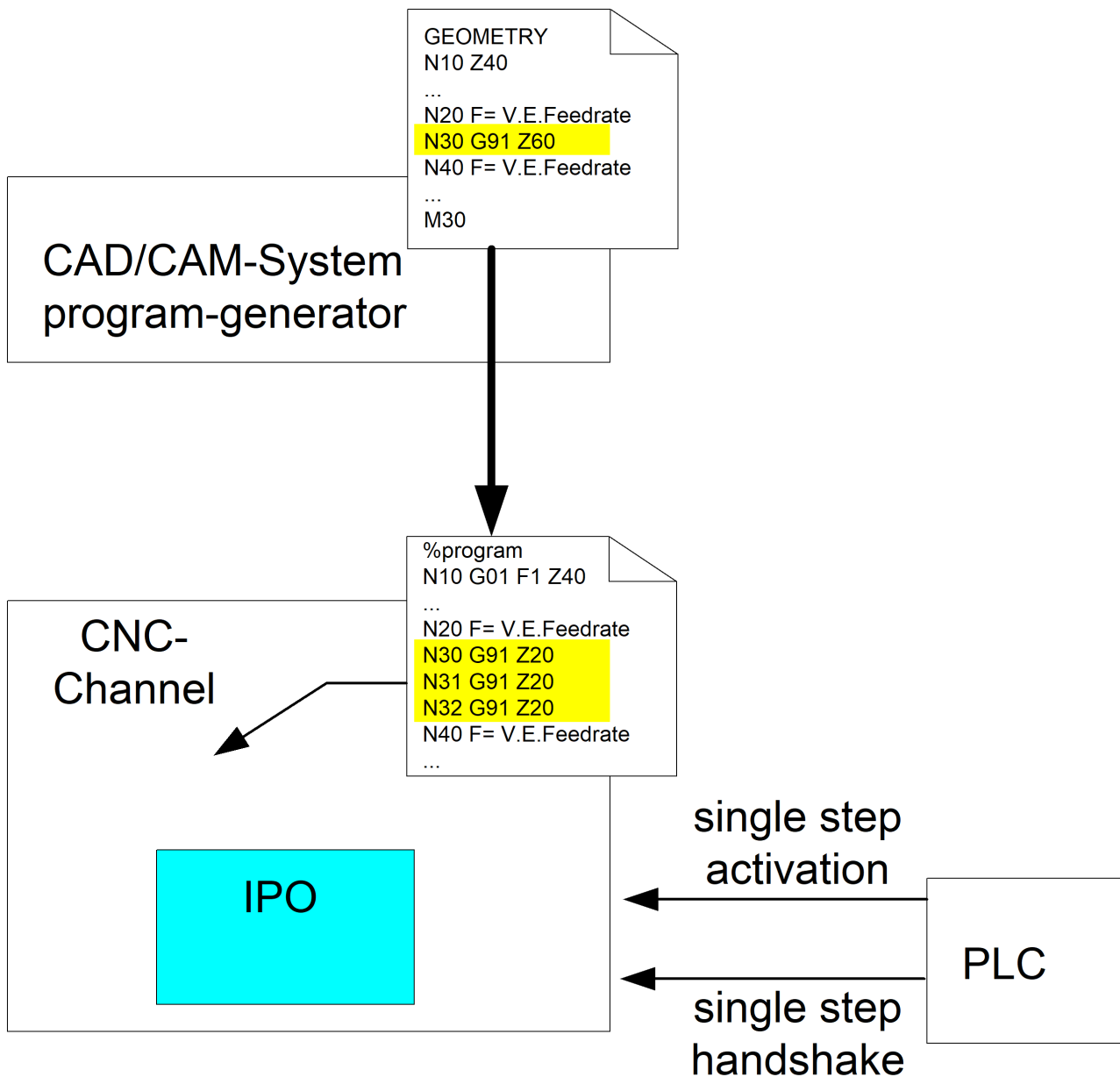


Fig. 1: A single item of geometric information may result in multiple NC motion blocks.

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.
 $\langle \text{Ganzzahliges Ergebnis} \rangle = \langle \text{Satznummer} \rangle / \langle \text{Auflösung} \rangle$
- < 0: Impermissible value for single-step resolution, an error message
is output.

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
...
```



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

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	<p>This parameter defines the basic behaviour of single-step mode after it is activated in the HMI.</p> <p>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.</p> <p>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.</p>
Parameter	einzelstschrittmodus
Data type	SGN16
Data range	<p>-1: Single-step mode for</p> <ul style="list-style-type: none"> • NC motion blocks <p>0: (Default) - Single-step mode for</p> <ul style="list-style-type: none"> • NC motion blocks and • relevant control blocks <p>1: Single-step mode for</p> <ul style="list-style-type: none"> • 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 [► 9]]		
Task	GEO (Port 551)		
Index group	0x12130<C _{ID} >	Index offset	0x1A
Data type	UNS32	Length	4
Attributes	read/ write	Unit	[-]
Remarks			

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