DOCUMENTATION ISG-kernel

System parameter

Short Description:
SYSP

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

1   CNC system parameters

Overview of TwinCAT CNC functionality

Explanation:

The ISG column contains the system limits or the current values permitted by ISG. For example, if the column contains general information such as CPU or memory, the settings for the actual controllers (see column TwinCAT CNC) can be changed due to customer-specific requirements or due to product definitions specified by Beckhoff.

Note: x = function is supported

1	Machining technologies	ISG	TwinCAT CNC
1.1	Turning	x	x
1.2	Milling	x	x
1.3	Drilling	x	x
1.4	Grinding	x	x
1.5	Handling	x	x
1.6	Special machines (plasma, laser, torch cutting, bending etc.)	x	x
1.7	Wire erosion	x	x
1.8	Punching and nibbling	x	x

2	Axis control	ISG	TwinCAT CNC
2.1	Maximum number of axes	CPU, memory	64
2.2	Default number of axes		8
2.3	Maximum number of axes/spindles per channel	32	32
2.4	Number of independent channels	CPU, memory	12
2.5	Maximum number of interpolation axes per channel	32	32
2.6	Maximum number of controlled spindles per channel	CPU, memory	6
2.7	Maximum number of independent axes per channel	32	32
2.8	PLC-controlled spindles per channel	CPU, memory	6
2.9	Axis identifier in the channel	Each string starting with X, Y, Z, U, V, W, Q, A, B, C	Each string starting with X, Y, Z, U, V, W, Q, A, B, C
2.10	Maximum number of synchronised spindles per channel	12	12
2.11	Number of definable coupling groups	Memory	7

2	Axis control	ISG	TwinCAT CNC
2.12	Number of programmable axis pairs within a coupling group	Memory	15
2.13	Maximum number of gantry combinations	Memory	16 (16 masters, with 1 slave each)
2.14	Maximum number of axes within a gantry combination	Memory	32 (1 master, with 31 slaves)
2.15	Programmable motion path limiting (software limit switches)	x	x
2.16	Axis transfer between channels	CPU, memory	32
2.17	Programming resolution	0.0001 mm	0.0001 mm
2.18	Probing signal resolution	0.0001 mm	0.0001 mm
2.19	Smallest programmable increment	0.0001 mm	0.0001 mm
2.20	Multiple position measuring systems		
2.21	Programming switchover inch/metric	G70/G71	G70/G71
2.22	Backlash compensation	x	x
2.23	Axis error compensation direction-dependent (bilateral leadscrew error compensation)	Memory	1500 points each Parameterisable by P-COMP-00059 as of Build V3.1.3079.06.
2.24	Cross compensation Overhang compensation	1 axis, memory	1 axis, 1000 points Parameterisable by P-COMP-00060 as of Build V3.1.3079.06.
2.25	Axis homing with limit switch and zero pulse	x	x
2.26	Velocity feedforward control	x	x
2.27	Acceleration feedforward control	x	x
2.28	Measuring	x	x
2.29	Axis position relative to PLC	x	x
2.30	Parameterisable axis filters	x	x
2.31	Temperature compensation	x	x
2.32	Plane compensation	2 axes, 100 points Parameterisable by P-COMP-00061/ P-COMP-00010/ P-COMP-00011 as of Build V3.1.3079.06.	2 axes, 100 points Parameterisable by P-COMP-00061/ P-COMP-00010/ P-COMP-00011 as of Build V3.1.3079.06.
2.33	Jerk feedforward control	x	x
2.34	Linear axis motion range	-214m to +214m	-214m to +214m
2.35	Rotary axis motion range	-594 to +594 (revolutions)	-594 to +594 (revolutions)

2	**Axis control**	**ISG**	**TwinCAT CNC**
2.36	Spindle rotary axis motion range	unlimited	unlimited
2.37	Circle radius	0 – 10⁶m	0 – 10⁶m
2.38	Axis-specific transformation	Crank, e-function	Crank, e-function
2.39	Maximum number of cycles to couple cross compensation (application-specific)	20	20
2.40	Volumetric compensation acc. to ISO 230	x	As of CNC Build 3039.0
2.41	Measurement and calibration cycles for kinematics 80 and 90 (in variants 0, 2, 8)	x	x
2.42	Maximum number of channels to which a spindle can be attached at start-up		7

3	**Interpolation functions**	**ISG**	**TwinCAT CNC**
3.1	Smallest interpolation size As of CNC Build 2806.0:	0.0001 mm 0.00000001 mm	0.0001 mm 0.00000001 mm
3.2	Rapid traverse	G0	G0
3.3	Linear interpolation	G1	G1
3.4	Exact stop	G60	G60
3.5	Circular interpolation	G2/G3	G2/G3
3.6	Programming absolute/relative centre point	G161/G162	G161/G162
3.7	Radius programming	x	x
3.8	Helical interpolation	G2/G3	G2/G3
3.9	Feedforward control/motion free from position lag	G135/G137	G135/G137
3.10	Feedforward control percentage weighting	G136	G136
3.11	Dwell time	G4	G4
3.12	Face machining	#FACE ON/OFF	#FACE ON/OFF
3.13	Lateral surface machining	#CYL ON/OFF	#CYL ON/OFF
3.14	Thread cutting	G33	G33
3.15	Multi-start thread	G33	G33
3.16	Thread tapping without compensating chuck based on feed rate	G63	G63
3.17	Thread tapping without compensating chuck based on pitch	G331, G332	G331, G332
3.18	Indexing table clamping	x	
3.19	NC block look ahead	200	200 (1000)
3.20	Configurable interpolation cycle time	0.5 to 20 ms	0.5 to 20 ms

3	Interpolation functions	ISG	TwinCAT CNC
3.21	Spline interpolation	AKIMA/BSPLINE	AKIMA/BSPLINE
3.22	Block-specific parameterisation of acceleration slope	#SLOPE [TYPE..]	#SLOPE [TYPE..]
3.23	Forward/reverse motion on the contour	x	x
3.24	Lead axis interpolation	#LEAD ON/OFF	#LEAD ON/OFF
3.25	Dynamic coordinate systems	x	x

4	Feed rate functions	ISG	TwinCAT CNC
4.1	Rapid traverse velocity	0.000001 - 3000 m/min	0.000001 - 1000 m/min
4.2	Rapid traverse override	x	x
4.3	F word (feed rate in block)	0.000001 - 3000 m/min	0.000001 - 1000 m/min
4.4	Speed	0.00017 – 715828 rpm	0.0002 – 100000 rpm
4.5	Manual rapid traverse	0 - 3000 m/min	0 - 1000 m/min
4.6	Manual feed rate	0 - 3000 m/min	0 - 1000 m/min
4.7	Axis-specific override	x	x
4.8	Feed per minute	G94	G94
4.9	Feed rate per revolution	G95	G95
4.10	Programming the machining time	G93	G93
4.11	Transmission response	G8/G9	G8/G9
4.12	Feed stop	x	x
4.13	Acceleration ramp for rapid traverse	x	x
4.14	Weighting factors for acceleration ramp	G132/G133	G132/G133
4.15	Constant cutting speed	G96	G96
4.16	Adjusting the feed rate when tool radius compensation is active	G10/G11	G10/G11
4.17	Feed rate specified by PLC	x	x
4.18	Feed rate reduction by PLC signal	x	x
4.19	Weighting of geometrical ramp time	G134	G134
4.20	E word (feed rate at block end)	x	x

5	5-axis functions	ISG	TwinCAT CNC
5.1	RTCP (rotation tool centre point)	#RTCP ON/OFF	#RTCP ON/OFF
5.2	TLC (tool length compensation)	#TLC ON/OFF	#TLC ON/OFF
5.3	Tool orientation	#TOOL ORI CS	#TOOL ORI CS

5	5-axis functions	ISG	TwinCAT CNC
5.4	Selecting the kinematic	#KIN ID	#KIN ID
5.5	Definition of a machining coordinate system	#CS ON/OFF	#CS ON/OFF
5.6	Definition of a coordinate system for fixture adaptation	#ACS ON/OFF	#ACS ON/OFF
5.7	Linkage of coordinate systems	Memory	8
5.8	Effector coordinate system	#ECS ON/OFF	#ECS ON/OFF
5.9	Temporary transition to the machine coordinate system	#MCS ON/OFF	#MCS ON/OFF
5.10	Kinematic library	x	x
5.11	Manual mode in machining coordinate system	x	x
5.12	Round pipe/section tube machining	x	x
5.13	Universal serial kinematics	x	x
5.14	Free definition of rotation rules for coordinate systems	x	x
5.15	Cascading 2 kinematic transformations	x	x

6	Programming inputs	ISG	TwinCAT CNC
6.1	Skipped block	/	/
6.2	Number of programs	Load from hard disc/network	Load from hard disc/network
6.3	Any block numbering	x	x
6.4	Radius/diameter programming	G51/G52	G51/G52
6.5	Interpolation planes	G17/G18/G19	G17/G18/G19
6.6	-		
6.7	Rotary axis mode	x	x
6.8	Endlessly rotating rotary axis	x	x
6.9	Freely definable machine coordinate system per channel	G53	G53
6.10	Workpiece coordinate system per channel	#CS ON	#CS ON
6.11	Workpiece zero points per channel	G54 – G59	G54 – G59
6.12	Extended workpiece zero points	Memory	90
6.13	Twisting the coordinate system	x	x
6.14	Clamping offsets	Memory	150 groups
6.15	Position preset	#PSET/#PRESET	#PSET/#PRESET
6.16	Reference point offset	G92	G92

6	Programming inputs	ISG	TwinCAT CNC
6.17	Number of definable coordinate systems (CS, ACS, BCS (as of Build V3.1.3079.36))	5 each	5 each
6.18	Insert chamfers and roundings	G301/G302	G301/G302
6.19	Number of P parameters per channel	Memory	1000
6.20	Dimension of parameter arrays	Memory	4
6.21	Global variables V.P (not cross-program)	Memory	1000
6.22	Global variables V.S (cross-program)	Memory	400
6.23	Local variables V.L (not cross-program)	Memory	200
6.24	Number of subroutine levels	Memory	50
6.25	Number of user macros per channel	Memory	100 Parameterisable by P-CHAN-00509 as of Build V3.1.3079.17.
6.26	Mirroring	G20/G21/G22/G23	G20/G21/G22/G23
6.27	Absolute/incremental data	G90/G91	G90/G91
6.28	Production time calculation	x	x
6.29	Mathematical functions	+, -, *, /, **, MOD, ABS, SQR, SQRT, EXP, LN, DEXP, &, |, ^, INV, LN, ==, !=, >=, <=, <, AND, OR, XOR, NOT TRUE, FALSE, SIN, COS, TAN, ASIN, ACOS, ATAN, ATAN2, ACOT, LOG, INT, FRACT, ROUND, CEIL, FLOOR, EXIST, SIZEOF, MIN, MAX, SIGN	+, -, *, /, **, MOD, ABS, SQR, SQRT, EXP, LN, DEXP, &, |, ^, INV, LN, ==, !=, >=, <=, <, AND, OR, XOR, NOT TRUE, FALSE, SIN, COS, TAN, ASIN, ACOS, ATAN, ATAN2, ACOT, LOG, INT, FRACT, ROUND, CEIL, FLOOR, EXIST, SIZEOF, MIN, MAX, SIGN
6.30	Time measurements	#TIMER	#TIMER
6.31	Control block statements (high-level language constructs)	BREAK, CONTINUE, RE-PEAT, DO, FOR, GOTO, IF; ELSE; ENDIF, SWITCH, CASE, DE-FAULT, ENDSWITCH, WHILE, ENDWHILE	BREAK, CONTINUE, RE-PEAT, DO, FOR, GOTO, IF; ELSE; ENDIF, SWITCH, CASE, DE-FAULT, ENDSWITCH, WHILE, ENDWHILE
6.32	Programming axis names	x	x
6.33	Messages from the NC program	#MSG	#MSG
6.34	Cross-channel synchronisation with parameter transfer	#SIGNAL/WAIT	#SIGNAL/WAIT
6.35	Clamping position compensation	#ACS ON/OFF	#ACS ON/OFF
6.36	Definition and activation of a machining co-ordinate system	#CS ON/OFF	#CS ON/OFF

6	Programming inputs	ISG	TwinCAT CNC
6.37	User macros: Max. number of characters in macro name	Memory	30 Parameterisable by P-CHAN-00511 as of Build V3.1.3079.17.
6.38	User macros: Max. number of characters in macro content	Memory	80 Parameterisable by P-CHAN-00512 as of Build V3.1.3079.17.
6.39	Overwritable user macros	x	x
6.40	Nesting depth user macros	Memory	14
6.41	Number of expression labels	Memory	200
6.42	Number of string labels	Memory	200
6.43	Max. string label length	Memory	30
6.44	Only P for parameters	x	x
6.45	Max. number of transfer parameters for cross-channel synchronisation	Memory	12
6.46	Max. string length of axis name	Memory	16
6.47	Workspace monitoring	Memory	20 spaces, 20 points each
6.48	Changing absolute/incremental in NC block	x	x
6.49	Axis-independent cycle programming	x	x
6.50	User macros: Initialisation via file	x	50
6.51	Use of multiple tool (fitting cycle)	x	x
6.52	String operations:	LEFT, MID, LEN, ...	LEFT, MID, LEN, ...
6.53	Scaling contours	#SCALE ON/OFF	#SCALE ON/OFF
6.54	Calling block sequences	L SEQUENCE..	L SEQUENCE..
6.55	Axis-specific polynomial programming (max. 2 axes)	X[POLY...]	X[POLY...]
6.56	Max. string length of an NC program row	4000	4000
6.57	Max. string length of a manual block	300	300
6.58	Max. index of user-defined variable or parameter arrays	0 .. 65535	0 .. 65535
6.59	Cross-channel variable V.I. (cross-program)	Memory	Memory

7	Operation	ISG	TwinCAT CNC
7.1	MDI mode per channel	x	x
7.2	Block search	x	x

7	Operation	ISG	TwinCAT CNC
7.3	Axis homing	x	x
7.4	Single-block mode	x	x
7.5	Manual mode	x	x
7.6	Absolute position determination	x	x
7.7	Homing position offset	x	x
7.8	Handwheel superimposition per channel	x	x
7.9	Handwheel superimposition per axis	x	x
7.10	Handwheel sensitivity	x	x
7.11	Handwheel interrupt	x	x
7.12	jog mode	x	x
7.13	Continuous jog mode	x	x
7.14	Programmed stop	M0	M0
7.15	Optional stop	M1	M1

8	Spindles and auxiliary functions	ISG	TwinCAT CNC
8.1	Configurable M functions per channel	Memory	M0 – M999
8.2	Configurable H functions per channel	Memory	H0 – H999
8.3	Maximum number of M/H functions per NC block	20	20
8.4	Constant cutting speed per channel	x	x
8.5	Tool-specific limit speed per spindle	x	x
8.6	Tool-specific limit acceleration per spindle	x	x
8.7	Spindle synchronisation	x	x
8.8	Multiple spindle control	Memory	6
8.9	Spindle interpolation (C axis)	x	x
8.10	Block global synchronisation of M/H function at NC command	x	x
8.11	Block global synchronisation of M/H function at G1	x	x
8.12	Automatic determination of gear stage	x	M40 – M45

9	Tool functions	ISG	TwinCAT CNC
9.1	Number of internal tool locations per channel	Memory	200
9.2	Connecting to external tool management system	x	x

9	Tool functions	ISG	TwinCAT CNC
9.3	Tool number	T0 to T2000000000	T0 to T2000000000
9.4	Sister tools and variants	x	x
9.5	Support for tool life calculation	x	x
9.6	Programmable tool data	x	x
9.7	Free tool-specific parameters	Memory	60
9.8	Tool-specific minimum and maximum speeds	x	x
9.9	Tool-specific acceleration	x	x
9.10	Tool-specific kinematic	x	x
9.11	Tool offsets in all axes	x	x
9.12	Tool-specific kinematic parameters	x	x
9.13	Tool length compensation	D	D
9.14	Tool radius compensation	G40/G41/G42	G40/G41/G42
9.15	Transition elements rounding/chamfer	x	x
9.16	Direct and indirect tool selection	x	x
9.17	Cutter radius compensation	x	x
9.18	Number of sister tools and variants	3	3
9.19	Tool wear compensation	x	x
9.20	Selection types of tool radius compensation	G05/G138/G139/G236/ G237/G238/G239	G05/G138/G139/G236/ G237/G238/G239

10	PLC functions	ISG	TwinCAT CNC
10.1	Configurable CNC/PLC variables and variable arrays V.E.	Memory	215 per channel (Build 15xx: 225 per channel)
10.2	M function look ahead	Distance/time	Distance/time
10.3	Structure definition for CNC/PLC variables	Memory	50 per channel
10.4	CNC/PLC variables: Elements per structure	Memory	50 per channel
10.5	CNC/PLC variables: Structure nodes reserved for variable structures	Memory	750 per channel
10.6	Extended string length of CNC/PLC variables	Memory	127 characters

11	Other system parameters	ISG	TwinCAT CNC
11.1	Maximum axis velocity	2000 m/s	2000 m/s
11.2	Maximum axis acceleration	1000 m/s2	1000 m/s2
11.3	Minimum ramp time	0 s	0 s

11	Other system parameters	ISG	TwinCAT CNC
11.4	Maximum ramp time	100 s	100 s
11.5	Maximum override	2000 ‰	2000 ‰

2 Conformity comparison between DIN ISO programming and CNC programming language syntax

The comparison is based on DIN 66025 Part 1 (last edition January 1983) and Part 2 (last edition September 1988):

2.1 Meaning of G functions

No.	DIN/ISO code	Description	TwinCAT / ISG Code	Conformity check
1	G00	rapid traverse	G00	compliant
2	G01	Linear interpolation with programmed feed rate	G01	compliant
3	G02	Clockwise circular interpolation with programmed feed rate	G02	compliant
4	G03	Anti-clockwise circular interpolation with programmed feed rate	G03	compliant
5	G04	Programmable dwell time	G04	compliant
6	G05	Not assigned	G05	Direct tangential selection/ deselection of tool radius compensation
7	G06	Selecting spline interpolation	G151	compliant
8	G07	Not assigned	Not assigned	
9	G08	Acceleration at block start	G08	compliant
10	G09	Deceleration at block end	G09	compliant
11	G10	Not assigned	G10	Constant feed rate with tool radius compensation
12	G11	Not assigned	G11	Adapted feed rate with tool radius compensation
13	G12	Not assigned	G12	Deselect corner deceleration
14	G13	Not assigned	G13	Select corner deceleration
15	G14	Not assigned	Not assigned	

16	G15	Not assigned	Not assigned	
17	G16	Not assigned	Not assigned	
18	G17	Select working plane XY	G17	compliant
19	G18	Select working plane ZX	G18	compliant
20	G19	Select working plane YZ	G19	compliant
21	G20	Not assigned	G20	Deselect mirroring
22	G21	Not assigned	G21	Mirroring programmed path on the Y axis
23	G22	Not assigned	G22	Mirroring programmed path on the X axis
24	G23	Not assigned	G23	Superimposing G21 and G22
25	G24	Not assigned	Not assigned	
26	G25	Not assigned	G25	Linear transitions with TRC
27	G26	Not assigned	G26	Circular transitions with TRC
28	G27	Not assigned	Not assigned	
29	G28	Not assigned	Not assigned	
30	G29	Not assigned	Not assigned	
31	G30	Not assigned	Not assigned	
32	G31	Not assigned	Not assigned	
33	G32	Not assigned	Not assigned	
34	G33	Thread cutting, constant pitch	G33	compliant
35	G34	Thread cutting, increasing pitch	Not assigned	
36	G35	Thread cutting, decreasing pitch	Not assigned	
37	G36	Not assigned	Not assigned	
38	G37	Not assigned	Not assigned	
39	G38	Not assigned	Not assigned	
40	G39	Not assigned	Not assigned	
41	G40	Deactivate tool radius compensation	G40	compliant
42	G41	Activate tool radius compensation on left of contour	G41	compliant
43	G42	Activate tool radius compensation on right of contour	G42	compliant
44	G43	Not assigned	Not assigned	
45	G44	Not assigned	Not assigned	
46	G45	Not assigned	Not assigned	

47	G46	Not assigned	Not assigned	
48	G47	Not assigned	Not assigned	
49	G48	Not assigned	Not assigned	
50	G49	Not assigned	Not assigned	
51	G50	Not assigned	Not assigned	
52	G51	Not assigned	G51	Selecting diameter programming
53	G52	Not assigned	G52	Deselecting diameter programming
54	G53	Cancel zero offset	G53	compliant
55	G54	Select zero offset 1	G54	compliant
56	G55	Select zero offset 2	G55	compliant
57	G56	Select zero offset 3	G56	compliant
58	G57	Select zero offset 4	G57	compliant
59	G58	Select zero offset 5	G58	compliant
60	G59	Select zero offset 6	G59	compliant
61	G60	Not assigned	G60	Exact stop (stop at block end, then continue motion in next block)
62	G61	Not assigned	G61	Select polynomial contouring
63	G62	Not assigned	Not assigned	
64	G63	Thread tapping	G63	compliant
65	G64	Not assigned	Not assigned	
66	G65	Not assigned	Not assigned	
67	G66	Not assigned	Not assigned	
68	G67	Not assigned	Not assigned	
69	G68	Not assigned	Not assigned	
70	G69	Not assigned	Not assigned	
71	G70	Inputs in inches (inch)	G70	compliant
72	G71	Inputs in metric units	G71	compliant
73	G72	Not assigned	Not assigned	
74	G73	Not assigned	Not assigned	
75	G74	Homing	G74	compliant
76	G75	Not assigned	Not assigned	
77	G76	Not assigned	Not assigned	
78	G77	Not assigned	Not assigned	

79	G78	Not assigned	Not assigned	
80	G79	Not assigned	Not assigned	
81	G80	End machining cycle	G80 or not assigned	Implicit subroutine call (if name was configured)
82	G81	Drilling, centring cycle	G81 or not assigned	Implicit subroutine call (if name was configured)
83	G82	Drilling, spot facing cycle	G82 or not assigned	Implicit subroutine call (if name was configured)
84	G83	Deep hole drilling, chip breaking cycle	G83 or not assigned	Implicit subroutine call (if name was configured)
85	G84	Thread tapping cycle	G84 or not assigned	Implicit subroutine call (if name was configured)
86	G85	Boring 1 cycle	G85 or not assigned	Implicit subroutine call (if name was configured)
87	G86	Boring 2 cycle	G86 or not assigned	Implicit subroutine call (if name was configured)
88	G87	Boring 3 cycle	G87 or not assigned	Implicit subroutine call (if name was configured)
89	G88	Boring 4 cycle	G88 or not assigned	Implicit subroutine call (if name was configured)
90	G89	Boring 5 cycle	G89 or not assigned	Implicit subroutine call (if name was configured)
91	G90	Absolute dimension	G90	compliant
92	G91	Incremental dimension	G91	compliant
93	G92	Reference point offset	G92	compliant
94	G93	Inverse-time feed rate in 1/mm	G93	Machining time in seconds
95	G94	Feed rate in mm/min, inch/min, degrees/min	G94	compliant
96	G95	Feed rate in mm/revolution, inch/revolution	G95	compliant
97	G96	Constant cutting speed m/min	G96	compliant
98	G97	Spindle speed in rpm.	G97	compliant
99	G98	Not assigned	G98	Setting negative software limit switch
100	G99	Not assigned	G99	Setting positive software limit switch
End of DIN/ISO definition				

2.2 Meaning of other M functions

No.	DIN/ISO code	Description	TwinCAT / ISG Code	Conformity check
1	M00	Programmed stop	M00	compliant
2	M01	Optional stop	M01	compliant
3	M02	Program end	M02	compliant
4	M03	Clockwise spindle rotation (Classes 1 - 3) or cutting on (Class 4)	M03	Compliant (meaning is configurable)
5	M04	Anticlockwise spindle rotation (Classes 1 - 3) or cutting off (Class 4)	M04	Compliant (meaning is configurable)
6	M05	Spindle stop (Classes 1 - 3) or not assigned (Class 4)	M05	Compliant (meaning is configurable)
7	M06	Tool change	M6 or not assigned	Implicit subroutine call (if name was configured)
8	M10	Clamp	M10	
9	M11	Release	M11	
10	M17	Not assigned	M17	Subroutine end
11	M19	Spindle positioning (Classes 1 - 3) or not assigned (Class 4)	M19	Compliant (meaning is configurable)
12	M29	Not assigned	M29	Subroutine end
13	M30	Program end	M30	compliant

No.	DIN/ISO code	Description	TwinCAT / ISG Code	Conformity check
14	M40	Automatic gear changes (Classes 1 - 3) or unassigned	M40 or not assigned	compliant
15	M41	Gear stage 1 (Classes 1 - 3) or free	M41 or not assigned	compliant
16	M42	Gear stage 2 (Classes 1 - 3) or free	M42 or not assigned	compliant
17	M43	Gear stage 3 (Classes 1 - 3) or free	M43 or not assigned	compliant
18	M44	Gear stage 4 (Classes 1 - 3) or free	M44 or not assigned	compliant
19	M45	Gear stage 5 (Classes 1 - 3) or free	M45 or not assigned	compliant
20	M48	Effective superimposition (e.g. override)	G166/G167	Select path/spindle override 100% (blockwise)
21	M49	Ineffective superimposition	not assigned	
22	M60	Tool change	not assigned	
The meanings of all other M functions are settable depending on the specific class used and defined in the DIN/ISO code.				

2.3 Address character and special characters

No.	DIN/ISO code	Description	Twin-CAT / ISG Code	Conformity check
1	A	rotation about X	A	compliant
2	B	rotation about Y	B	compliant
3	C	Rotation about Z	C	compliant
4	D	Tool data	D	compliant
5	E	Not assigned	E	Feed at block end
6	F	feed	F	compliant
7	G	Path preparatory functions	G	compliant
8	H	Not assigned	H	Additional technology functions
9	I	Interpolation parameter for X	I	compliant
10	J	Interpolation parameter for Y	J	compliant
11	K	Interpolation parameter for Z	K	compliant
12	L	Not assigned	L/LL	Definition/call of subroutines
13	M	Technology functions	M	compliant
14	N	Block number	N	compliant
15	O	Not assigned	not as-signed	
16	P	Not assigned	P	Calculation parameter
17	Q	Not assigned	Q	Freely configurable axis
18	R	Not assigned	R	Circle radius
19	S	Spindle speed	S	compliant
20	T	Select tool position	T	compliant
21	U	Motion parallel to X axis	U	compliant
22	V	Motion parallel to Y axis	V	compliant
23	W	Motion parallel to Z axis	W	compliant
24	X	Motion in direction of X axis	X	compliant
25	Y	Motion in direction of Y axis	Y	compliant
26	Z	Motion in direction of Z axis	Z	compliant

27	%	Program start	%	compliant
28	(	Start of a comment	(	compliant
29	)	End of a comment	)	compliant
30	+	Plus	+	compliant
31	-	Minus	-	compliant
32	.	Decimal point	.	compliant
33	/	Skip block	/	compliant
34	:	Main block, also conditional stop of program reset	:	Marker to define a jump label (block number) or 2-path programming
35	;	Start of a comment	;	Comment up to block end

3   Appendix

3.1   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

---

> **ℹ** | **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