

ABB

ABB AC Brushless Servodrives

AC Brushless Servomotors Series 9C
Variants

9C Servomotors Variants Manual



AC Brushless Servomotors Series 9C

9C Servomotors Variants Manual

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Safety Instructions

Introduction

This chapter states the safety instructions that must be followed when installing an AC Brushless Servomotor of the 9C Series manufactured by ABB. The material in this chapter must be studied before attempting any work on, or with, the servomotor.

This chapter refers in particular to 9C Series Servomotors coupled with ABB ACSM1 Drive Modules, or with brushless drives in general.

Warnings and Notes

This manual distinguishes two sorts of safety instructions. Warnings are used to inform of conditions that can, if proper steps are not taken, lead to a serious fault condition, physical injury and death. Notes are used when the reader is required to pay special attention or when there is additional information available on the subject. Notes are less crucial than Warnings, but should not be disregarded.

Warnings

Readers are informed of situations that can result in serious physical injury and/or serious damage to equipment with the following symbols:



WARNING! Dangerous Voltage: warns of situations in which a high voltage can cause physical injury and/or damage equipment. The text next to this symbol describes ways to avoid the danger.



WARNING! General Warning: warns of situations that can cause physical injury and/or damage equipment by means other than electrical. The text next to this symbol describes ways to avoid the danger.

Notes

Readers are notified of the need for special attention or additional information available on the subject with the following symbol:

CAUTION! **Caution** aims to draw special attention to a particular issue.

Note. **Note** gives additional information or points out more information available on the subject.

General Safety Instructions



WARNING! The contents of this guide refer to 9C Series Servomotors correctly installed as described in this *Servomotors Variants Manual*.

Only properly qualified electricians who are familiar with operation on Servomotors are allowed to perform the commissioning and operation activities of the Servomotors described in this Guide.



WARNING! For no reason should any person access the terminals of the servomotor, before at least eight minutes from the power outage of the drive system.

However this time strongly depends on the converter type connected to the motor.

Potentially lethal voltages may be present on the drive's intermediate DC circuit and the associated circuits, including the motors connected to the drive.



WARNING! The machine manufacturer, who commissions the servomotor, must install proper additional protection functions to avoid damages to health or equipment when the machine is operating.



Neglecting these instructions can cause physical injury and death. More Warnings and Notes are printed at appropriate instances along the text.

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Introduction to this Manual

Introduction

This document *Servomotors Variants Manual* is intended for providing information about the most common motor variants; for the installation, commissioning and use of the servomotors in general, consult the *9C Servomotors Manual*.

Before You Start

The reader is expected to have an appropriate knowledge of electrical fundamentals, electrical wiring practices and, in general, of drive systems, i.e. motors and converters.

What This Manual Contains

The aim of this manual is to provide the reader with all the necessary information about the possible variants available for 9C Series Servomotors.

For the installation procedures, please refer to the *9C Servomotors Manual*.

Safety Instructions are featured in the first few pages of this Manual. Safety Instructions describe the formats for various warnings and notations used within this Manual. Other instructions are given along the present document.

Introduction to this Manual, contains a short description of this Manual. The manual is organized according the motor type code digits: each digit describes a feature of the motor and the available variants, with respect to the default configuration. The default configuration of the motors is described in the *9C Servomotors Manual*.

Digit 2: IP protection Variants, shows other possible protection levels, if any.

Digit 5-6: Speed Variants, describes the alternative speed available for 9C servomotors.

Digit 7: Flange type Variants, describes the available alternate flanges or shaft diameters.

Digit 8-9: Position Transducer Variants, gives an overview of the most common alternatives, being possible that other devices, here not described, can be mounted.

Digit 10: Connections Variants, shows the possible connection variants and the connection schemes related to the most common position transducers shown in the previous paragraph.

Digit 11: Rotor Variants, gives information about rotor variants like increased inertia, vibration levels, etc.

Digit 12: DE details Variants, gives information about the possible configurations of the DE, keyway, oil seal, etc.

Digit 13: Brake Variants, gives information about other brake types available, improved torque, magnetic type, etc.

Digit 14: Temperature sensors Variants, gives a list of the possible other sensors usable in 9C motors.

Digit 15: Voltage supply Variants, lists the other available windings configurations to match different supply voltages.

Digit 16-17: Accessories, lists the available accessories for 9C servomotors.

Related Publications

In addition to this *Servomotor Variants Manual*, please consult the *9C Servomotor Manual* and, if needed, also the complete user documentation of ACSM1 Drive Modules.

Terminology

Listed below are the terms and conventions which have special meaning throughout this Manual.

ServoDrive

A Servodrive is a system made of a servo converter coupled with a servomotor.

DE and NDE

According to IEC 60034-7, the two ends of a motor are defined as follows:

DE: Drive End of the motor

NDE: Non Drive End of the motor

On the DE typically the shaft has its extension to transmit the torque to a load. On the NDE of the 9C Servomotors is typically mounted the position transducer. The optional parking brake of the motor is mounted on the DE side.

Rights

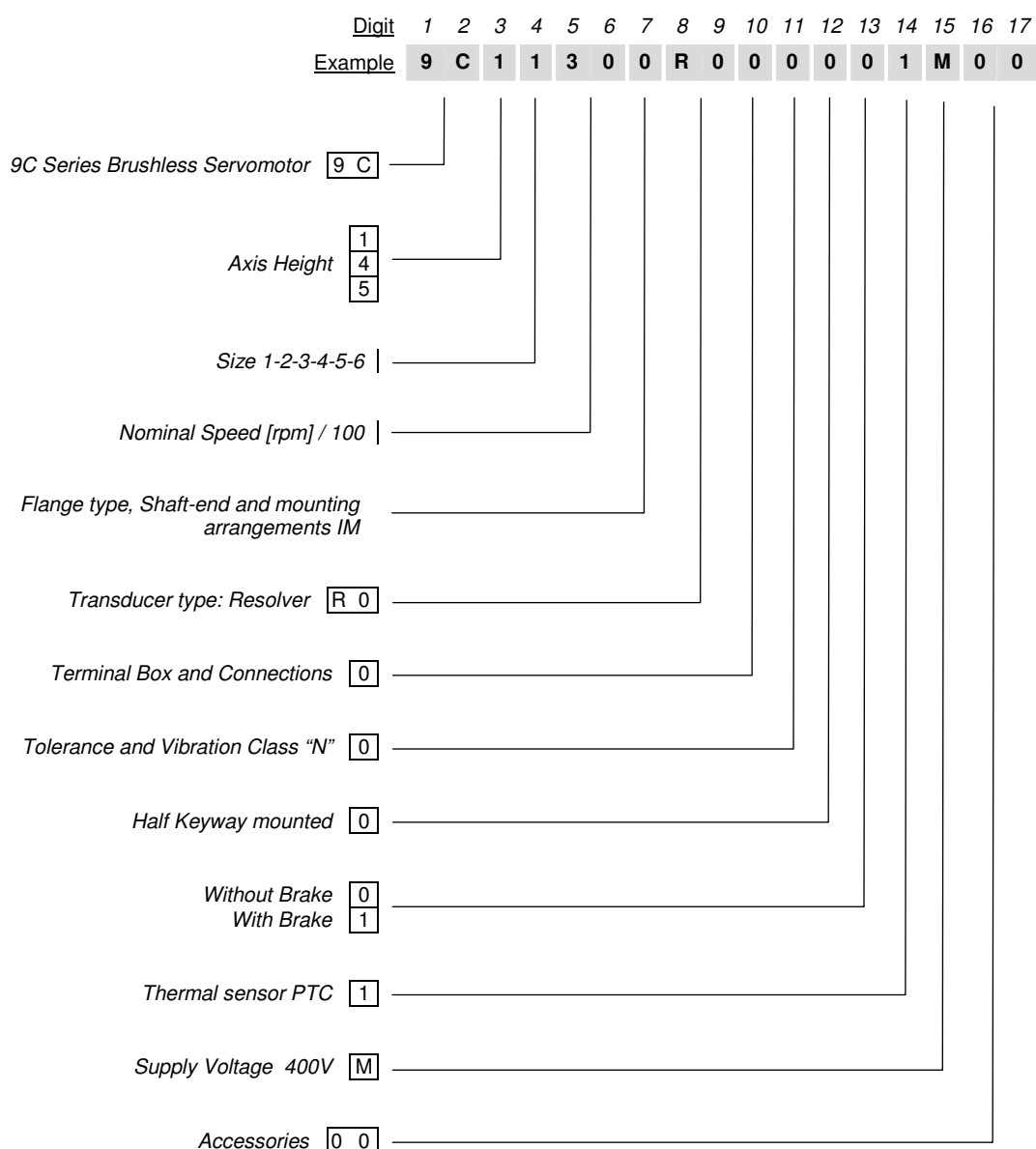
ABB works on a policy of continuous improvement of products performances to gear the market demand, as well as of the marketing and technical documentation. Therefore all the materials and technical data contained in this manual are subjected to changes without notice.

Up-to-date documentation is available online on the websites www.abb.com/ProductGuide , weblink Motors.

9C Servomotors Variants

Introduction

This chapter gives general information on the AC Brushless Permanent Magnet Servomotors Variants of the 9C Series, manufactured by ABB - Line S. The main variants, components and accessories of the 9C Servomotors are here described following the order of the ordering code digits of the motors, as it is here below described:



Digit 2: IP protection variants

9C Series Servomotors are protected according to IEC 60034-5.

For standard 9C Servomotors with power and signal connectors the IP protection degree is:

- IP65 on the motor body, IP54 on DE shaft-end

The motor body can reach IP67 protection degree by special arrangements, at the moment this variant has not been implemented yet.

Digit 5-6: Speed Variants

9C Servomotors are designed with a base speed of 3000 RPM.

However alternate speed values are available, different for each motor size. In particular a second speed value is available for each motor size, as follows:

- 9C1: 6000 RPM
- 9C4: 4000 RPM
- 9C5: 2000 RPM

However, other speed values can be done, depending on motor type, mechanical limitations, voltage constraints, maximum continuous current rating, best matching with current output of a particular drive etc.

It is not therefore possible to give all the available speeds.

ABB Line S can design different windings based on Customer specifications and on internal consideration related to e.g. the quantity of motors to be produced in a certain speed configuration, the cost of such implementation etc.

Digit 7: Flange type Variants

By default 9C motors have one flange type available, together with a dedicated shaft diameter and extension. However, for some motors there may be only a different shaft diameter and not a second flange.

This is the list of the available options:

- 9C1: flange IEC F75, B14, with shaft 16 mm diameter, 40 mm length
- 9C4: flange IEC F130, B5, with shaft 19 mm diameter, 40 mm length
- 9C5: flange IEC F165, B5, with shaft 32 mm diameter, 58 mm length

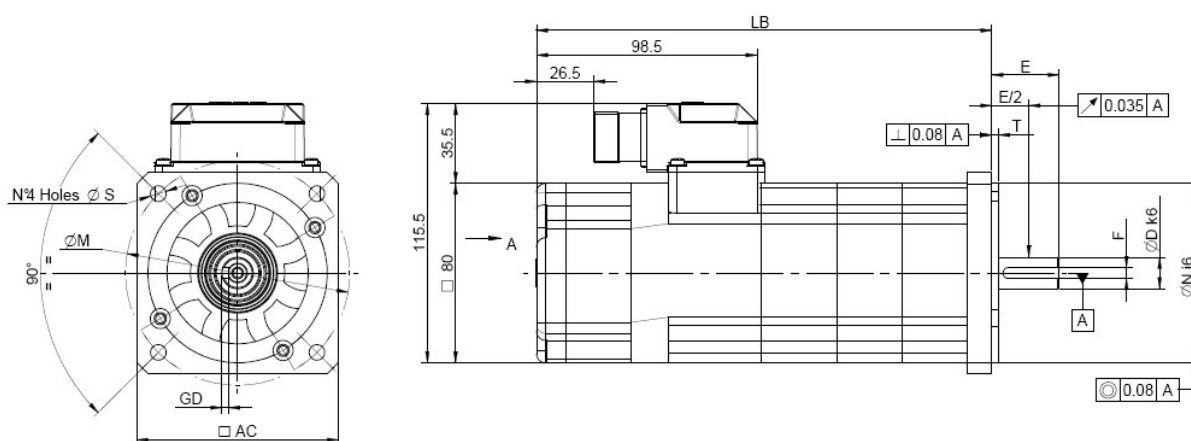
The overall dimension drawings given below offer an overview of each servomotor frame type 9C1, 9C4 and 9C5. Actual dimension drawings are different according to the motor frame, size, accessories and options, such as the transducer and the brake.

Overall dimension drawings for any motor design and mounting configuration are available. Contact ABB – Line S, for details.

9C1 Overall Dimensions

The following figure and dimension table show the overall dimension of the 9C1 Servomotors. Note that the dimension drawing refers to a servomotor frame 9C1, size 1, with brake and encoder.

The shaft can be supplied with keyway premounted, with half key premounted and keyway in the motor case, or with the flat shaft, i.e. without a keyway.



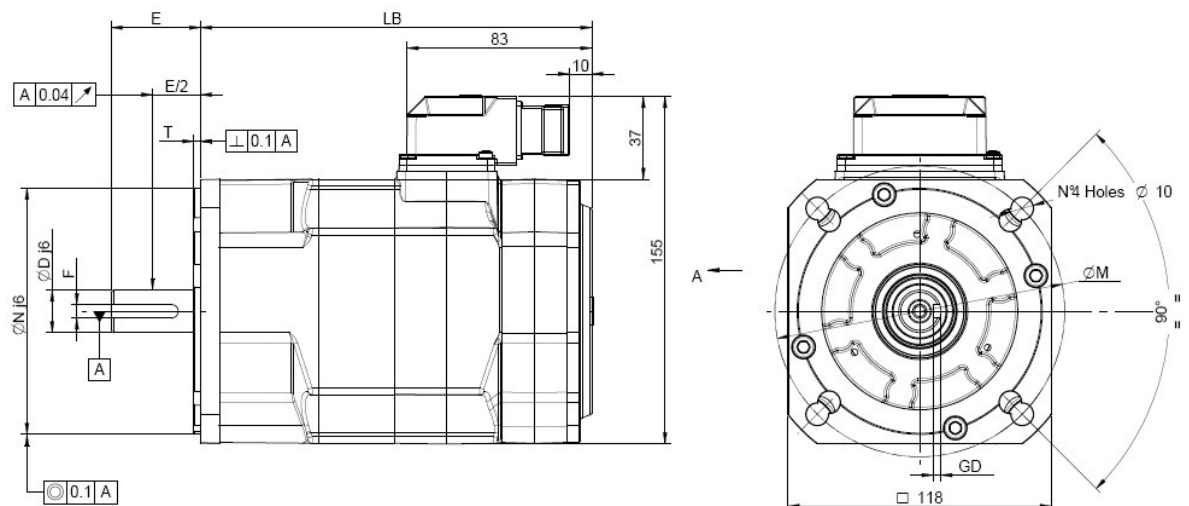
Frame	Motor Base Length				Front Flange - Shaft End								
	LB Resolver	LB Encoder	LB Resolver +Brake	LB Encoder +Brake	Reduced								
					Flange F75 – B14					D-END			
N	M	S	AC	T	D	E	F	GD					
9C1.1.xx	142	171	171	200	60	75	M5	100	3	16	40	5	3
9C1.2.xx	176	205	205	234	60	75	M5	100	3	16	40	5	3
9C1.3.xx	210	239	239	268	60	75	M5	100	3	16	40	5	3
9C1.4.xx	244	273	273	302	60	75	M5	100	3	16	40	5	3

9C4 Overall Dimensions

The following figure and dimension table show the overall dimension of the 9C4 Servomotors.

Note that the dimension drawing refers to a servomotor frame 9C4, size 1, with encoder and no brake.

All the motors are supplied with half-key inserted and full-key in package.



Frame	Motor Base Length				Front Flange - Shaft End										
	LB Resolver	LB Encoder	LB Resolver +Brake	LB Encoder +Brake	Increased										
					Flange F130			D-END, Key type UNI6604 – 8X7X40							
N	M	T	D	E	F	GD									
9C4.1.xx	146	175,5	175,5	205	110	130	3	24	50	8	4				
9C4.2.xx	180	209,5	209,5	239	110	130	3	24	50	8	4				
9C4.3.xx	214	243,5	243,5	273	110	130	3	24	50	8	4				
9C4.4.xx	248	277,5	277,5	307	110	130	3	24	50	8	4				

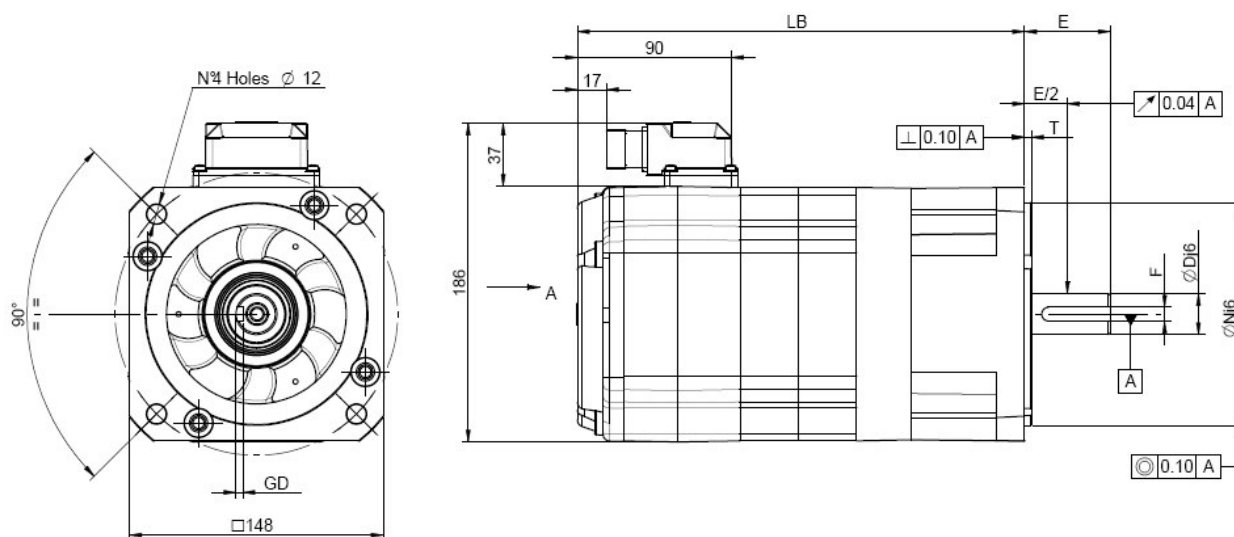
9C5 Overall Dimensions

The following figure and dimension table show the overall dimension of the 9C5 Servomotors.

Note that the dimension drawing refers to a servomotor frame 9C5, size 2.

The 9C5 motor base length is the same with resolver or encoder, and with or without brake.

For 9C5 motors a second flange is not available yet.



Frame	Base Length	Front Flange - Shaft End							
		Standard							Key type UNI6604
	LB	Flange F165			D-END				
		N	M	T	D	E	F	GD	
9C5.2.xx	261	130	165	3,5	24 j6	58	10	5	10X8X40
9C5.3.xx	295	130	165	3,5	24 j6	58	10	5	10X8X40
9C5.4.xx	329	130	165	3,5	32 k6	58	10	5	10X8X40
9C5.5.xx	363	130	165	3,5	32 k6	58	10	5	10X8X40
9C5.6.xx	397	130	165	3,5	32 k6	58	10	5	10X8X40

Digit 8-9: Position Transducer Variants

9C brushless servomotors can be equipped with one of the following position transducer types as default:

- Tyco resolver size 15, 2 poles, model V23401D1001B101
- LTN resolver size 15, 2 poles, model RE15-1-A14 (alternate)
- Heidenhain encoders of the 13xx Series:
 - EQN1325, 512 pulses per revolution, absolute multiturn encoder, Endat 01

Alternative feedback devices are available:

- Tyco resolver size 21, 2 poles, model V23401U2017C333
- Heidenhain encoders of the 13xx Series:
 - EQN1325, 2048 pulses per revolution, absolute multiturn encoder, Endat 01
 - EQI1329, 32 pulses per revolution, absolute multiturn encoder, Endat 01
 - ERN1387, 2048 pulses per revolution, absolute 1 Vpp encoder
- Sick encoders of the Hiperface type:
 - SRM50: absolute multi turn sincos encoder, 1024 pulses per revolution
 - SRS50: absolute single turn sincos encoder, 1024 pulses per revolution
 - SEK52: absolute single turn sincos encoder, 16 pulses per revolution

The position transducer is mounted on the motor NDE-side.

For other types of position transducers agreements with the Sales department and the factory must be taken. Contact ABB – Line S, Customer Service for further details and ordering options.

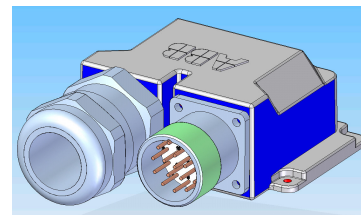
Digit 10: Connections Variants

All power and signal connections to the motor assembly are indicated in this paragraph.

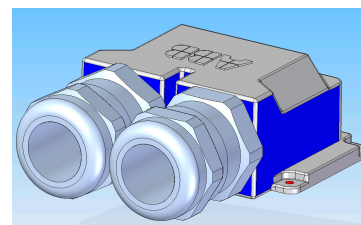
By default, 9C Series Servomotors are provided with a connection box that includes a power connector (8 pins) and a signal connector (17 pins).

Upon customer request, the connection box can be provided in the following variants:

- Power skintop and signal connector



- Power skintop and signal skintop



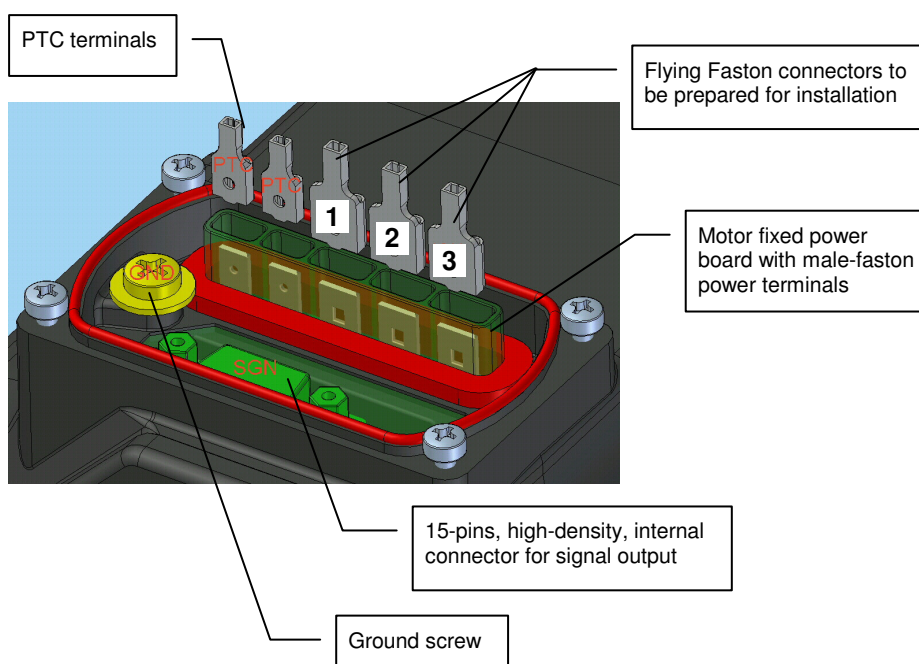
Note. For motors provided with skintops, every power and signal cable shall pass through the passing hole using the M25 cable glands. Every cable must be connected to the appropriate terminal, observing the labels inside the connection box and the cabling instructions of the frequency converter.

Pre-assembled power and signal cables are available. Special cables can be manufactured as well. For information contact ABB - Line S, Sales Office.

Power connections through Skintop

For motors provided with power and/or signal skintop, all the cables shall pass through the passing hole using the M25 cable glands. In this configuration all the connections must be performed directly inside the motor connection box.

The Power connections must be ensured by insertion of female fastons into the internal terminal block of the motor “lead frame”, as shown in figure. The thermal sensor as well must be connected to the same terminal block.



Servomotor Frame	Faston		
	1	2	3
9C1	U	V	W
9C4	U	V	W
9C5	U	V	W

Power connections

The supply cable female fastons must be suitable for 6.3X0.8 mm male fastons, and must be firmly inserted in the male contacts on the motor internal power board, observing the phase markers “U”, “V”, “W”.

The yellow-green earth cable must be connected to the ground screw inside the motor terminal box, which is marked with the earth symbol according to international standards. The ground terminal must be equipped with an M4 eyebolt.

Note. If the motor is provided with a parking brake, than the brake terminals must be naked, tinned wires to be screwed to the proper terminals inside the motor box.

Note. Terminals of the thermal sensor are usually on the signal connector. In this configuration instead they must be connected directly inside the motor connection box on the separate terminals marked with “PTC” (see figure

above). The PTC wires must be prepared with two female faston connectors, suitable for 4.8X0.8 mm male fastons.

Note. For the route between the electrical control cabinet and the motor, it is recommended to use a shielded four-pole cable (three-phases + yellow-green), with appropriate cross section for the converter output rated current. For these connections it is also possible to use metal sheath cables.

Note. In any case, the external shield must be connected to the motor earth.

Note. When preparing the installation strictly observe the provisions of Appendix B, *Application guide to electromagnetic compatibility*, of the *9C Servomotors Manual*, and the installation guidelines of the frequency converter.



WARNING!

In general, for any kind of converter, it is mandatory to observe the correspondence of the U-V-W connections between motor and converter.

The exchange of phases prevents the drive system from operating.



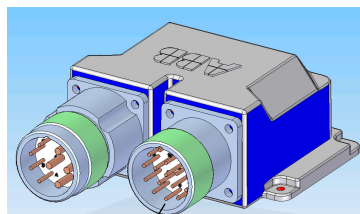
WARNING!

When connecting the motor brake, if present, the polarity of the power supply must absolutely be respected.

Inverting polarity means failure of the brake supply and therefore a braking action on the motor.

Signal Connections Through Signal Connector

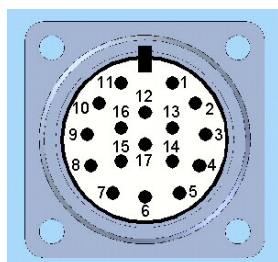
The signal connector of the position transducer is a standard 17-pins male connector for industrial application integrated into the connection box.



17-pins signal connector

Standard 9C Servomotors are equipped either with a resolver transducer, or with an encoder transducer at customer's choice.

Pin-out of the 17-pins connector is standardized as follows, for any type of resolver or encoder installed.



Pin	Resolver	Endat EQN Encoder	ERN 1387 Encoder	Hiperface Encoder
1	S1 (Cos+)	Sensor	Sensor	
2	S2 (Sin+)	-	R-	
3	S3 (Cos-)	-	R+	
4	S4 (Sin-)	Sensor (0 V)	Sensor (0 V)	
5	Thermal sensor	Thermal sensor	Thermal sensor	Thermal Sensor
6	Thermal sensor	Thermal sensor	Thermal sensor	Thermal Sensor
7	R1 (Supply+)	Up	Up	Us (7-12 V)
8	R2-R3 (Supply-)	CLOCK	D-	
9	-	CLOCK -	D+	
10	-	0V	0V	GND
11	Internal shield	Internal shield	Internal Shield	
12	-	B +	B+	+COS
13	-	B -	B-	REFCOS
14	-	DATA +	C+	Data +
15	-	A +	A+	+ SIN
16	-	A -	A-	REFSIN
17	-	DATA -	C-	Data -



WARNING!

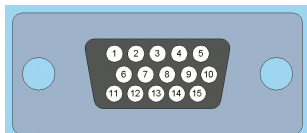
Wrong wiring of the signal connections can cause malfunctioning that seriously compromise the operation of the drive system with risk of physical injury and/or damage to the equipment!

Preassembled signal cables are available upon request complete with right connectors both on the motor assembly side and on the drive side. These cables can be purchased together with the drive system. Consult the Product Catalogue or contact the Sales Office for ordering codes.

Signal Connections Through Skintop and internal SUB-D connector

When the signal cable is connected to the motor through the M25 skintop, there is always an internal SUB-D 15-pins, high density, internal connector fixed inside the motor connection box.

Pin-out of the 15-pins connector is standardized as follows depending on the transducer type installed, resolver or encoder.



Pin	Resolver	Endat EQN Encoder	ERN 1387 Encoder	Hiperface Encoder
1	S1 (Cos+)	Sensor	Sensor	
2	S2 (Sin+)	-	R-	
3	S3 (Cos-)	-	R+	
4	S4 (Sin-)	Sensor	Sensor (0 V)	
5	R1 (Supply+)	Up	Up	Us (7-12 V)
6	R2-R3 (Supply-)	CLOCK	D-	
7	-	CLOCK -	D+	
8	-	0V	0V	GND
9	Internal shield	Internal shield	Internal Shield	
10	-	B +	B+	+COS
11	-	B -	B-	REFCOS
12	-	DATA +	C+	Data +
13	-	A +	A+	+ SIN
14	-	A -	A-	REFSIN
15	-	DATA -	C-	Data -

The thermal sensor must be connected directly in the terminal block of the lead frame inside the terminal box.

Digit 11: Rotor Variants

9C motors are designed according to the minimum possible inertia values to improve dynamic response of the servomotor. For some applications it is well known that the inertia of the motor may be closer to the inertia of the load, therefore rotor inertia must be increased.

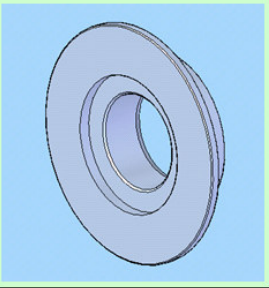
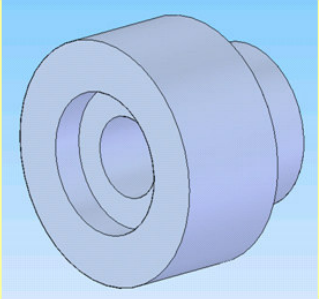
9C motors have been designed in such a way that the inertia of the rotor can be improved in several different ways to get closer to a proper matching with the load inertia.

Two options are normally available:

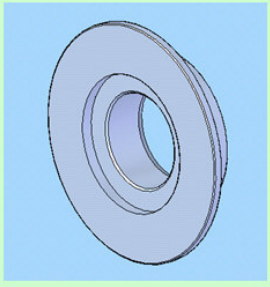
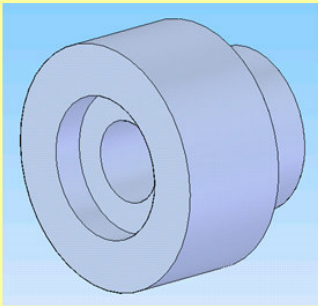
- An “simple” increase of the inertia value that does not change motor length
- A “complex”, higher increase, of the inertia, that requires a change in length of the motor

The following tables show the proposed alternative values of the rotor inertia.

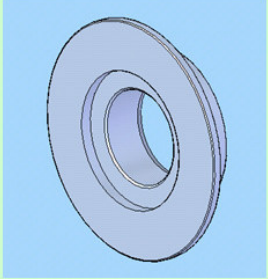
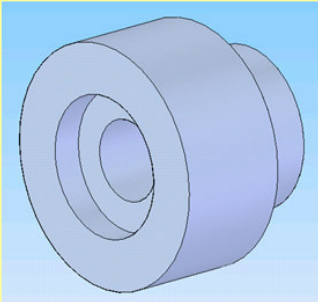
9C1

kg-mm ²	Standard	Increased simple (disc on collar)	Δ%	Increased complex	Δ%
9C1.1	58.57	102.92	75.72	361.19	516.67
9C1.2	106.86	151.21	41.50	409.48	283.18
9C1.3	155.15	199.51	28.59	457.77	195.04
9C1.4	203.44	247.80	21.80	506.06	148.75
Inertia increaser (disc on rotor collar) Motor length does not change		44.35 kg-mm²			
					
Inertia increaser Motor length is increased 1 size Inertia can be adjusted from a minimum value of 44.35 up to this max value E.g. by adapting inertia values from size to size the % inertia increment between sizes can be the same				302.62 kg-mm²	
					

9C4

kg-mm ²	Standard	Increased simple (disc on collar)		Increased complex	
			Δ%		Δ%
9C4.1	399.49	636.78	59.40	1138.59	185.01
9C4.2	765.96	1003.25	30.98	1505.05	96.49
9C4.3	1132.42	1369.72	20.95	1871.52	65.27
9C4.4	1498.89	1736.18	15.83	2237.98	49.31
Inertia increaser (disc on rotor collar) Motor length does not change		237.29 kg-mm ²		739.10 kg-mm ²	
					
Inertia increaser Motor length is increased 1 size Inertia can be adjusted from a minimum value of 237.29 up to this max value E.g. by adapting inertia values from size to size the % inertia increment between sizes can be the same					

9C5

kg-mm ²	Standard	Increased simple (disc on collar)		Increased complex	
			Δ%		Δ%
9C5.1	1214.19	1890.91	55.73	3361.40	176.84
9C5.2	2211.03	2887.74	30.61	4358.23	97.11
9C5.3	3207.86	3884.58	21.10	5355.07	66.94
9C5.4	4204.70	4881.42	16.09	6351.91	51.07
9C5.5	5201.54	5878.25	13.01	7348.74	41.28
9C5.6	6198.37	6875.09	10.92	8345.58	34.64
Inertia increaser (disc on rotor collar) Motor length does not change		676.72 kg-mm ²		2147.21 kg-mm ²	
					
Inertia increaser Motor length is increased 1 size Inertia can be adjusted from a minimum value of 676.72 up to this max value E.g. by adapting inertia values from size to size the % inertia increment between sizes can be the same					

Digit 12: DE details and shaft variants

The default configuration of the 9C motors DE is with a keyway seat, a half-key mounted and a full key given in the motor case, but not mounted. This allows for the maximum possible arrangements of the motor, without changes. With this configuration the Customer can in fact use e.g. a pulley or a gearbox with a keyway or, alternatively, mount a load with a friction coupling. The half key does not exceed the shaft diameter, therefore the friction coupling works without troubles, according to the manufacturers.

On the DE also the oil seal can be mounted upon request. A detailed description how to mount the oil seal is given below. A special tool is needed.

Other solutions for the DE are however available: the following table lists the various options.

Keyway DE	Keyway kit annexed	Oil seal mounted	Oil seal kit annexed
No keyway	No	No	Yes
Keyway mounted	No	No	Yes
Half key mounted	Yes	No	Yes
No	No	No	No
Keyway mounted	No	No	No
Half key mounted	Yes	Yes	No
No	No	Yes	No
Keyway mounted	No	Yes	No

The shaft material can be changed upon request as well, in case the radial loads foresee exceed the standard values. Normally with a higher load also the diameter of the shaft must be changed and consequently also the bearings are changed. Since the change in shaft material involve various aspects of the motor, there is not a list of the possible variants: a contact with ABB Servomotors Customer Service or the ABB Servomotors Technical Department is mandatory, in this case.

Radial oil seal

The oil seal provided by ABB is made of Viton material.

The Customer may ask that the oil seal is provided in the motor case or that it is mounted in factory. For this option see the *Servomotors Variants Manual*.

The radial oil seal mounted on the drive end side improves the capacity of the shaft end to withstand leakage of fluids into the motor, in particular oil. Therefore the radial oil seal has the function to protect the motor insulation and the permanent magnets from potentially dangerous fluids.

The IP protection degree of 9C servomotors without oil seal installed is IP54 for the shaft-end. Installing the oil seal improves the IP protection degree of the motor shaft end to IP64. Special oil seals may improve the motor IP protection level even further.

The oil sealer shall be installed **only** if the motor shaft and the oil sealer itself are actually wet by oil.



If lubricating fluids other than common mineral and synthetic oils are used and in case of over-pressure of these fluids, contact ABB before operation.



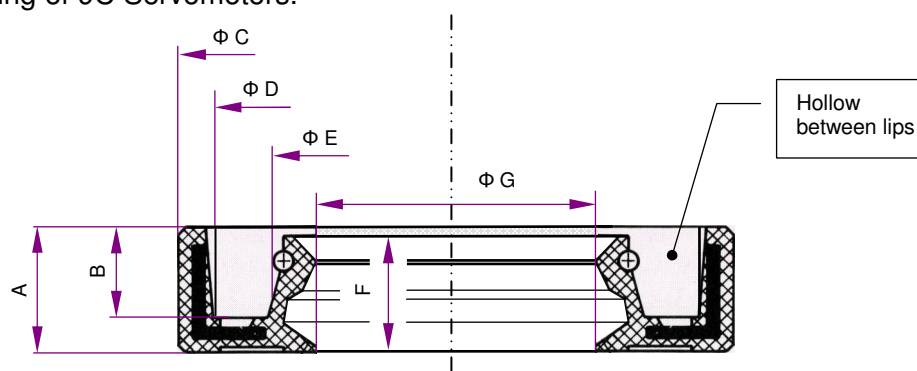
Avoid mounting the oil seal if dry operation is foreseen: the material of the device will be quickly damaged and worn out, creating dust and likely damaging the bearing itself.



If the radial oil seal is installed, when cleaning the shaft-end use cleaning products compliant with the material of the oil seal installed. Non-conformal, corrosive or abrasive products will cause a decay of the oil seal properties and cause impurities to seep into the motor.

Dimension Drawing of the Radial Oil Seal

The figure below shows the dimension drawing of the radial oil seal included in the shipping of 9C Servomotors.



Motor Code	A	B	C	D	E	F	G
9C1	7	5	35	32	29	6	25
9C4	5	3,3	42	38,5	35,5	4,5	30
9C5	7	5,2	62	57	44	6,3	40

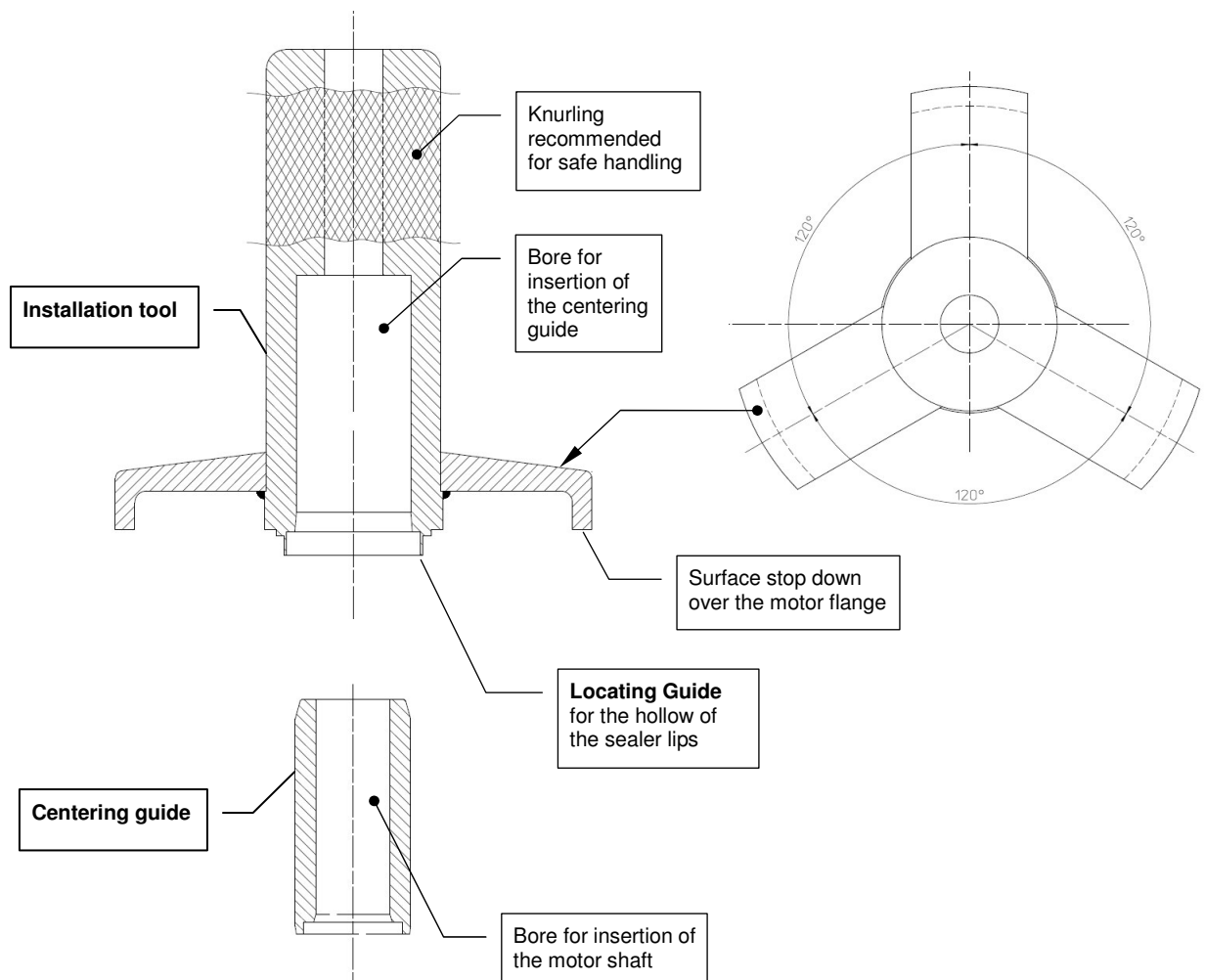
Installation of the Radial Oil Seal

The oil seal provided with 9C servomotors is a double-lip ring with an internal spring. The flexible lips rub against the shaft to prevent the leakage of fluids and dirt, while the spring of the inner lip helps to keep the lip in contact with the shaft.

The efficiency and duration of the oil seal are strictly connected to the preservation of its physical and mechanical characteristics. Incorrect installation or incorrect operation of the oil seal can lead to deterioration of its properties and hence to motor failure.

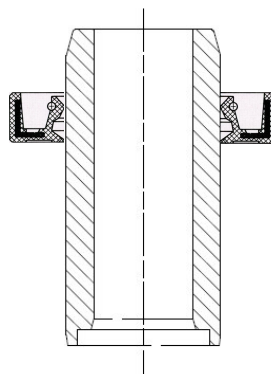
Therefore, when mounting the radial oil seal carefully observe the following rules to assist the installation.

- The oil sealer must be installed vertically centered over the shaft absolutely avoiding stress, sliding frictions and consequent deformation. Therefore it is then recommended to prepare an installation tool according to the following illustration.

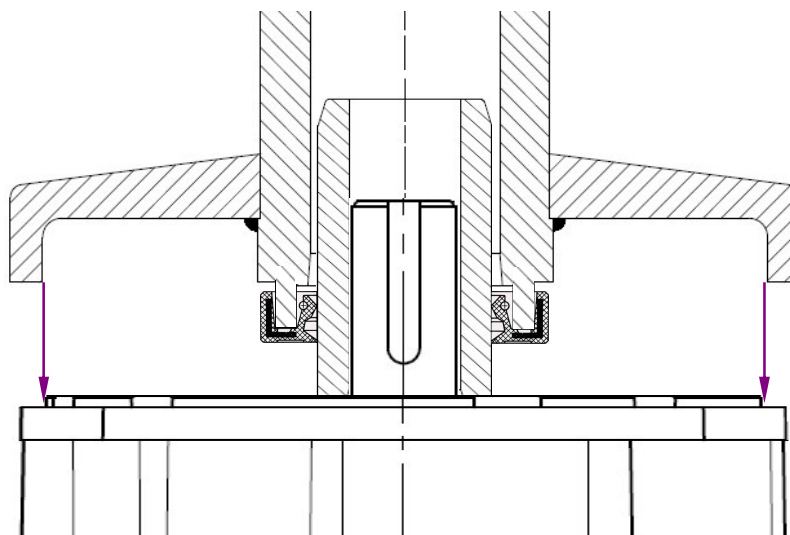


Note. Overall dimensions of the installation tool and centering guide must be compliant with dimension of the shaft end and radial oil seal used.

- Lay down the motor vertical, shaft up.
- Grease the radial oil seal with common mineral grease.
- Insert the oil seal vertically centered over the centering guide. The seal lips must be oriented in the direction of the leakage fluid, i.e. lips and hollow up toward the installer.



- Then install the centering guide over the motor shaft, down to stop.
- Insert the locating guide of the installation tool into the oil seal hollow and push the installation tool down to stop. **Absolutely avoid to force the tool and the oil seal. Absolutely avoid forces or sliding friction that might deform the lips** or dislodging the inner contact spring. The contact surface of the lips must keep smooth and keep the integrity overall.



- Check that the surface of the installation tool is stopped down over the motor flange and centered on the flange centering diameter. If so, the radial oil seal is correctly installed; the installation tool and the centering guide can be now removed.

Digit 13: Brake variants

For particular applications, the motor can be arranged with an electrically driven brake that mechanically acts on the servomotor shaft; when mounted, the brake is fully integrated into the motor structure.

Do not confuse this mechanical-action brake with the braking electronic unit of the converter circuit, allowing dissipation of electric regenerated power on a resistor.

The servomotor's brake can be considered as a "parking and emergency brake"; its main function is to lock the motor shaft when the converter is discharged and to brake in emergency cases. It must not be used for stopping the drive in normal operation.

In case of axial loads on the motor shaft, please contact the Customer Service before operation.

The servomotor can be provided by default with a spring-applied brake; another type of mechanical brake is available as a variant:

- permanent magnet brake

The characteristics of permanent magnet brakes are similar to those of spring applied brakes. However, permanent magnet brakes have some advantages and some disadvantages: the main advantage is that, contrary to spring brakes, they do not have backlash; the main disadvantage is that they are normally more delicate device, in particular it is very sensitive to the axial position of the braking disc, and they are normally not usable for dynamic braking since the wear that occurs on the braking disc affects the axial positioning of the braking disc.



Since brakes are typically disc brakes they are very sensitive to axial movements of the shaft.

Therefore, for servomotors equipped with brakes, if axial loads are foreseen, please contact our Customer Service.

Frame	Technical data of the mechanical brakes			
	Power supply voltage: 24 VDC; Tolerance: ±10%			
	Holding Torque (20 °C)		Moment of inertia	Excitation current
	$M_{br \text{ permanent magnet}}$ [Nm]	$M_{br \text{ spring}}$ [Nm]	J_{br} [kgcm ²]	I_{br} [A]
9C1	2	2.5	0,4	0,5
9C4	10	16	4	0,75
9C5	18	32	11	1,2

Note. Upon request, other holding torques are available for both permanent magnet and spring brakes.

When the brake option is present, the connection must be performed observing the following.



The brake management is fully under care and responsibility of the installer and manufacturer of the electrical control cabinet. The brake is a safety brake and so it is **operating (i.e. it brakes) when it is not powered**.

It is therefore mandatory to power the brake, i.e. unlock the motor shaft, before powering the motor itself; so the logic of the electrical control cabinet must provide a timely and adequate power supply to the brake, also checking that the brake is continuously powered during the servomotor operation.

Note. The brake shall be powered by **DC current**, coming from a separate power supply having adequate power and the specified voltage tolerance.

The power supply polarity must be respected: inverting the polarity means failure of brake supply and therefore a braking action on the motor.

Digit 14: Temperature sensors variants

The Servomotors embody a temperature sensor of PTC type. This thermal sensor provides information to the control circuits on the motor temperature. Therefore this device must be connected to the servo converter before operation, and proper alarm levels must be set on the converter control circuits in order to prevent motor overheating and failure.

Other kinds of thermal sensors may be used:

- PT100
- KTY
- Thermal switches
- Etc.

The thermal sensors available on the market are so many that it is not reasonable to list them.

If a thermal sensor different than the PTC is required, please contact ABB Servomotors Customer Service.

Digit 15: Voltage supply variants

9C Servomotors are designed for a standard Voltage supply level of 400 V. Since according to IEC other voltages are available, there is a certain possibility of adaptation of 9C servomotors to other voltage levels.

The insulation system in 9C servomotors does not change for different voltages, being them higher or lower than 400Vac.

As an upper limit the 600 Vac supply can be taken. This is due to the way the insulation system is designed, based on the use of resin encapsulation under vacuum, which practically eliminates any kind of source of partial discharges up to 3 kV, the use of advanced ground insulation materials like Stanyl or Ixef, and a careful design of the windings, that are not done any longer in a random way like traditional distributed windings motors, but in a prefabricated, controlled way, like the formed windings of larger electrical machines.

Theoretically, from the point of view of the insulation system there is no limit to the lower voltage level. However there is a limit due to the maximum current that the faston connectors in the terminal box can carry indefinitely. At the moment there is a limitation for 9C5 motors, that are not allowed to be done at 230 Vac power supply, at least at the standard speed of 3000 RPM but also at the special speed of 2000 RPM. For lower speeds, e.g. 1500 RPM, the motors can be done at 230 Vac.

Therefore this is the list of motors that can be done at 230 V:

Vac	230
Motor designation	Speed [RPM]
9C1x30xxxxxxxxExx	3000
9C1x60xxxxxxxxExx	6000
9C4x30xxxxxxxxExx	3000
9C4x40xxxxxxxxExx	4000
9C5x15xxxxxxxxExx	1500

A second option to be considered is that, since there is no difference in insulation system of the motors for different voltage supply levels, 9C Servomotors can be used at different speed levels in function of the voltage supply level: e.g. the same motor rated for 6000 RPM at 400 V is approximately a motor rated 3000 RPM at 230 V: the relationship between voltage supply level and speed is almost linear, therefore this relationship can be exploited to extend the field of usability of the 9C Servomotors. For this reason all 9C motors are rated by default at 400 Vac, and the different indication of voltage level is seldom used.

The following table shows the equivalent rated speed at 230 Vac, for motors equipped with windings designed for 400 Vac:

Vac	400	230
Motor designation	Speed [RPM]	
9Cxx20xxxxxxxxMxx	2000	1150
9Cxx30xxxxxxxxMxx	3000	1725
9Cxx40xxxxxxxxMxx	4000	2300
9Cxx60xxxxxxxxMxx	6000	3450
9Cxx70xxxxxxxxMxx	7000	4025

Digit 16-17: Accessories

No accessories are foreseen in this moment for 9C Servomotors

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Customer Service

For any additional question and support, please contact our Customer Service.

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9C SERVOMOTORS VARIANTS
MANUAL
MANUM09 REV E EN
EFFECTIVE: 15.03.2008

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