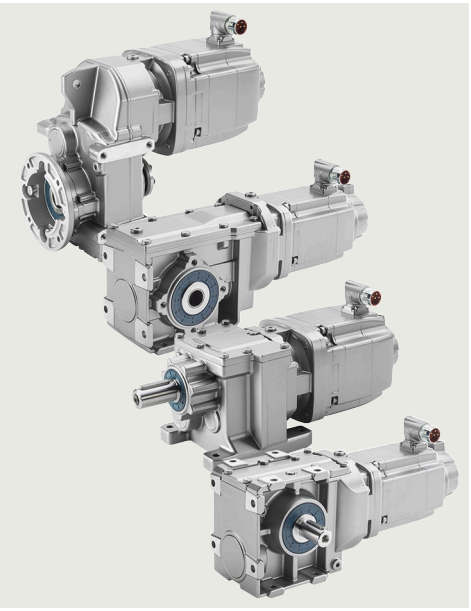
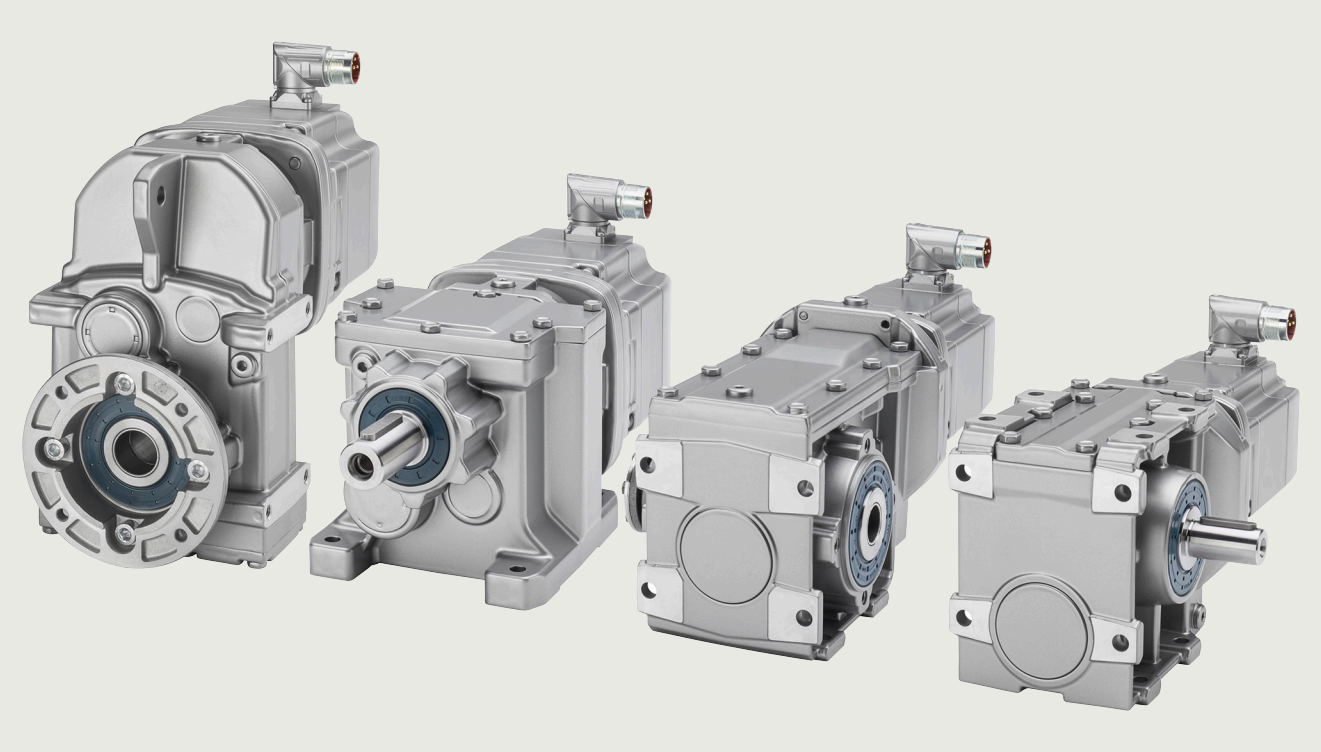
Introduction



Overview



SIMOTICS S-1FG1 is the new generation of servo geared motors from Siemens.

They are available as servo helical, servo parallel shaft, servo bevel and servo helical worm geared motors and are delivered as a completely assembled unit and with oil-filled gearbox. A wide range of mechanical mounting methods can be implemented with the numerous options.

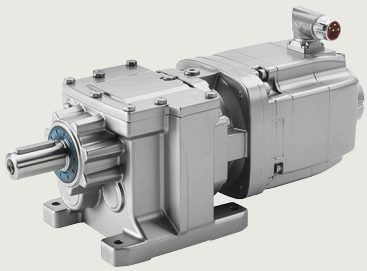
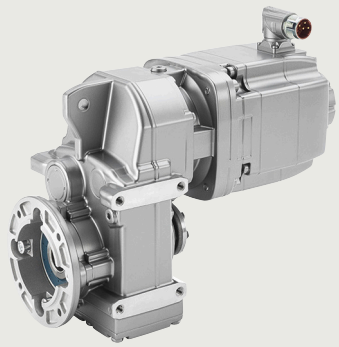
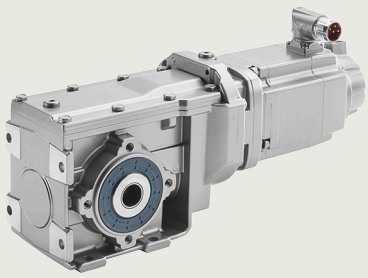
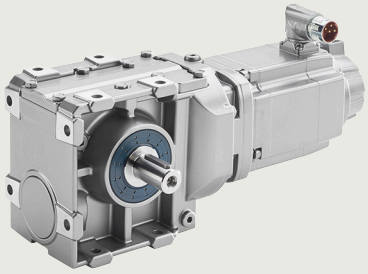
SIMOTICS S-1FG1 servo geared motors are designed for operation without external cooling and the heat is dissipated through the motor surface and the gearbox mounting surface.

SIMOTICS S-1FG1 servo geared motors can be combined with the SINAMICS S120 drive system to create a powerful system with high functionality.

This catalog presents a comprehensive overview of the portfolio of SIMOTICS S-1FG1 servo geared motors and is designed to help users make a preliminary selection of products to meet the requirements of a particular drive application.
The information in the catalog relating to specific motors and gearboxes is intended as a guide so that the correct servo geared motor can be identified on the basis of a known application.

We recommend use of the "SIZER for Siemens Drives" (integrated into TIA Selection Tool) engineering tool so that SIMOTICS S-1FG1 servo geared motors can be accurately configured. This tool takes load duty cycles into account and performs a thermal and mechanical analysis of the gearbox.

Overview (continued)

	Gearbox designation	Transmission ratios	Number of gearbox sizes	Maximum output torque $M_{2max, G}$ Nm	Gear ratio i
Servo helical geared motors					
	***Z19 ... Z129***	2-stage	10	14 … 5200	3.4 … 62.5
	D19 ... D129	3-stage	10	102 … 5000	35.8 … 373
Servo parallel shaft geared motors					
	***FZ29 ... FZ129***	2-stage	8	17 … 5140	3.6 … 70.7
	FD29 ... FD129	3-stage	8	163 … 5010	46.4 … 413
Servo bevel geared motors					
	***B19 ... B49***	2-stage	4	15 … 465	3.5 … 59.3
	K39 ... K149	3-stage	8	24 … 8160	5.2 … 244.3
Servo helical worm geared motors					
	***C29 ... C89***	2-stage	5	46 … 1480	6.2 ... 102.5

Overview (continued)

Torque classes

SIMOTICS S-1FG1 servo geared motors are classified according to fixed torque steps. Within a torque class, almost the same output torques are achieved for different gearbox types.

Servo helical geared motors 2-stage and 3-stage												
Gearbox types *Z*, *D*												
Gearbox size		***19***	***29***	***39***	***49***	***59***	***69***	***79***	***89***	***109***	***129***	–
Maximum output torque	Nm	114	161	215	360	480	680	1010	1930	3690	5200	–

Servo parallel shaft geared motors 2-stage and 3-stage												
Gearbox types *FZ*, *FD*												
Gearbox size		–	***29***	***39***	***49***	–	***69***	***79***	***89***	***109***	***129***	–
Maximum output torque	Nm	–	184	325	580	–	665	1100	2010	3530	5140	–

Servo bevel geared motors 2-stage												
Gearbox type *B*												
Gearbox size		***19***	***29***	***39***	***49***	–	–	–	–	–	–	–
Maximum output torque	Nm	51	114	250	465	–	–	–	–	–	–	–

Servo bevel geared motors 3-stage												
Gearbox type *K*												
Gearbox size		–	–	***39***	***49***	–	***69***	***79***	***89***	***109***	***129***	***149***
Maximum output torque	Nm	–	–	230	460	–	640	840	1610	3070	4700	8160

Servo helical worm geared motors 2-stage												
Gearbox type *C*												
Gearbox size		–	***29***	***39***	***49***	–	***69***	–	***89***	–	–	–
Maximum output torque	Nm	–	126	255	400	–	730	–	1480	–	–	–

Benefits

High energy efficiency for a fast return on investment

When developing SIMOTICS S-1FG1 servo geared motors, great emphasis was placed on achieving the highest possible energy efficiency.

Using the plug-on pinion principle in the first gearbox stage of the servo geared motors, higher transmission ratios are achieved when compared to gearboxes with slip-on pinion.

This means that frequently instead of 3-stage gearboxes with an efficiency of approx. 94 %, 2-stage helical and parallel shaft gearboxes with an efficiency of ≥ 96 % can be used.

Extremely compact and low weight for easy handling in the machine or system in the smallest space

Since the gearbox is mounted directly on the servomotor, the unit is lighter and requires a smaller footprint in the customer's machine. In addition, interfaces and sealing joints are reduced as a result of the integrated end shield.

Harmoniously coordinated modular system to provide the optimum solution for your particular drive task

The SIMOTICS S-1FG1 portfolio of servo geared motors has been finely scaled in terms of gearbox sizes and transmission ratios so that it can offer the perfect drive with respect to motor size, output speed or output torque for any application.

When developing SIMOTICS S-1FG1 servo geared motors, particular emphasis was placed on achieving well-balanced gearbox properties such as:

- Maximum output torque
- Permissible radial force
- Output shaft diameter
- Bearing service life
- Housing stiffness
- Gearing reliability (fatigue endurable)
- Shaft strength (fatigue endurable)

Fine scaling of transmission ratios for the right output speed for any application

With their wide range of transmission ratios, from very low up to very high, SIMOTICS S-1FG1 servo geared motors provide the necessary flexibility for any kind of drive application.

Further, the gearboxes are quieter as a result of the lower circumferential velocity of the first gearbox stage.

Intelligent sealing concept for easy maintenance

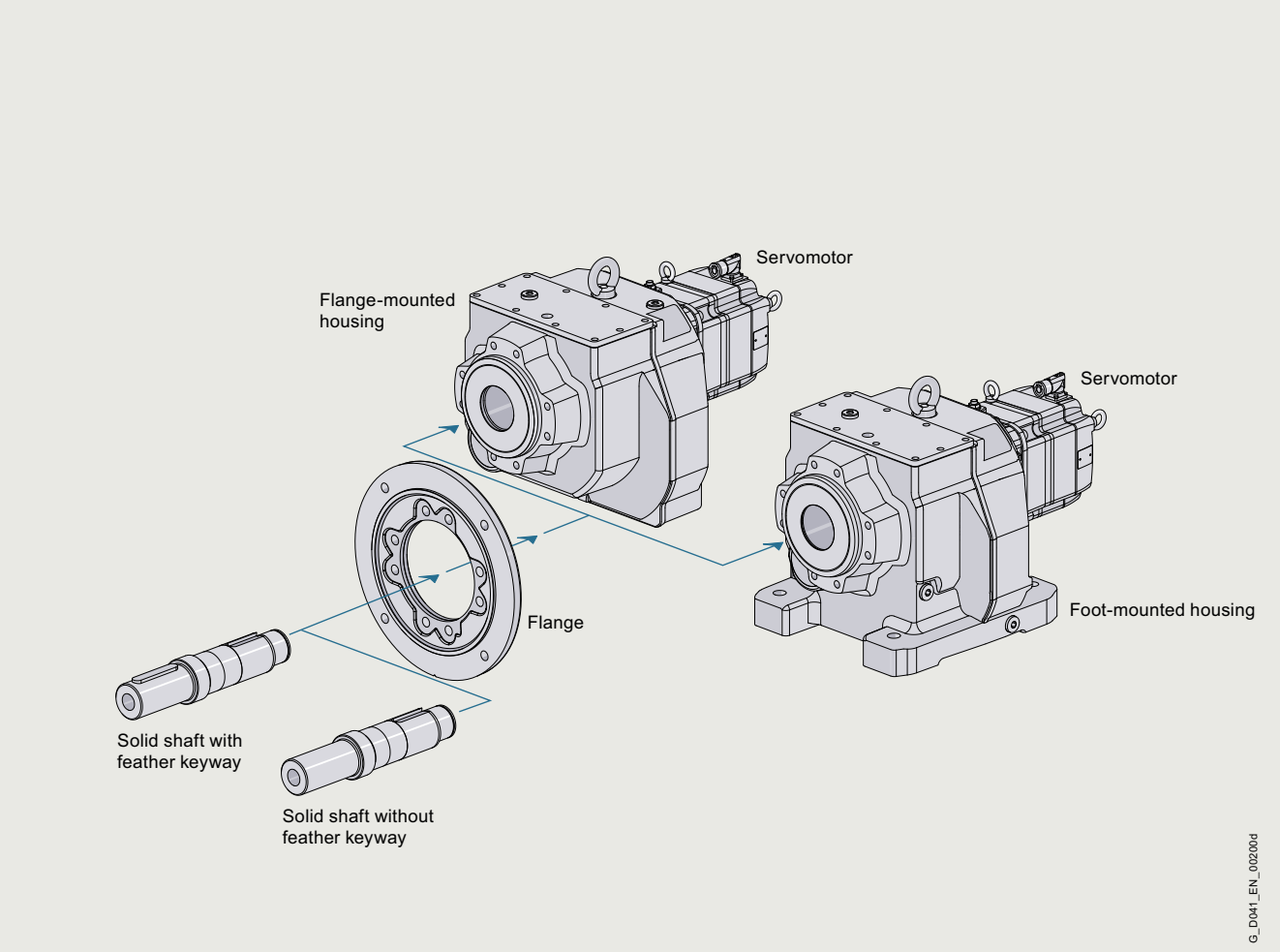
Optimally coordinated output shaft sealing concepts are available for the various applications and ambient conditions in which SIMOTICS S-1FG1 servo geared motors are deployed.

Gearboxes in gearbox sizes *19* and *29* are lubricated for life.

All SIMOTICS S-1FG1 servo geared motors with venting are equipped as standard with a pressure breather valve.

Design

Servo helical geared motors 2-stage – gearbox type Z, 3-stage – gearbox type D



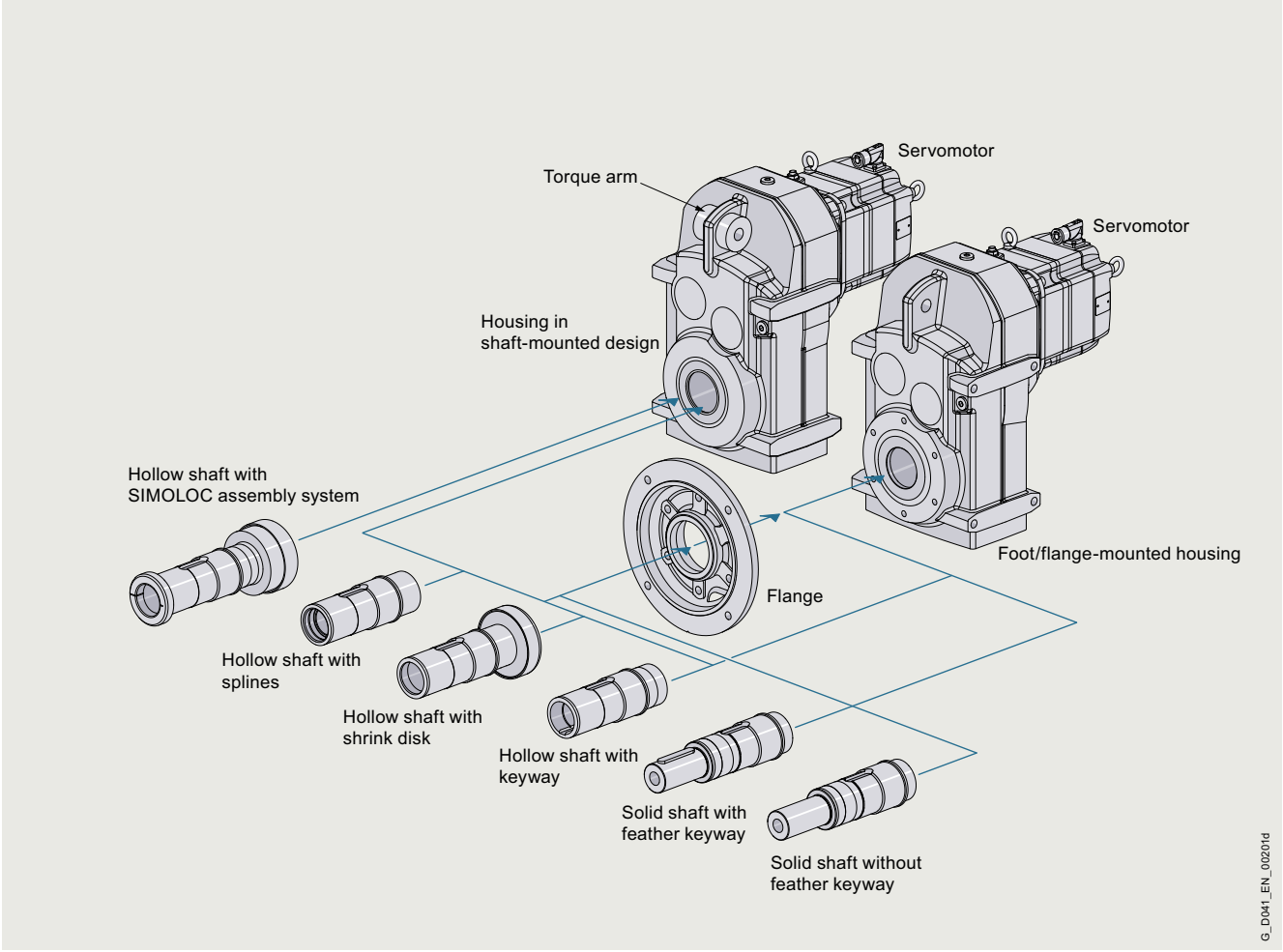
Modular system, servo helical geared motor

SIMOTICS S-1FG1 servo helical geared motors are available in the following versions for mounting in any position:

- 2 or 3 stages
- Foot-mounted design
- Flange-mounted design
- Combined foot/flange-mounted design (gearbox sizes 29 to 89)
- Design with integrated housing flange
- Solid shaft design with feather keyway or without feather keyway

Design (continued)

Servo parallel shaft geared motors 2-stage – gearbox type FZ, 3-stage – gearbox type FD



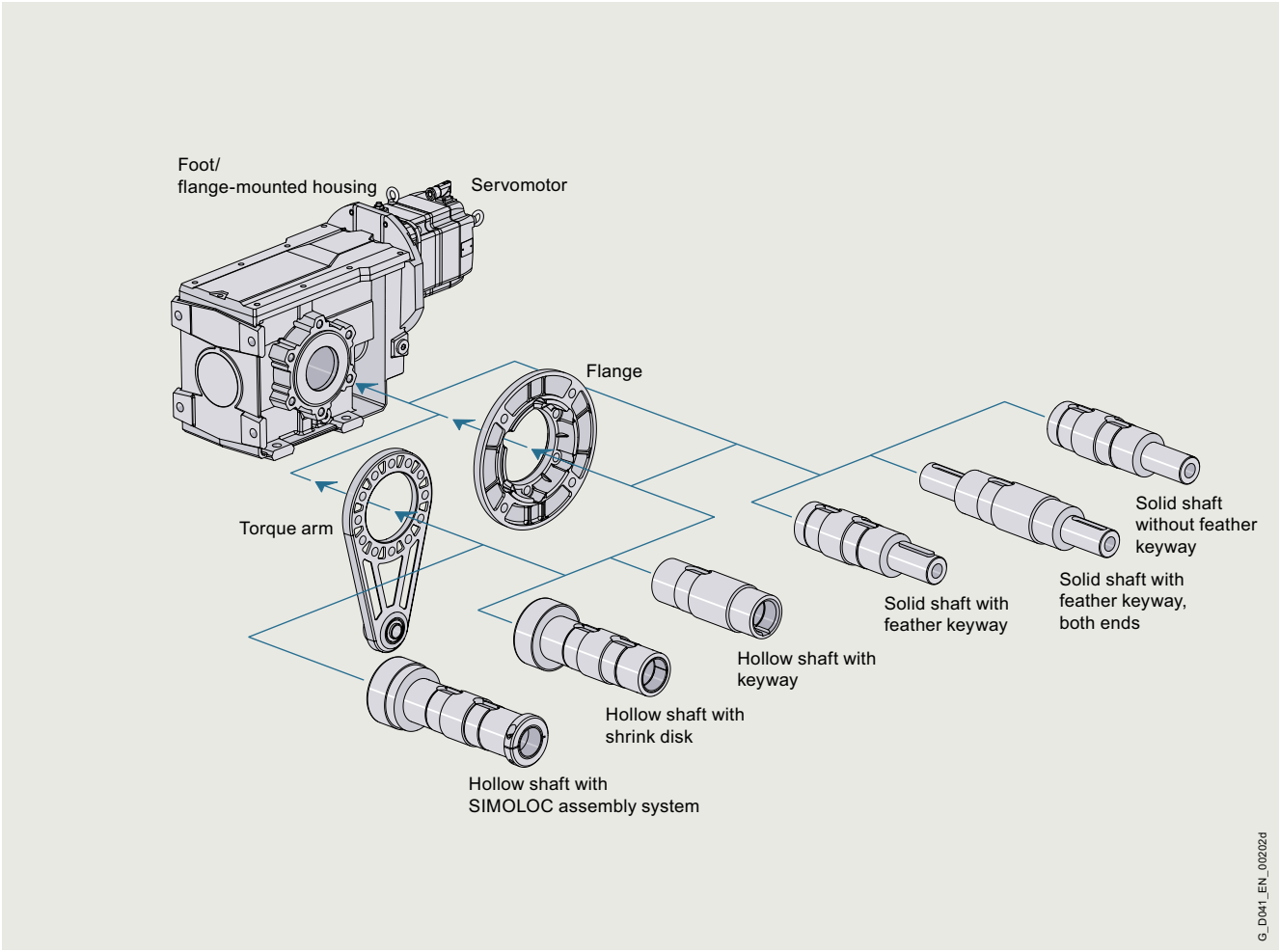
Modular system, servo parallel shaft geared motor

SIMOTICS S-1FG1 servo parallel shaft geared motors are available in the following versions for mounting in any position:

- 2 or 3 stages
- Foot-mounted design
- Flange-mounted design
- Design with integrated housing flange
- Shaft-mounted design (torque arm)
- Hollow-shaft design with feather keyway, splined shaft, shrink disk or SIMOLOC assembly system
- Solid shaft design with feather keyway or without feather keyway

Design (continued)

Servo bevel geared motors 2-stage – gearbox type B



Modular system, servo bevel geared motor 2-stage – gearbox type *B*

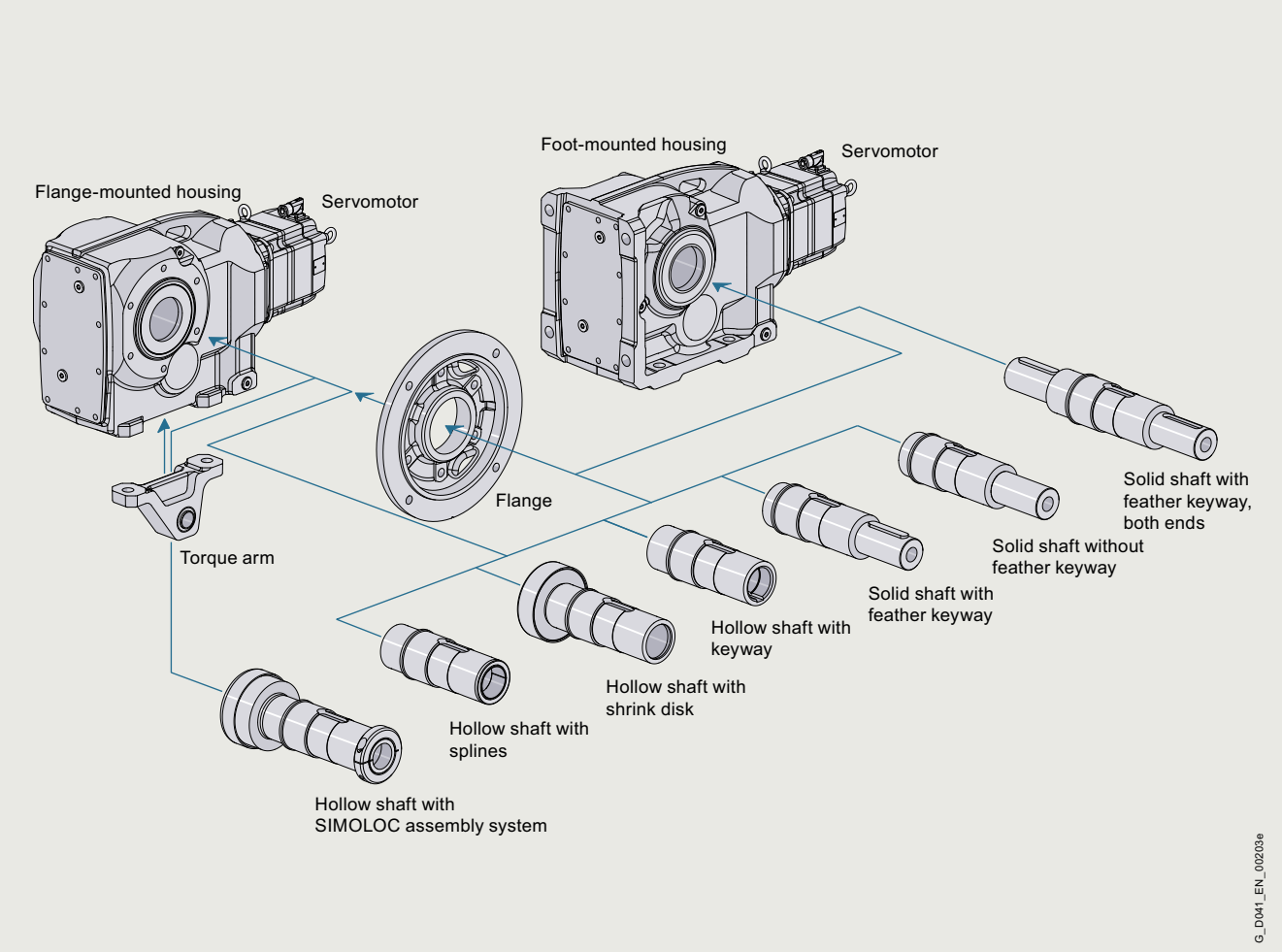
SIMOTICS S-1FG1 servo bevel geared motors – gearbox type *B* are available in the following versions for mounting in any position:

- 2 stages
- Foot-mounted design
- Flange-mounted design
- Design with integrated housing flange
- Shaft-mounted design (torque arm)
- Hollow-shaft design with feather keyway, splined shaft, shrink disk or SIMOLOC assembly system
- Solid shaft design with feather keyway (at one end or both ends) or without feather keyway

For 2-stage bevel gearboxes *B*, the torque arm is supplied loose to enable it to be mounted as required on site.

Design (continued)

Servo bevel geared motors 3-stage – gearbox type K



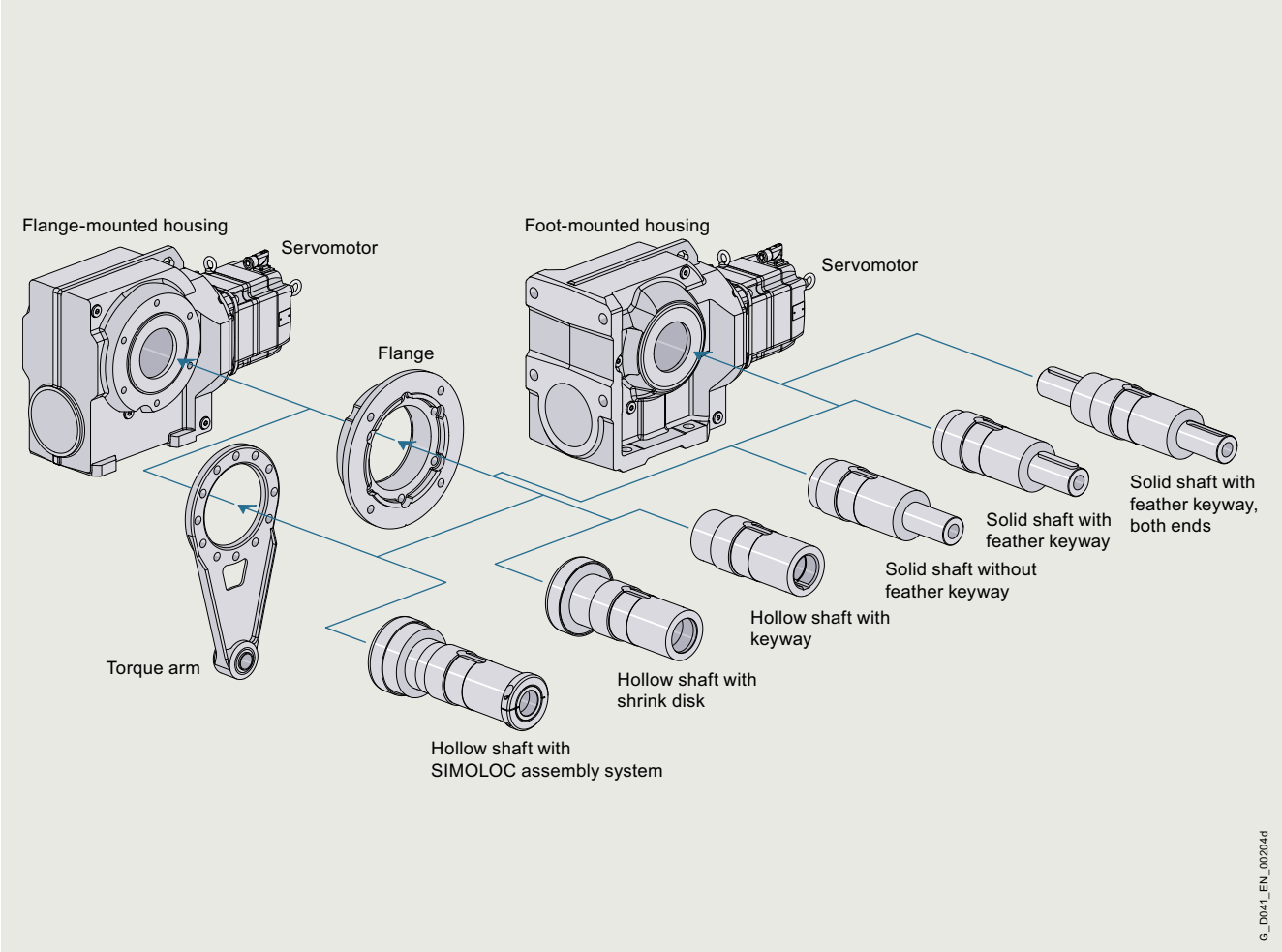
Modular system, servo bevel geared motor 3-stage – gearbox type *K*

SIMOTICS S-1FG1 servo bevel geared motors – gearbox type *K* are available in the following versions for mounting in any position:

- 3 stages
- Foot-mounted design
- Flange-mounted design
- Design with integrated housing flange
- Shaft-mounted design (torque arm)
- Hollow-shaft design with feather keyway, splined shaft, shrink disk or SIMOLOC assembly system
- Solid shaft design with feather keyway (at one end or both ends) or without feather keyway

Design (continued)

Servo helical worm geared motors 2-stage – gearbox type C



Modular system, servo helical worm geared motor

SIMOTICS S-1FG1 servo helical worm geared motors are available in the following versions for mounting in any position:

- 2 stages
- Foot-mounted design
- Flange-mounted design
- Design with integrated housing flange
- Shaft-mounted design (torque arm)
- Hollow-shaft design with feather keyway, shrink disk or SIMOLOC assembly system
- Solid shaft design with feather keyway (at one end or both ends) or without feather keyway

For helical worm gearboxes, the torque arm is supplied loose to enable it to be mounted as required on site.

Integration

SIMOTICS S-1FG1 servo geared motors are part of the Siemens integrated system configuration.

Siemens integrated system configuration stands for standardized, tailored and modular components, systems and services. It encompasses the world's most extensive portfolio – from geared motors through motor starters and converters, identification systems and switchgear up to the automation.

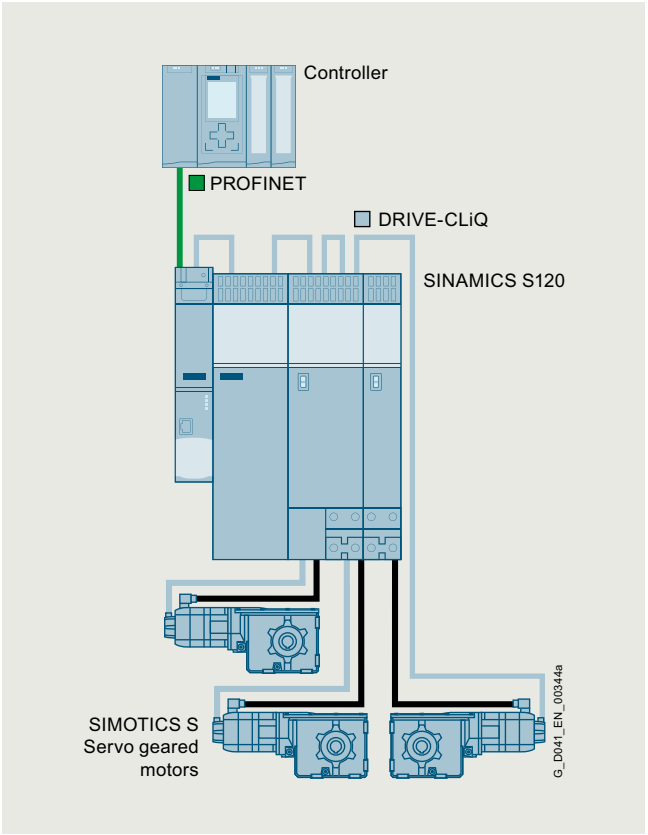
The complete portfolio is exhaustively tested – also in the field – for maximum availability. The components are harmonized and coordinated with one another with standard interfaces and power bus systems.

Siemens therefore allows users to reduce their installation and commissioning costs, while increasing flexibility and system availability at the same time.

Energy-efficient motors, motor starters, soft starters and converters as well as the Power Management system based on SIMATIC PCS 7, SIMATIC WinCC and power monitoring devices ensure a high energy saving potential.

Optimum interaction

When developing SIMOTICS S-1FG1 servo geared motors, special emphasis was placed on making them completely compatible with the SINAMICS S110 and SINAMICS S120 drive systems. Motors, converters and commissioning tools are all perfectly coordinated. The electronic rating plate and the ability to integrate the motors via the DRIVE-CLiQ system interface ensure quick commissioning. Prefabricated MOTION-CONNECT signal and power cables offer an easy, reliable method of connecting components.

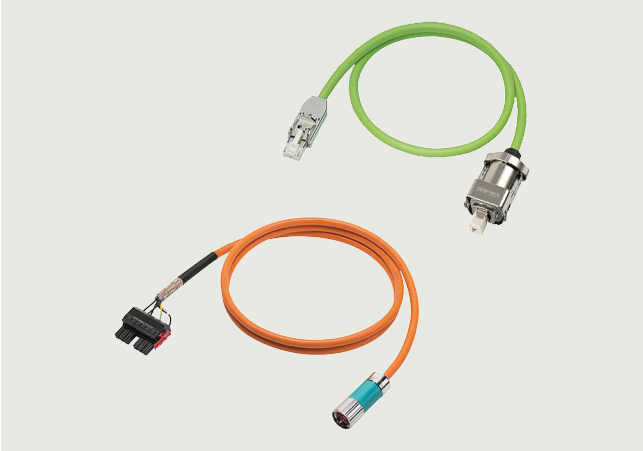


Integrated in Totally Integrated Automation

Together with SINAMICS converters, the SIMOTICS S-1FG1 servo geared motors are an integral part of Totally Integrated Automation.
This means: They can be seamlessly integrated into the drive and automation environment. The TIA Portal speeds up the engineering process and reduces costs and outlay – at the planning and commissioning stages, during operation and maintenance and when automation systems are expanded. This ensures security of investment and helps users to achieve a sustained improvement in their competitive position.

MOTION-CONNECT connection system

MOTION-CONNECT includes connection systems and components which are optimally tailored to individual areas of application. MOTION-CONNECT cables feature state-of-the-art connection systems to ensure fast, reliable connection of different components, and offer maximum quality as well as system-tested reliability.



MOTION-CONNECT power cable and signal cable

MOTION-CONNECT cables are available as fully-assembled power and signal cables or sold by the meter. The pre-assembled cables can be ordered in length units of 10 cm (3.94 in) and can be extended, if necessary.

Whatever your machine requirements, MOTION-CONNECT offers the solution.

- **Robust, high-performance and easy to use**
  thanks to pre-assembled cables with a rugged metal connector in degree of protection IP67 and reliable SPEED-CONNECT quick-release lock
- **Outstanding and proven quality**
  achieved by consistent quality management and system-tested cables

Cables are available in two different qualities – MOTION-CONNECT 500 and MOTION-CONNECT 800PLUS.

MOTION-CONNECT 500	MOTION-CONNECT 800PLUS
• Cost-effective solution for predominantly fixed installation • Tested for travel distances up to 5 m (16.4 ft)	• Meets requirements for use in cable carriers • Oil-resistant • Tested for travel distances of up to 50 m (164 ft)

More information

- SIMOTICS S-1FG1 and SIMOTICS S-1FK7 signal cables are identical with the same encoder type.
- Catalogs D 21.4, NC 62
- Internet:
  www.siemens.com/motion-connect
  www.siemens.com/industrymall
  www.siemens.com/tia-selection-tool

Configuration

The following electronic configuring and engineering tools are available for SIMOTICS S-1FG1 servo geared motors and the SINAMICS converter family:

SinaSave energy efficiency tool

The SinaSave energy efficiency tool determines energy saving potential and amortization times based on your individual conditions of use and therefore offers practical assistance in making decisions about investments in energy-efficient technologies.

Siemens Product Configurator

The Siemens Product Configurator helps to configure the optimum drive technology products for a large number off applications – starting with gear units, motors, converters as well as the associated options and components and ending with controllers, software licenses and connection systems.

The Siemens Product Configurator can be used on the internet without requiring any installation. The Siemens Product Configurator can be found in the Siemens Industry Mall at the following address:
www.siemens.com/spc

SIZER for Siemens Drives engineering tool (integrated into TIA Selection Tool)

The SIZER for Siemens Drives engineering tool makes it easy to engineer SIMOTICS low-voltage motors including servo geared motors. It provides support when selecting the hardware and firmware components necessary to implement a drive task. SIZER for Siemens Drives is designed to support configuring of the entire drive system.

Additional information on the SIZER for Siemens Drives engineering tool is provided in the chapter Engineering tools.

The SIZER for Siemens Drives engineering tool is available free on the internet at:
www.siemens.com/sizer

STARTER commissioning tool

The STARTER commissioning tool allows menu-prompted commissioning, optimization and diagnostics. Apart from the SINAMICS drives, STARTER is also suitable for MICROMASTER 4 devices.

You can find further information about the STARTER commissioning tool in the chapter Engineering Tools.

Additional information about the STARTER commissioning tool is available on the internet at:
www.siemens.com/starter

SINAMICS Startdrive commissioning tool

SINAMICS Startdrive is a tool for configuring, commissioning and diagnosing the SINAMICS converter family that is integrated into TIA Portal (V15.1 or higher).

You can find further information about the SINAMICS Startdrive commissioning tool in the chapter Engineering Tools.

The SINAMICS Startdrive Basic commissioning tool is available free on the internet at:
www.siemens.com/startdrive

Drive ES engineering system

Drive ES is the engineering system that can be used to integrate the communication, configuration and data management functions of Siemens drive technology into the SIMATIC automation world easily, efficiently and cost-effectively. This system is based on the STEP 7 Manager user interface. Two software packages are available for SINAMICS – Drive ES Basic and Drive ES PCS.

You can find further information about the Drive ES engineering system in the chapter Engineering Tools.

Additional information about the Drive ES engineering system is available on the internet at:
www.siemens.com/drive-es

More information

All the latest information such as promotional literature, catalogs or brochures can be found on the internet at
www.siemens.com/servo-geared-motors

You can order or download the listed documentation in common file formats (PDF, ZIP) from this website.

Overview

The Article No. comprises a combination of digits and letters. To obtain a better overview, the Article No. is split up into three, hyphenated blocks.

Example:

1FG1102-1RE03-2AK1-Z D01+K06

The first block (positions 1 to 7) identifies the gearbox type and size; the second (positions 8 to 12) codes the output shaft and the motor type; and additional design characteristics are coded in the third block (positions 13 to 16).

Ordering data

- Complete Article No., with a **-Z** suffix, and order code(s) or plain text.
- The following order codes must be appended to each Article No.:
  - **K06**, **K07**, **K08**, **K11** or **K12** for the oil type
  - **D01** to **D06**, **D11** to **D16** or **D21** to **D26** for the mounting position

  For further information, see chapter "Options"
- If a quotation has been requested, please specify the quotation number in addition to the Article No.

Structure of the Article No.			Position:	1	2	3	4	5	6	7	-	8	9	10	11	12	-	13	14	15	16	-	Z
SIMOTICS S-1FG1 servo geared motors																							
1st to 5th positions: Digit, letter, letter, digit, digit	**Servo helical geared motor**	• 2-stage – gearbox type *Z*		**1**	**F**	**G**	**1**	**1**	■	■	-	■	■	■	■	-	■	■	■	■		
		• 3-stage – gearbox type *D*		**1**	**F**	**G**	**1**	**2**	■	■	-	■	■	■	■	-	■	■	■	■		
	Servo parallel shaft geared motor	• 2-stage – gearbox type *FZ*		**1**	**F**	**G**	**1**	**3**	■	■	-	■	■	■	■	-	■	■	■	■		
		• 3-stage – gearbox type *FD*		**1**	**F**	**G**	**1**	**4**	■	■	-	■	■	■	■	-	■	■	■	■		
	Servo bevel geared motor	• 2-/3-stage – gearbox type *B*/*K*		**1**	**F**	**G**	**1**	**5**	■	■	-	■	■	■	■	-	■	■	■	■		
	Servo helical worm geared motor	• 2-stage – gearbox type *C*		**1**	**F**	**G**	**1**	**6**	■	■	-	■	■	■	■	-	■	■	■	■		
6th and 7th position: Digit, digit	Gearbox size								■	■													
8th position: Digit	Solid shaft with feather keyway, design 1											**1**											
	Solid shaft with feather keyway, design 2											**2**											
	Solid shaft with feather keyway, design 3											**3**											
	Hollow shaft with feather keyway, design 1											**5**											
	Hollow shaft with feather keyway, design 2											**6**											
	Hollow shaft with feather keyway, design 3											**7**											
	Hollow shaft, special shaft design – for further information, see chapter "Options"											**9**											
9th position: Letter	R14DQ resolver with Drive-CLiQ												**P**										
	AS20DQI encoder with Drive-CLiQ												**Q**										
	AM20DQI encoder with Drive-CLiQ												**R**										
	R15DQ resolver with Drive-CLiQ												**U**										
	AM20DQI encoder with Drive-CLiQ and plug M17 – order code **J4R** – see chapter "Options"												**Z**										
10th and 11th position: Letter, digit	Motor shaft height 36													**C**									
	Motor shaft height 48													**D**									
	Motor shaft height 63													**E**									
	Motor shaft height 80													**F**									
	Motor shaft height 100													**G**									
	Motor length 0														**0**								
	Motor length 1														**1**								
	Motor length 2														**2**								
	Motor length 3														**3**								
	Motor length 4														**4**								
	Motor length 5														**5**								
	Motor length 6														**6**								
12th position: Digit	2000 rpm															**2**							
	3000 rpm															**3**							
	4500 rpm															**4**							
	6000 rpm															**6**							
13th position: Digit	Line voltage 200 ... 240 V 1 AC (DC link voltage 270 ... 330 V DC) in motor version CT (Compact)																**1**						
	Line voltage 380 ... 480 V 3 AC (DC link voltage 510 ... 720 V DC) in motor version CT (Compact)																**2**						
	Line voltage 200 ... 240 V 1 AC (DC link voltage 270 ... 330 V DC) in motor version HD (High Dynamic)																**3**						
	Line voltage 380 ... 480 V 3 AC (DC link voltage 510 ... 720 V DC) in motor version HD (High Dynamic)																**4**						
14th position: Letter	Foot-mounted design																	**A**					
	Foot/flange-mounted design – for flange-mounted design, see chapter "Options"																	**B**					
	Shaft-mounted design (torque arm)	• only for servo bevel geared motors, 3-stage	for torque arm design, see chapter "Options"															**C**					
		• for other servo geared motors																**D**					
	Flange-mounted design – for flange-mounted design, see chapter "Options"																	**F**					
	Housing flange design																	**H**					
15th to 16th positions: Letter, digit	Gear ratio																						
Special designs																							
Coded	Order code required – see chapter "Options"																					**-**	**Z**
Non-coded	Plain text required																						

Overview (continued)

Example of how to compile an Article No. correctly

The SIZER for Siemens Drives engineering tool (integrated into TIA Selection Tool) must always be used to design the drive system. The main purpose of this example is to explain the structure of article numbers and to reference the relevant information in the catalog.

Selection and ordering example

Requirement:

- Two-stage servo helical geared motor in foot-mounted design – mounting position M1
- Solid shaft with feather keyway
- Motor with low rotor moment of inertia – motor version HD (High Dynamic)
- Rated motor speed $n_{N,\,M}$ = 3000 rpm
- Maximum torque required by application M_{2maxA} = 180 Nm
- Maximum speed required by application n_{2maxA} = 150 rpm
- Multi-turn absolute encoder (20 bits/revolution, max. 4 096 distinguishable motor shaft revolutions)
- Operation on a SINAMICS S120 drive system with a DC link voltage of 600 V DC

How to determine the correct servo geared motor and article number:

In accordance with the requirements listed above, the servo geared motor must be selected from one of the selection and ordering data tables for line voltage 380 ... 480 V 3 AC (DC link voltage 510 to 720 V DC) in chapter "SIMOTICS S-1FG1 servo helical geared motors".

Derivation of the Article No.	Structure of the Article No.
• SIMOTICS S-1FG1 servo geared motor	**1FG1□□□ - □□□□□ - □□□□**
Preselection of the servomotor under "Overview of motors" in chapter "Technical definitions for servomotors":	
• Guide value for $i_{\sim} = n_{N,\,M}/n_{2maxA} \rightarrow$ 3000 rpm/150 rpm = 20 • Guide value for max. motor torque $M_{max,\,M} = M_{2maxA}/i_{\sim} \rightarrow$ 180 Nm/20 = 9 Nm With the requirements for $n_{N,\,M}$ = 3000 rpm, n_{2maxA} = 150 rpm, M_{2maxA} = 180 Nm, the consequent need for $i_{\sim}$ = 20 and $M_{max,\,M}$ = 9 Nm and the requirement for an HD version, the following HD version servomotor (the smallest possible for this application) with **$n_{N,\,M}$ = 3000 rpm**, $M_{max,\,M}$ **= 11.3 Nm** (next-higher max. torque) and **motor shaft height 48** is the right product for this application, and forms part of the Article No. for the servomotor:	1FG1□□□ - □□ **D 4 3** - **4** □□□
A suitable servo helical geared motor is included in the selection and ordering data table "For line voltage 380 ... 480 V 3 AC (DC link voltage 510 ... 720 V DC) **– gearbox type Z39" in chapter "SIMOTICS S-1FG1 servo helical geared motors" under "Gearbox size 39, 2-stage – 1FG1103":**	
i = 20.07 (according to table, next-higher transmission ratio of $i_{\sim}$ = 20), M_{2max} = 205 Nm ≥ M_{2maxA} = 180 Nm with	
• Helical gearbox, 2-stage	1FG1 **1 0**□ - □□ D 4 3 - 4 □□□
• Gearbox size 39	1FG1 1 0 **3** - □□ D 4 3 - 4 □□□
• Transmission ratio ***i* = 20.07**	1FG1 1 0 3 - □□ D 4 3 - 4 □ **P 1**
Article No. of the servo helical geared motor:	**1FG1 1 0 3 - □□ D 4 3 - 4 □ P 1**
To complete the Article No., see table "Shaft design, encoder system, mounting type and special designs" in the selection and ordering data in chapter "SIMOTICS S-1FG1 servo helical geared motors" under "Gearbox size 39, 2-stage – 1FG1103":	
• Solid shaft with feather keyway	1FG1 1 0 3 - **1** □ D 4 3 - 4 □ P 1
• AM20DQI multi-turn absolute encoder	1FG1 1 0 3 - 1 **R** D 4 3 - 4 □ P 1
• Foot-mounted design	1FG1 1 0 3 - 1 R D 4 3 - 4 **A** P 1
Article No. of the servo helical geared motor without essential options:	**1FG1 1 0 3 - 1 R D 4 3 - 4 A P 1**
To add essential options to the Article No., see table "Shaft design, encoder system, mounting type and special designs" in the selection and ordering data in chapter "SIMOTICS S-1FG1 servo helical geared motors" under "Gearbox size 39, 2-stage – 1FG1103", and refer to the selection and ordering data in chapter Options:	
• Oil type (standard, designation according to DIN 51502: CLP ISO VG 220)	1FG1 1 0 3 - 1 R D 4 3 - 4 A P 1 **- Z K06**
• Mounting position, M1, see chapter "Options" under "Mounting positions"	1FG1 1 0 3 - 1 R D 4 3 - 4 A P 1 - Z K06 + **D01**
Complete Article No. of the servo helical geared motor with Z options:	**1FG1 1 0 3 - 1 R D 4 3 - 4 A P 1 - Z K06 + D01**

Overview

Type designation of gearboxes

Gearbox type	
Helical gearbox	–
Parallel shaft gearbox	***F***
Bevel gearbox, 2-stage	***B***
Bevel gearbox, 3-stage	***K***
Helical worm gearbox, 2-stage	***C***

Transmission ratio	
2-stage	***Z***
3-stage	***D***

Type	
Shaft	
Solid shaft	–
Hollow shaft	***A***
Mounting	
Foot-mounted design	–
Foot/flange-mounted design	***B***
Flange-mounted design (A type)	***F***
Housing flange (C type)	***Z***
Shaft-mounted design (torque arm)	***D***
Connection	
Parallel key	–
Shrink disk	***S***
Splining	***T***
SIMOLOC	***R***
Special features	
Reduced-backlash version	***W***

Example:

	F	***D***	***A***	***D***	***S***	***89***
Gearbox type: Parallel shaft gearbox						
Transmission ratio: 3-stage						
Shaft: Hollow shaft						
Mounting: Shaft-mounted design (torque arm)						
Connection: Shrink disk						
Gearbox size: 89						

1

Notes on the tables in chapters for selection of servo geared motors

Overview

Structure of the technical specifications tables

Technical specifications tables

Gearbox type ...												
Servo geared motor Type	i	R_{ex}	$M_{2N,\,G}$ Nm	$M_{2max,\,G}$ Nm	$M_{2Em.Off,\,G}$ Nm	$n_{2max,\,G}$ rpm	$n_{1max,\,G}$ rpm	$\varphi_{2,\,G}$ '	$F_{R2,\,G}$ N	$F_{R2max,\,G}$ N	$c_{T,\,G}$ Nm/ '	J_G 10^{-4} kgm^2
1FG1...-…..-....												

Legend:

Gear ratio

Ratio, number of teeth

Maximum permissible output torque of gearbox in continuous duty

Maximum permissible output torque of gearbox for brief periods

Emergency off output torque of gearbox

Maximum permissible output speed for brief periods

Maximum permissible input speed for brief periods

Circumferential backlash of gearbox –
data are for option reduced-backlash version – order code **G99** required

Maximum permissible radial force on output side of gearbox in continuous duty

Maximum permissible radial force for brief periods on output side of gearbox

Torsional stiffness of gearbox

Mass moment of inertia of gearbox

Definition of the designations for product and components

Characteristic value without expansion of the index: Refers to the designated complete product, e.g. servo geared motor
Example: M_{2N} = rated torque of the complete product "geared motor"

Characteristic value with expansion of the index: Refers to a component of the complete product, e.g. "gear head" or "servomotor"
Example: $M_{2N,\,G}$ = rated torque of the component "gear head"

Overview (continued)

Structure of the selection and ordering data tables

Table for selecting servo geared motors

All combinations of servo geared motors with the transmission ratios available in each case can be found in the selection tables contained in the chapters for selection of servo geared motors. The selection tables are sorted according to gearbox type and size.
The short-time maximum permissible output torques of the geared motor M_{2max} specified in the catalog refer to a speed of 1450 rpm, mounting position M1 and comparable types of construction, where the input stage does not run completely immersed in oil. Further, standard equipment and standard lubrication of the servo geared motors as well as normal ambient conditions are assumed.

Example:

For line voltage 380 ... 480 V 3 AC (DC link voltage 510 ... 720 V DC) **– gearbox type** *Z29*

Geared motor torque at 1450 rpm
Note: All values in **bold** print are maximum gearbox values.
M_{2max}

Servo helical geared motors SIMOTICS S-1FG1

Nm

Article No.

Max. output speed $n_{2max,\,G}$ = **109 rpm**, Transmission ratio i = **41.4**

146	146	146	146	146	146	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–

1FG1102- . . ■ ■ 6 - ■ . A2 -Z

Motor shaft height:

36																			C	
			48																D	
						63													E	
										80									F	
																100			G	

Motor length/motor version (**CT** = Compact, **HD** = High Dynamic)**:**

			0/CT			**0/CT**				**0/CT**						**0/CT**			0	2
											1/CT						**1/CT**		1	2
							1/HD												1	4
2/CT				**2/CT**				**2/CT**											2	2
									3/CT			**3/CT**						**3/CT**	3	2
	3/HD				**3/HD**														3	4
		4/CT												**4/CT**					4	2
						4/HD				**4/HD**									4	4
																		5/CT	5	2
															5/HD				5	4
																6/HD			6	4

Selection of shaft design, encoder system, mounting type and special designs on page 3/3.

1FG1102- ■ ■ . . . - ■ . . -Z

For a description of formula symbols or abbreviations, refer to the glossary in the appendix.

Overview

Motor shaft heights

DIN 747 motor shaft heights for machines

Motor shaft height	Tolerance
mm	mm
≤ 250	-0.5
> 250	-1

Note:

For foot-mounted gearboxes, the mounted motor can extend below the mounting surface of the gearbox.

Shaft extensions

DIN 748-1 cylindrical shaft extensions

Diameter tolerance:

Diameter	Tolerance
mm	mm
≤ 50	ISO k6
> 50	ISO m6

Centering holes according to DIN 332, form DR:

Diameter	Thread size
mm	–
> 16 … 21	M6
> 21 … 24	M8
> 24 … 30	M10
> 30 … 38	M12
> 38 … 50	M16
> 50 … 85	M20
> 85 … 130	M24
> 130	M30

Undercut acc. to DIN 509:

Diameter	Undercut acc. to DIN 509	Suggested construction, minimum hollow on mating piece
mm		mm
> 16 … 18	E1.0 × 0.2	0.9 × 45°
> 18 … 50	E1.2 × 0.2	1.1 × 45°
> 50 … 80	E1.6 × 0.3	1.4 × 45°
> 80 … 125	E2.5 × 0.4	2.2 × 45°

Hollow shafts

Diameter tolerance Ø: ISO H7 measured using a mandrel gauge

Feather key: acc. to DIN 6885 (high form)

Hollow shafts with shrink disk

Diameter tolerance Ø: ISO H7 with mandrel gauge, measured in the area of the shrink disk seat. Hub seat, output side equipped with journal bearing sleeve.

Minimum requirements for the material of the customer shaft:

- Yield strength $R_e \geq 360$ N/mm²
- Module of elasticity, approx. 206 kN/mm²

Hollow shafts with splines

Splines according to DIN 5480

Hollow shafts for the SIMOLOC assembly system

The diameters of the taper bushing and the bronze bushing are designed to hold a customer shaft with tolerance h11.

Minimum requirement for the design of the customer shaft:

- Bright steel drawn DIN EN10278 (tolerance Ø: ISO h11)
- Yield strength $R_e \geq 360$N/mm²
- Module of elasticity, approx. 206 kN/mm²
- Straightness less than 0.5 mm/m

Note:

Deviation from the specified straightness will cause radial runout of the customer's shaft. Customer shafts with minor radial runout ensure optimum operating conditions for geared motors. This has a positive impact on the service life of the drive train.

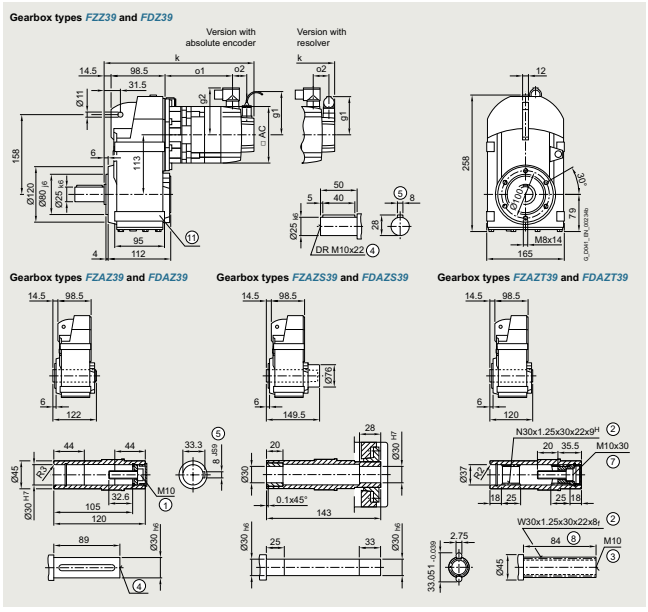
Flanges

Centering edge tolerance:

Outer flange diameter	Tolerance
mm	mm
≤ 230	ISO j6
> 230	ISO h6

Vent valves

The gearboxes are shown in the dimensional drawings with screw plugs.
If venting is required, then depending on the type of construction, an activated vent valve is installed.
The contour dimension can slightly change as a result.



Example, dimensional drawings

Overview

Regulations, standards and specifications

The motors comply with the appropriate standards and regulations, see table below.

As a result of the fact that in many countries the national regulations have been completely harmonized with the international IEC 60034-1 recommendation, there are no longer any differences with respect to coolant temperatures, temperature classes and temperature rise limits.

General specifications for rotating electrical machines	IEC 60034-1
Terminal designations and direction of rotation for electrical machines	IEC 60034-8
Types of construction of rotating electrical machines	IEC 60034-7
Cooling methods of rotating electrical machines	IEC 60034-6
Degrees of protection of rotating electrical machines	IEC 60034-5
Vibration severity of rotating electrical machines	IEC 60034-14
Noise limit values for rotating electrical machines	IEC 60034-9
Cylindrical shaft extensions for electrical machines	DIN 748-3/IEC 60072-1

The SIMOTICS S-1FG1 servo geared motors are UL-approved by Underwriters Laboratories Inc. and also comply with Canadian cUR standards.

Degrees of protection for AC motors

A suitable degree of protection must be selected depending on the operating and environmental conditions to protect the machine against:

- ingress of water, dust and solid foreign objects,
- contact with rotating parts inside a motor and
- contact with live parts.

Degrees of protection of electric motors are specified by a code. This comprises two letters, two digits and, if required, an additional letter.

IP (International Protection)
Code letter designating the degree of protection against coming into contact with and the ingress of foreign bodies and water

0 to **6**
1st digit designating the degree of touch protection and protection against ingress of solid foreign objects

0 to **8**
2nd digit designating the degree of protection against the ingress of water (no protection against the ingress of oil)

W, **S** and **M**
Additional code letters for special degrees of protection

Most motors are supplied with the following degrees of protection:				
Motor	Degree of protection	1st digit, protection of persons against contact	Protection against foreign objects	2nd digit, protection against water
Internally cooled	IP23	Protection against finger contact	Protection against medium-sized, solid foreign objects above 12 mm Ø	Protection against spray water up to 60° from the vertical
Surface-cooled	IP54	Complete protection against accidental contact	Protection against harmful dust deposits	Splash water from any direction
	IP55			Water jets from any direction
	IP64	Complete protection against accidental contact	Protection against ingress of dust	Splash water from any direction
	IP65[1)]			Water jets from any direction
	IP67[1)]			Motor under specified pressure and time conditions under water

Note:
The servo drive motor of the SIMOTICS S-1FG1 servo geared motor has the degree of protection IP65, see also in chapter "Configuring guide".

Recommended degrees of protection for AC motors

When cooling lubricants are used, protection against water alone is inadequate. The IP rating should only be considered as a guideline in this case. The motors may have to be protected by a suitable cover. Attention must be paid to providing suitable sealing of the motor shaft for the selected degree of protection for the motor.

The table can serve as a decision aid for selecting the proper degree of protection for motors.

Effect / Liquids	General workshop environment	Water, general cooling lubricants (95 % water, 5 % oil)
Dry	IP64	–
Humid/moist environment	–	IP64
Mist	–	IP65
Spray	–	IP65
Jet	–	IP67
Splash/brief immersion/constant inundation	–	IP67

[1)] DIN VDE 0530 Part 5 or EN 60034 Part 5 specifies that there are only 5 degrees of protection for the first digit code and 8 degrees of protection for the second digit code in relation to rotating electrical machinery. However, IP6 is included in DIN 40050 which generally applies to electrical equipment.