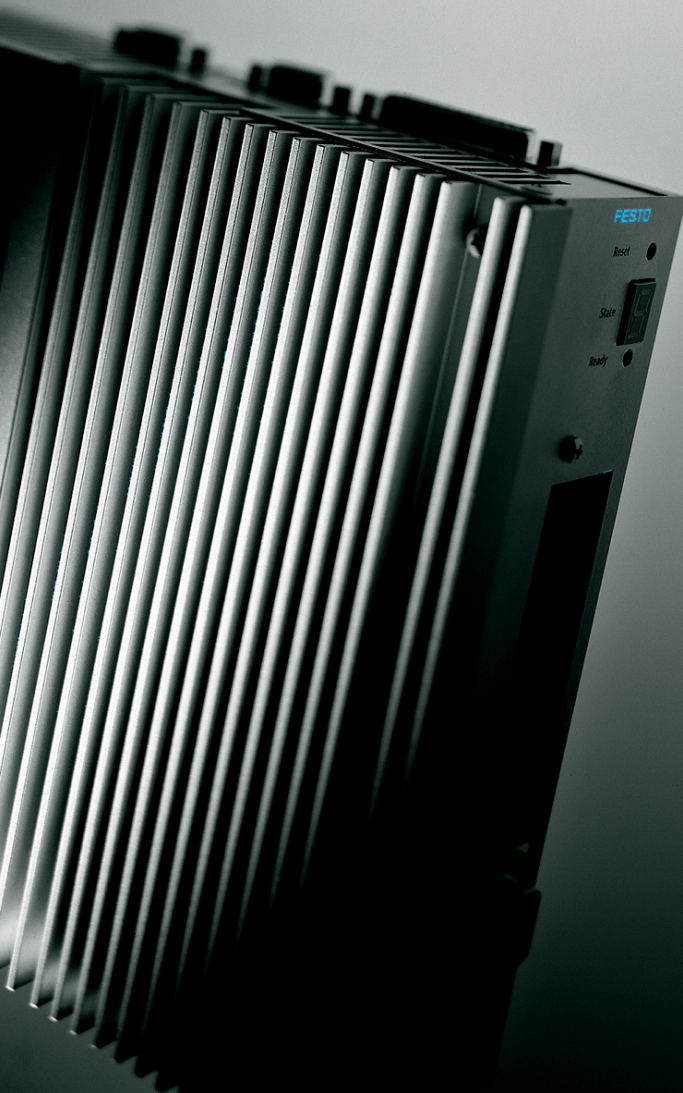


Smart Electromotor Controller

FESTO

Description

Fitting and
installation
Type SEC-AC-305
Type SEC-AC-508



Description

192 346
en 0802d
[715 646]

Contents and general instructions

Original de

Edition en 0802d

Designation P.BE-SEC-AC-HW-EN

Order no. 192 346

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Contents and general instructions

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Designated use

The SEC-AC (Smart Electromotor Controller) has been designed for use in control cabinets for supplying AC servo motors and for controlling their torque (current), speed and position.

The SEC-AC must be operated in a safe working environment. An EMERGENCY STOP circuit must be installed for the system.

Operate the SEC-AC only under the permitted ambient conditions.

The SEC-AC may only be used in stationary industrial and commercial use. The electromagnetic interference immunity of the power electronics is not designed for operation in mobile systems, in households or firms connected directly to the low voltage network.

Fit the SEC-AC with screening into an earthed control cabinet. Otherwise, the electromagnetic compatibility (EMC) of the power electronics will not be guaranteed. Use the SEC-AC only as follows:

- as designated
- in a technically faultless state
- without undertaking any modifications.

If used in conjunction with additional commercially-available components, such as sensors and actuators, the specified maximum limits (temperatures, electrical datas, torques, etc.) must be observed.

Please comply with national and local safety laws and regulations.

Areas of application and approval by authorities

Certain configurations of the product are certified by Underwriters Laboratories Inc. (UL) for the USA and Canada. These configurations are marked as follows:



UL Listing Mark for Canada and the United States



Please note

If the requirements of UL must be observed in your application, note the following:

- Regulations for conforming with the UL certification can be found in the separate UL specific documentation. The technical specifications contained therein have priority.
- The technical specifications in this documentation may show different values.

Target group

This manual is aimed at technicians trained in control and automation technology, fitters etc. who

- are working for the first time with digital drive controllers
- are already familiar with digital drive controllers, but who are installing a digital drive controller like the SEC-AC for the first time.

The aim of this manual

This manual will help you to carry out the first commissioning of the SEC-AC successfully.

In this manual you will find important information and acquire the basic knowledge necessary for operating the SEC-AC correctly.

Most work steps in this manual are divided into two parts:

- Description part: here you will learn important instructions and the aim of each individual work step.
- Instruction part: here you carry out the work step.

In the left-hand margin you will find symbols which simplify the orientation in this manual for you during commissioning.

As this manual is intended for the first commissioning of the complete SEC-AC product family, the regulator for which the work step is intended is always specified for each individual work step.

Trade marks

All product names in this document may be registered trade marks. All trade marks in this document are only used for identifying the individual product.

Service

If you have any technical problems, please contact your local Festo Service.

Safety instructions



Warning

Inside the SEC-AC and on its connections there are high voltages which can be extremely dangerous.

Switch off the power supply of the SEC-AC, therefore, and wait for at least 5 minutes in order that the intermediate circuit can discharge before you connect or disconnect any plugs.



Warning

During installation, commissioning and maintenance you must observe the safety and accident prevention regulations valid for the specific application.

The following regulations apply but are not guaranteed to be complete:

- VDE 0100 Regulations for setting up high-voltage systems up to 1000 V
- VDE 0113 Electrical equipment in machines
- VDE 0160 Equipment in high-voltage systems with electronic operating methods

Important user instructions

Danger categories

This manual contains instructions on the dangers which may occur if the product is not used correctly. These instructions are marked with a heading (Warning, Caution, etc.), printed on a shaded background and accompanied by a pictogram. A distinction is made between the following danger categories:



Warning

This means that there is a danger of serious human injury and damage to property if these instructions are not observed.



Caution

This means that there is a danger of human injury and damage to property if these instructions are not observed.



Please note

This means that there is a danger of damage to property if these instructions are not observed.

In addition, the following pictogram marks passages in the text which describe activities involving electrostatically sensitive components:



Electrostatically sensitive components: Incorrect handling may result in damage to the components.

Marking special information

The following pictograms mark passages in the text containing special information.

Pictograms



Information:
recommendations, tips and references to other sources of information.



Accessories:
information on necessary or useful accessories for the Festo product.



Environment:
information on the environmentally-friendly use of Festo products.

Text markings

- The bullet denotes activities which can be carried out in any sequence.
- 1. Figures denote activities which must be carried out in the order specified.
- Hyphens denote general activities.







Type	Title		Description
Fitting and installation manual	“Fitting and installation”, type P.BE-SEC-AC-HW-...		Information on fitting and installing the motor controller SEC-AC.
Commissioning manual	“Commissioning SEC-AC” type P.BE-SEC-AC-SW-...		Information on commissioning and diagnosing the motor controller SEC-AC.
Field bus coupling manual	“Commissioning SEC-AC with field bus coupling CANopen” type P.BE-SEC-AC-CO-...		Supplementary information on commissioning and diagnosing the motor controller SEC-AC with CANopen field bus coupling.
	“Commissioning SEC-AC with field bus coupling Profibus DP” type P.BE-SEC-AC-PB-...		Supplementary information on commissioning and diagnosing the motor controller SEC-AC with CANopen field bus coupling.
Special documentation UL	UL information SEC-AC		Requirements for observing the conditions of UL when the product is operated in the USA and Canada.
Software	“WMEMOC”, type WMEMOC-3.3		Parametrizing program for the SEC-AC.

Fig. 0/1: Manuals on the SEC-AC

Summary of components

Chapter 1

1. Summary of components

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1. Summary of components

1.1 Summary

The SEC-AC servo regulators are fully digital AC servo regulators which can be adapted very flexibly to a large number of applications due to their extensive parametrizing possibilities.

The SEC-AC-508 is closely related to the SEC-AC-305. Apart from the different mains voltage, the two devices are fully compatible.

The SEC-AC Smart Electromotor Controllers must be fitted in a control cabinet. The circuitry can be carried out in uniform manner.

1.2 Features

- Full integration of all components for the controller and power units, evaluation of the rotary transducer (motor angle of rotation feedback) has been designed as a plug-in module.
- Slot for technological extensions.
- Integration of all filters in the device necessary for complying with the EMC regulations in operation (industrial area), e.g. network filter, motor output filter, filter for supply as well as for the inputs and outputs.
- Integrated braking module with braking chopper enables braking energy to be dissipated via the internal braking resistors.
External resistors with up to several kW continuous output can be connected for considerable braking energy.

1. Summary of components

- Mechanical concept:
The completely enclosed EMC-optimized metal housing has been designed for direct mounting and fastening onto the usual mounting plates in a control cabinet.
- Complete electrical isolation of the controller unit and the final output stage, digital inputs and outputs, analogue and control electronics in accordance with VDE 0160.
- 4-quadrant operation with complete continuous transfer between the quadrants.
- Droopless control in conjunction with a digital nominal value specification.
- Sinus-shaped current injection, therefore continuous torque compared with block-commutated controllers.
- Can be operated as a speed, torque or position regulator.
- Smooth or time-optimum positioning relatively or absolutely to a reference point.
- Speed and rotary angle synchronization with electronic gears via an incremental sensor input.
- Short cycle times, the control dynamics are similar to those of an analogue regulator.
- Simple coupling to a higher-order controller, e.g. to a PLC.
- The digital controller permits error-tolerant operation, i.e. faults are recognized in good time and regulated when possible.

1. Summary of components

1.3 Controller unit

1.3.1 Brief description

The central component in the controller unit is a highly integrated 32-bit RISC micro controller of type HITACHI SH 7032.

Communication with higher-order controllers, PLCs or master computers is accomplished with the optional CAN bus interface, via the serial interface and via the digital inputs/outputs.

The ten external digital inputs and the five digital outputs are completely electrically isolated.

1.3.2 Analogue-digital converter

The analogue-digital converter is integrated in the SEC-AC. It digitizes analogue variables, e.g. the motor currents, analogue nominal values or the temperatures of the motor and the final output stage.

1.3.3 Digital-analogue converter

The digital-analogue converter serves for displaying digital control variables on an analogue monitor. This function is of help, e.g. with regulator optimizations. The SEC-AC has two analogue monitor devices.

1.3.4 Internal monitoring

A watchdog timer and extensive monitoring functions ensure very reliable operation of the controller unit.

The microcontroller and additional external hardware logic register error signals from the motor, from the rotary-angle evaluator and from the final output stage.

1. Summary of components

1.4 Final output stage

1.4.1 Brief description

Final output stage

The final output stage is a three-phase design.

The motors should be connected star-shaped, in order to prevent circulating currents in the motor. The intermediate circuit voltages comply with the standard European or international values.

Operation with lower intermediate circuit voltages is also possible (with reduction of output). If very fast components are used, signal distortions will be reduced to a minimum.

1.4.2 Power supply

SEC-AC-305

An external power unit is not necessary for rated outputs in the dimensioning range. Connection is made via the single-phase 230 V AC network.

EC-AC-508

These devices can be connected directly to the 400 V three-phase network.

1. Summary of components

1.4.3 Feeding back the braking energy

SEC-AC-305 and SEC-AC-508

The braking energy is fed back into the intermediate circuit where it creates a voltage increase.

Braking chopper with braking resistor

A braking chopper with braking resistor is integrated in the final output stage. If a certain limit value of the intermediate circuit voltage is exceeded during the feedback, the braking energy will be converted to heat by the internal braking resistors. Control of the braking chopper is carried out by software in the SEC-AC. The internal braking resistors are protected against overload.

If, in a particular application, the output of the internal resistors is not sufficient, an external resistor can be connected as described in chapter 3.3.2.

Simultaneous operation of the internal and external braking resistors is not possible. The external resistors are not protected against overload automatically by the SEC-AC.

1. Summary of components

1.4.4 Internal monitoring

The final output stage will be switched off very quickly by the controller unit if operating faults occur. A high degree of protection is ensured for the motor and the SEC-AC.

An extensive arrangement of sensors and monitoring functions ensure operational safety:

- measurement of the motor temperature
- measurement of the final output stage temperature
- recognition of device-internal earth connections (protective earth)
- recognition of connections between two motor phases
- recognition of connections at the output for the external braking resistor
- recognition of overvoltages in the intermediate circuit
- recognition of faults in the internal voltage supply

1. Summary of components

1.5 Displays

1.5.1 Brief description

During operation, the SEC-AC can assume various operating states. These states are communicated to the user via visual displays.

1.5.2 Ready-to-operate display

The green ready-to-operate LED on the front of the SEC-AC indicates the readiness to operate.

1.5.3 Operating mode and error display

Seven segment display The seven segment display on the front of the SEC-AC indicates the operating mode and shows any error messages.

1. Summary of components

1.6 Rotary transducer evaluation

The rotary transducer evaluating unit is incorporated on a plug-in board.

Different sensor adaptations are therefore possible. As standard, the SEC-AC operates with a resolver. It also possesses an additional incremental sensor input and an incremental sensor output. The sensor evaluation possesses the following features:

- a resolver resolution set at 16 bits
- an additional incremental sensor input (synchronizing input), the resolution can be set, internal 4-fold evaluation
- an additional incremental sensor output with fixed set resolution of 1024 inc/rev.

The incremental sensor inputs and output can be used, e.g. for synchronizing several SEC-ACs as electronic gears.

1.6.1 Serial interface

The serial interface with RS 232 specification serves for parametrizing the SEC-AC. Parametrizing is carried out in conjunction with the PC parametrizing program for WINDOWS/NT and a PC.

In applications in which high data transmission and the networking of several regulators are not required, the RS 232 can also be used for controlling the regulator.

1. Summary of components

1.7 User interfaces

1.7.1 Digital inputs

Ten digital inputs are available for the elementary control functions:

Positioning destination

For saving positioning destinations, the SEC-AC possesses a destination table in which the positioning destinations with individual positioning profiles can be saved and from which they can later be accessed. Four outputs serve for destination selection, a fifth input is used as the starting input.

Hardware limit switches

The hardware limit switches are used for setting safety limits to the area of movement. During reference travel, one of the two limit switches serves as the reference point for positioning control.

Two inputs are used for the hardware-controlled final output stage enable, as well as for the software-controlled regulator enable.

For time-critical tasks (e.g. sensor evaluations) a high-speed sample input is available.

1.7.2 Analogue inputs

The SEC-AC possesses two analogue inputs for the input level. The inputs have been designed as differential inputs, in order to ensure a high degree of immunity to interference. The analogue signals are digitized by the analogue-digital converter. The analogue signals serve for specifying nominal values (speed or torque) for the regulator.

1. Summary of components

1.8 Parametrizations

1.8.1 The parameter memory

The SEC-AC possesses two memory ranges in which it stores parameters. The FLASH memory is used for parameters which are loaded when the controller is switched on or after RESET. These parameters are retained even when the power supply is switched off. The internal memory (RAM) is used for parameters which are currently used for controlling. These parameters can be accessed with the parametrizing program.

The FLASH technology also enables a software update (e.g. for customer-specific software) to be loaded into the RS 232 at a later date.

1.8.2 The parametrizing program

The parametrizing program is a program for parametrizing, controlling and monitoring the operation of the SEC-AC via communication interfaces. It can be used with every AT-compatible PC as from 80486-processor with at least 16MB main memory, providing it is running with WINDOWS 95, 98 or WINDOWS NT. User-friendly operation under WINDOWS also facilitates work for users with only limited EDP knowledge.

1.8.3 CAN module (optional)

The optional CAN module operates in accordance with CANopen specifications with the CIA-DS 402 positioning profile.

1.8.4 PROFIBUS module (optional)

The optional PROFIBUS module operates in accordance with current PROFIBUS-DP specification of the "PROFIBUS Nutzerorganisation (PNO)" (PROFIBUS user organisation).

1. Summary of components

1.9 Monitoring functions

1.9.1 Brief description

The SEC-AC possesses an extensive arrangement of sensors which monitor the faultless functioning of the controller unit, the final output stage, the motor and the communication with the peripherals.

Error memor

Any faults which occur are saved in the internal error memory. Most errors cause the controller unit to switch off the regulator and the final output stage. The regulator cannot be switched on again until the fault has been rectified and the error memory has been deleted by quitting (switch off the voltage or actuate the reset button above the figure display).

1.9.2 Monitoring the final output stage

The final output stage is monitored by extensive protective functions.

- Overcurrent and short-circuit monitoring:
This responds as soon as the current in the intermediate circuit exceeds twice the maximum current of the regulator. Short circuits between two motor phases are recognized as well as short circuits at the motor output terminals in respect of the positive and negative reference potential of the intermediate circuit and in respect of protective earth. When the error monitoring recognizes an overcurrent, the final output stage is switched off immediately, so that resistance to short circuits is guaranteed.
- Overvoltage monitoring for the intermediate circuit:
This responds as soon as the intermediate circuit voltage exceeds the operating voltage range. The final output stage is then switched off.
- Temperature monitoring for the heat sink: The heat sink temperature of the final output stage is measured with a

1. Summary of components

linear temperature sensor. The regulator will be switched off when a certain defined temperature is exceeded.

1.9.3 Monitoring the motor

The SEC-AC possesses the following protective functions for monitoring the motor and the connected rotary transducer:

- Monitoring the rotary transducer:
An error of the rotary transducer causes the final output stage to be switched off. The carrier signal and the tracer signal are monitored.
- Measuring and monitoring the motor temperature:
The SEC-AC possesses an input for registering and monitoring the motor temperature.

1.9.4 I^2t monitoring

The SEC-AC has I^2t monitoring for limiting the medium loss of output in the final output stage and in the motor. As the loss of output occurring in the power electronics and in the motor increases in the most unfavourable case in squared value with the current flowing, the digitized current value will be accepted as a measure of the loss of output.

1.9.5 Automatic braking

The SEC-AC can directly control a parking brake with limited current consumption of up to 0.5 A. Operation of the holding brake can be carried out automatically with programmable delay times.

Fitting

Chapter 2

2. Fitting

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2. Fitting

2.1 Dimensions

2.1.1 Dimensions of the SEC-AC

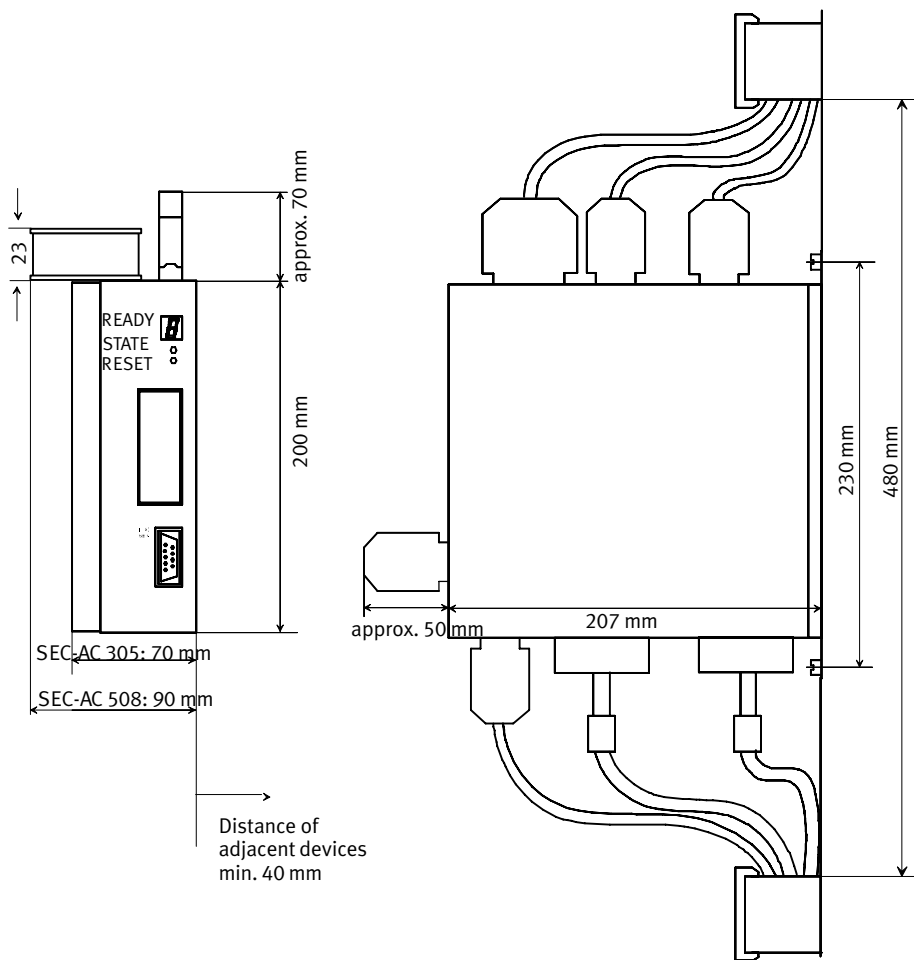


Fig. 2/1: Dimensions of the SEC-AC

2. Fitting



Please note

Connect the screening/shield with equal potential on the mounting plate. If necessary, in the case of X10 or X11, use an earthing screw above (e.g. with external regulators) and **always** below.

Fastening screws must not be used as earthing screws.

The devices are intended as compact devices for mounting in series in a control cabinet or on a wall. Any number of SEC-ACs can be connected next to each other. The loss of output occurring in operation, together with the heating of the device depends on the output consumption. The cooling of the SEC-AC is performed by free convection or by forced convection (only SEC-AC-508) with the series fan supplied. For sufficient cooling, the upper and lower dimensions shown in Fig. 2/2 must be observed as a minimum.

- 1 Control cabinet wall
- 2 Fan (SEC-AC-508)

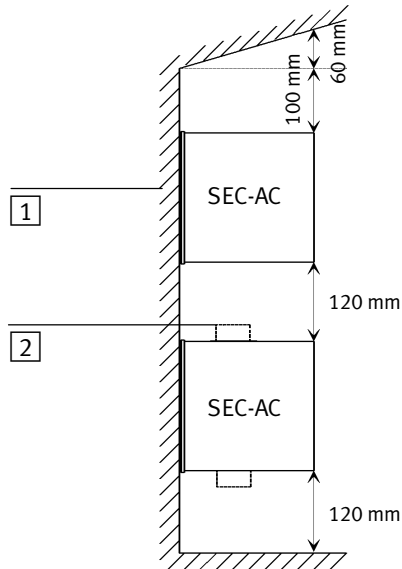


Fig. 2/2: Minimum distances for control cabinet or wall fitting

2. Fitting

2.2 Electromechanics

2.2.1 Front view

- 1 RESET
RESET key
- 2 STATE
7-segment display as status display
- 3 READY
Geady-to-operate display
- 4 Techno Slot for CAN or PROFI-BUS module (optional)
- 5 X5
Serial interface
- 6 Cool profile
- 7 Air channel (only SEC-AC-508)
- 8 Fan (only SEC-AC-508)

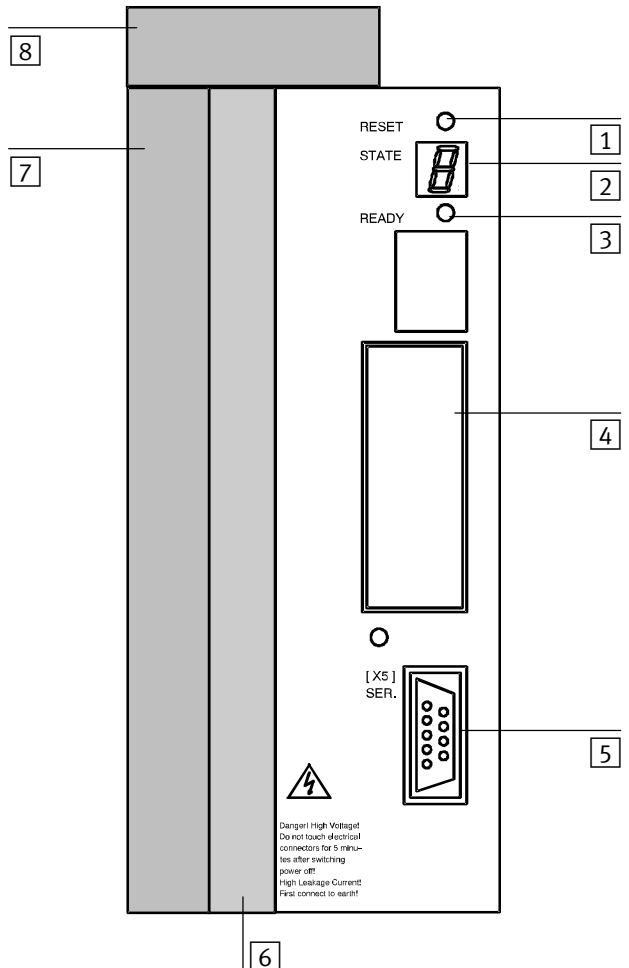


Fig. 2/3: Front view of SEC-AC

2. Fitting

2.2.2 Top view

- 1 X12
Connection for external braking resistor (only SEC-AC-508)
- 2 X11
Incremental sensor output
- 3 X10
Incremental sensor input
- 4 X1
Digital and analogue inputs and outputs
- 5 Fan (only SEC-AC-508)

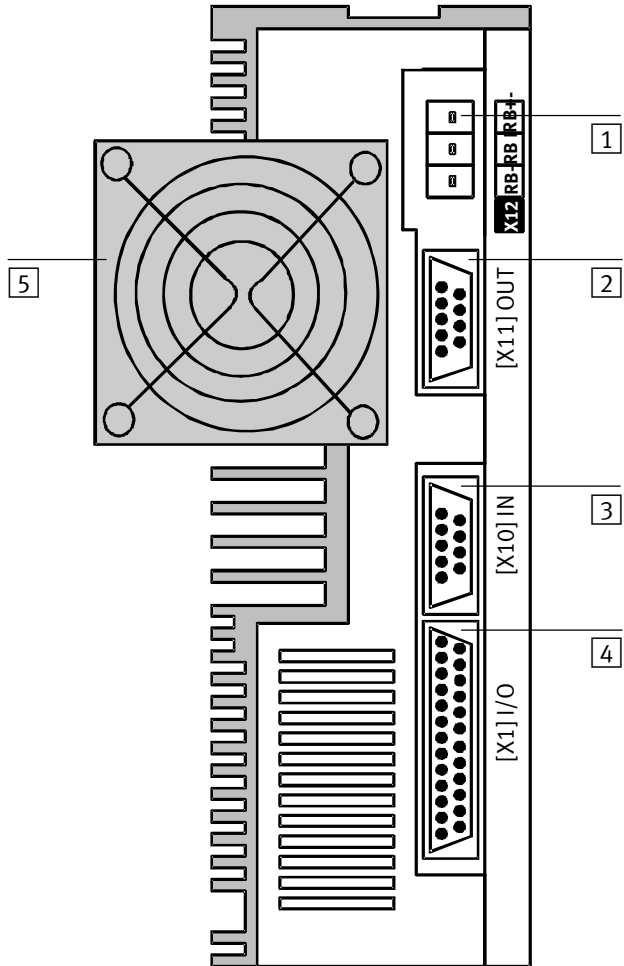


Fig. 2/4: Top view of SEC-AC

2. Fitting

2.2.3 Bottom view

- 1 X2
Phase-angle sensor input
- 2 X6
Power supply to motor, temperature sensor, parking brake
- 3 PE
Protective earth connection of SEC-AC
(max. 1 Nm)
- 4 FAN
Connection for fan (with SEC-AC-508 series standard)
- 5 X9
Power supply/
mains connection
- 6 Air channel (only SEC-AC-508)

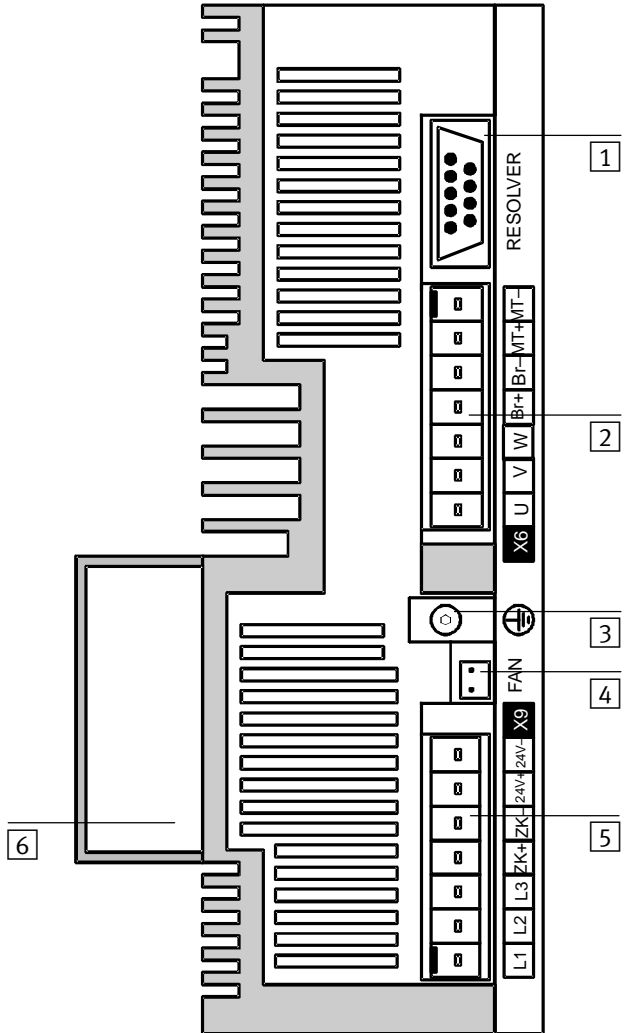


Fig. 2/5: Bottom view of SEC-AC

2. Fitting



Warning

The voltages at X12 can be as much as 800V!

Handle the plug with great care. Before touching the plug, switch off the device completely and wait 5 minutes.



Warning

Observe the plug assignment on connector X9. Swapping the connecting terminals can be very dangerous and will also cause damage to the device. Connection X6 can also carry dangerous high voltages.

Installation

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3. Installation

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3. Installation

3.1 General instructions on installation



Please note

If the requirements of UL must be observed in your application, note the following:

- Regulations for conforming with the UL certification can be found in the separate UL specific documentation. The technical specifications contained therein have priority.
- The technical specifications in this documentation may show different values.

3.2 Material

3.2.1 Cables



Caution

Use only the cables listed below for connecting the system. Only then will the correct functioning of the system be guaranteed.



Caution

Incorrectly produced cables can damage the electronics and trigger unexpected movements of the slide.

Test each cable in accordance with the instructions on fitting the cables. Make sure that the cables are laid correctly and that the plugs have strain relief.

3. Installation



We recommend the following Festo cables for connecting our electric positioning systems:

	Designation	Part number
Cable set		
Cable set 5 m, consisting of: Motor cable KMTR-AC-5 Resolver cable KRES-AC-5	KSEC-AC-5	00526747
Cable set 10 m, consisting of: Motor cable KMTR-AC-10 Resolver cable KRES-AC-10	KSEC-AC-10	00526748
Cable set 15 m, consisting of: Motor cable KMTR-AC-15 Resolver cable KRES-AC-15	KSEC-AC-15	00526749
Cable set length x, consisting of: Motor cable KMTR-AC-X *) Resolver cable KRES-AC-X	KSEC-AC-X	00529984
*) Special EMC protection measures are required for motor cables > 25 m (see sections 3.5 and 3.6)		
Motor cable (X6)		
Motor cable 5 m	KMTR-AC-5	00526739
Motor cable 10 m	KMTR-AC-10	00526740
Motor cable 15 m	KMTR-AC-15	00526741
Motor cable length x *)	KMTR-AC-X	00526742
Resolver cable (X2)		
Resolver cable 5 m	KRES-AC-5	00526743
Resolver cable 10 m	KRES-AC-10	00526744
Resolver cable 15 m	KRES-AC-15	00526745
Resolver cable Länge x	KRES-AC-X	00526746
Encoder cable (X11)		
Encoder cable 2,5 m	KENC-M-BSM-2,5	00192341
Encoder cable length x	KENC-M-BSM-X	00192342

3. Installation

	Designation	Part number
Programming cable (X5)		
Cable IPC	PS1ZK11	00160786
Control cable (X1)		
Control cable	KES-SEC-AC-2,5	00652237
*) Special EMC protection measures are required for motor cables > 25 m (see sections 3.5 and 3.6)		

The encoder cable is only required when a separate (external) position controller is used. In this case the SEC-AC is operated as a speed controller.

3.2.2 Plug for power cable X6



1 PHOENIX POWER-COMBICON plug, 7-pole without pins grid 7.62mm, PC 4/7-ST-7.62, included in delivery. Coding profile to avoid swapping the connections CP-HCC 4.

3.2.3 Plug for external braking resistor (recommended for high braking power)



1 PHOENIX POWER-COMBICON plug, 3-pole without pins grid 7.62mm, PC 4/3-ST-7.62.



Included in delivery (inserted in X12). Remove the wire bridges on the plug if using an external braking resistor.

3.2.4 Plug for power supply to the SEC-AC



1 PHOENIX POWER-COMBICON plug, 7-pole without pins grid 7.62mm, PC 4/7-ST-7.62, included in delivery. Coding profile to avoid swapping the connections CP-HCC 4.

3. Installation

3.2.5 PE connection of the SEC-AC

The PE connection of the SEC-AC (network and motor) is made with an M5 threaded pin.

3.2.6 Interface cable for serial interface (zero modem)



2 D-SUB plug, 9-pin socket 2 housing for 9-pin D-SUB plug with locking screws 4/40 UNC screened cable, 3-core

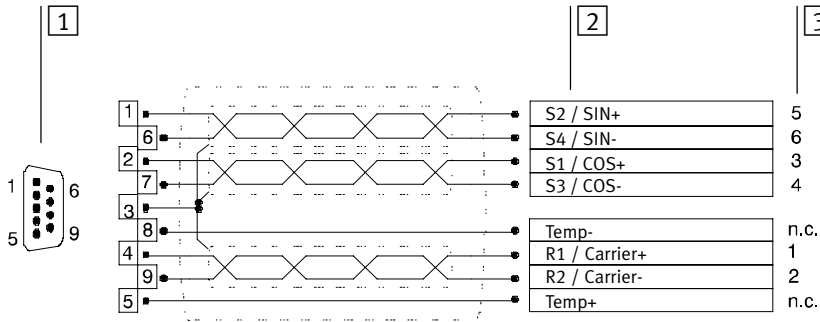
3.3 Plug connectors and their pin assignments

3.3.1 Rotary-angle sensor cable for motors with resolver, plug X2 (rotary-angle sensor evaluation)

- plug connector: D-Sub socket 9-pin
- mating connector: D-Sub plug 9-pin

The outer screening is always connected to protective earth (PE) (plug housing).

3. Installation



1 DSUB-plug to X2: Resolver (view of soldering side)

2 Resolveroutput of motor

3 Pinassignment Festo-Resolver plug connector

Pin no.	Symbol	Value	Specification
1	SIN+	$3,5 V_{eff} / 10 \text{ kHz}$ $R_i > 5 \text{ k}\Omega$	Sine tracer signal
6	SIN-		Sine tracer signal inverted
2	COS+	$3,5 V_{eff} / 10 \text{ kHz}$ $R_i > 5 \text{ k}\Omega$	Cosine tracer signal
7	COS-		Cosine tracer signal inverted
3	AGND	0 V	Screening for signal pairs (inner screening)
8	MOT-TEMP-	GND	Reference potential motor temperature sensor
4	REF+	$7 V_{eff} / 10 \text{ kHz}$ $I_{A\leq} 150 \text{ mA}_{eff}$	Carrier signal to resolver
9	REF-	GND	Carrier signal to resolver inverted
5	MOT-TEMP+	$5 \text{ V} / R_i = 2 \text{ k}\Omega$	Motor temperature sensor: normal closed, normal opened, PTC

Fig. 3/1: Assignment of plug connector X2 (resolver/encoder input)

3. Installation

3.3.2 Control signal plug with analogue monitor output X1 (digital and analogue inputs and outputs)

- plug connector: D-Sub plug connector 25-pin (socket)
- mating connector: D-Sub plug connector 25-pin (pin)

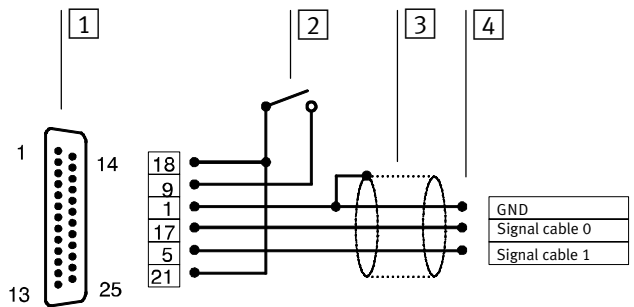
This circuit for plug connector X1 will suffice for the first commissioning. Further details see table.

With PLC interfaces the inputs:

- 21= final output stage enable
- 9 = regulator enable

must be treated separately.

- 1 DSUB-plug to X1 of ARS (view of soldering side)
- 2 Final stage and controller enable switch
- 3 Screening
- 4 BNC-plug of oscilloscope



Pin no.	Symbol	Value	Specification
1	Screening	0 V	Screening /shield connection
14	Screening	0 V	Screening /shield connection
2	Ain0	$\pm 10 \text{ V} \pm 5\%$ $R_i = 20 \text{ K}\Omega \pm 1\%$	Analogue nominal value input (A/B signals) channel 0 Differential max. 25 V input voltage
15	Ain0/		Reference connection, analogue connection channel 0
3	Ain1	$\pm 10 \text{ V} \pm 5\%$ $R_i = 20 \text{ K}\Omega \pm 1\%$	Analogue nominal value input (A/B signals) channel 1 Differential max. 25 V input voltage

3. Installation

Pin no.	Symbol	Value	Specification
16	Ain1/		Reference connection, analogue connection channel 1
4	+VREF	+10 V \pm 5%	Reference voltage output (for optional nominal value potentiometer)
17	AMON0	\pm 10 V \pm 5%	Analogue monitor output 0
5	AMON1	\pm 10 V \pm 5%	Analogue monitor output 1
18	+24VDC	\pm 24 VDC \pm 20% max. 200mA	24 V DC power supply output, not resistant to short circuits, supply via power plug X3, common potential for switching signals of digital inputs (e.g. for limit switches)
6	GND	GND	Digital earth/GND
19	Din0	POS-Bit 0	Position selection bit 0
7	Din1	POS-Bit 1	Position selection bit 1
20	Din2	POS-Bit 2	Position selection bit 2
8	Din3	POS-Bit 3	Position selection bit 3
21	Din4	ENA-PWR	Final output stage enable
9	Din5	ENA-CL	Regulator enable (1), acknowledge fault (falling edge)
22	Din6	END-0	Limit switch negative
10	Din7	END-1	Limit switch positive
23	Din8	START	Start positioning
11	Din9	SAMPLE	High-speed input
24	Dout0	READY	Ready-to-operate *)
12	Dout1	PRG-1	Freely programmable output *)
25	Dout2	PRG-2	Freely programmable output *)
13	Dout3	PRG-3	Freely programmable output *)
*) Max. capacity 100 mA with external 24 V supply. Outputs not protected against overload or short circuits, not suitable for providing external devices.			

Fig. 3/2: Assignment of plug connector X1 (inputs and outputs)

3. Installation

3.3.3 X10 (additional incremental sensor input)

- plug connector: D-Sub socket 9-pin
- mating connector: D-Sub plug 9-pin

Pin no.	Symbol	Value	Specification
1	A	5 V $R_i \approx 120 \Omega$	Input signal tracer A
6	A/	5 V $R_i \approx 120 \Omega$	Input signal tracer A inverted
2	B	5 V $R_i \approx 120 \Omega$	Input signal tracer B
7	B/	5 V $R_i \approx 120 \Omega$	Input signal tracer B inverted
3	C	5 V $R_i \approx 120 \Omega$	Input signal tracer C (zero pulse)
8	C/	5 V $R_i \approx 120 \Omega$	Input signal tracer C inverted
4	Schirm	0 V	Screening/shield connection *)
9	GND	0 V	Digital earth/ground *)
5	+5VDC	+5 VDC	Auxiliary voltage for external sensor + 5 V DC max. 100 mA *)
*) Not assigned with Festo cables			

Fig. 3/3: Assignment of plug connector X10 (additional incremental sensor input for special functions, input circuitry compatible with RS422)

3. Installation

3.3.4 X11 (additional incremental sensor output)

- plug connector: D-Sub socket 9-pin
- mating connector: D-Sub plug 9-pin

Pin no.	Symbol	Value	Specification
1	A	5 V $R_a \approx 60 \Omega$	Output signal tracer A
6	A/	5 V $R_a \approx 60 \Omega$	Output signal tracer A inverted
2	B	5 V $R_a \approx 60 \Omega$	Output signal tracer B
7	B/	5 V $R_a \approx 60 \Omega$	Output signal tracer B inverted
3	C	5 V $R_a \approx 60 \Omega$	Output signal tracer C (zero pulse)
8	C/	5 V $R_a \approx 60 \Omega$	Output signal tracer C inverted
4	Schirm	0 V	Screening/shield connection ^{*)}
9	GND	0 V	Digital earth/ground ^{*)}
5	+5VDC	+5 VDC	Auxiliary voltage for external sensor + 5 V DC max. 100mA ^{*)}

^{*)} Not included in Festo cables 192341 or 132342.

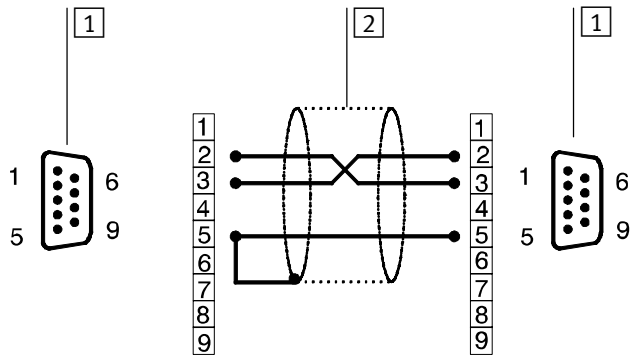
Fig. 3/4: Assignment of plug connector X11 according to RS422 (additional incremental sensor output for special functions and when a separate external position transducer is used)

3. Installation

3.3.5 X5 (serial interface/serial test interface)

- plug connector: D-Sub plug 9-pin
- mating connector: D-Sub socket 9-pin

- 1 View of plug side
- 2 Screening



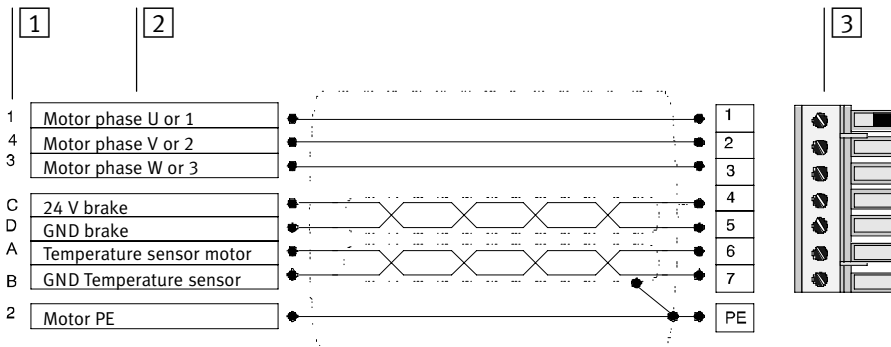
Pin no.	Designation	Specification
1	—	—
6	—	—
2	RXD	Receiver cable as per RS232 specification
7	—	—
3	TXD	Sender cable as per RS232 specification
8	—	—
4	—	—
9	—	—
5	GND	Relevant earth/ground is connected to GND of digital part

Fig. 3/5: Assignment of plug connector X5 (serial interface)

3. Installation

3.3.6 X6 (motor supply, power supply, brake and temperature sensor)

- plug connector: Phoenix Power-Combicon 7-pin, PC 4/7-G-7.62
- mating connector: Phoenix Power-Combicon 7-pin, PC 4/7-ST-7.62



1 Pinassignment of Festo motor plug connector

2 Connection plug on motor side

3 PHOENIX-POWER-COMBICON to X6

Pin	Symbol	Meaning/remarks
1	U	Motor connection phase 1
2	V	Motor connection phase 2
3	W	Motor connection phase 3
4	Br+	Control of 24 V parking brake in the motor
5	Br-	Relevant earth/ground connected to 24GND
6	MT+	Temperature sensor (normally closed contact)
7	MT-	Earth/GND for temperature sensor

Fig. 3/6: Assignment of plug connector X6 (motor connection)

3. Installation



Please note

The temperature sensor in the motor (normally-closed contact) can be wired either via the the sensor cable or the power cable (depending on the motor). The unused connection remains in each case unwired.

In Festo drive packages the temperature sensor is wired via the motor cable.

The parking brake is supplied with power by the power supply for the SEC-AC.

If the parking brake requires more than 0.5 A, it cannot be supplied directly by the SEC-AC. The tolerances in the voltage supply must also be observed (see section 2.2.).

If necessary, a relay must be inserted in the circuit between the SEC-AC and the parking brake, as shown in the diagram below.

- 1 SEC-AC
- 2 Power unit
- 3 Brake
- 4 Motor
- 5 Free-running diode
- 6 Resistor and capacitor for spark extinguisher

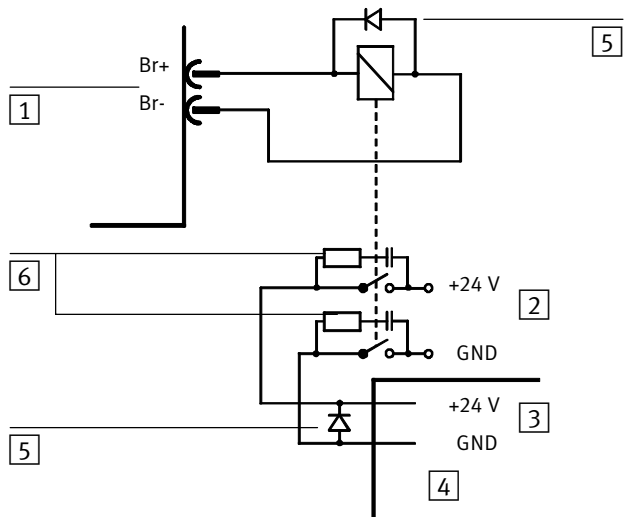


Fig. 3/7: Connecting a parking brake to the SEC-AC

3. Installation

3.3.7 Power supply cable for the SEC-AC

- 1 PHOENIX POWER-COMBI-CON to X9
- 2 Power supply for SEC-AC-305

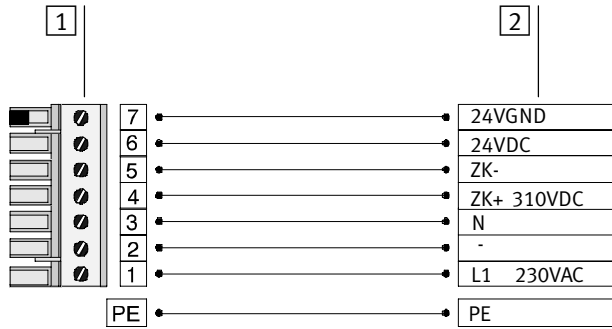


Fig. 3/8: Assignment of the power supply cable for the SEC-AC-305

- 1 PHOENIX POWER-COMBI-CON to X9
- 2 Power supply for SEC-AC-508

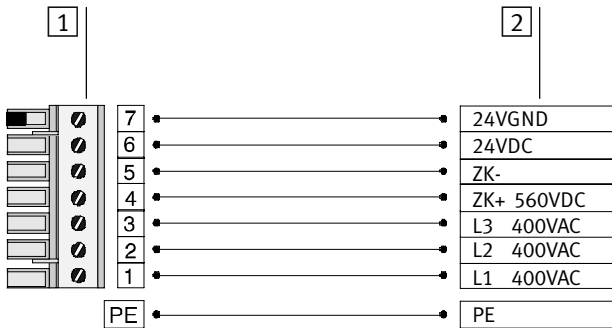


Fig. 3/9: Assignment of the power supply cable for the SEC-AC-508

3. Installation

3.4 Power supply of the SEC-AC

The SEC-AC receives its power supply via plug connector X9.

Specifications:

1. Voltage for electronics: 24 V DC \pm 20%, 0.5 A
If you are using a motor with a parking brake, you must make sure that the tolerances of the voltage supply for the parking brake are observed. Note here that an additional voltage drop of approx. 1.5 V can occur in the SEC-AC.
2. Final output stage
The voltage supply for the power unit can be made via the mains input voltage or the intermediate circuit supply.

3.4.1 X9 (power supply of the SEC-AC)

- plug connector: Phoenix Power-Combicon 7-pin, PC 4/7-G-7.62
- mating connector: Phoenix Power-Combicon 7-pin, PC 4/7-ST-7.62

Pin	Symbol	Meaning/remarks	
		SEC-AC-305	SEC-AC-508
1	L1	AC input (230Veff)	AC input (400Veff, cond.-cond.)
2	(L2)		
3	N(L3)	AC input N-conductor	
4	UZK+	Positive intermediate circuit voltage	
5	UZK-	Negative intermediate circuit voltage	
6	24V+	24 V DC auxiliary supply	
7	24V-	Earth/GND for auxiliary supply	

Fig. 3/10: Assignment of plug connector X9 (power unit)

3. Installation

3.4.2 X12 (Braking resistors)

- plug connector: Phoenix Power-Combicon 3-pin, PC 4/7-G-7.62
- mating connector: Phoenix Power-Combicon 3-pin, PC 4/7-ST-7.62

Pin	Symbol	Meaning/remarks
1	RB+	External braking resistor, positive terminal
2	RBI	Terminal for internal braking resistors
3	RB-	External braking resistor, negative terminal

Fig. 3/11: Assignment of plug connector X12 (braking resistors)



Please note

The mating connector is included in delivery. There must be a bridge on this plug between terminals RB- and RBI in order that the internal braking resistors can be operated.



Warning

There is an intermediate circuit potential (up to 800V) at these terminals! Select a suitably insulated cable. Before starting work, switch off the device completely and wait 5 minutes. This bridge must be removed in order that the external braking resistors can be operated. Simultaneous operation of the internal and external braking resistors is not possible. The bridge between RB- and RBI is already fitted when the device is supplied from the factory.

3. Installation

The following external braking resistors are recommended:

Wire-wrapped tube resistor type DEZ 140406-75R
75 Ω 370 W

Supplied by: Gielen+Notnagel GmbH
Friedrich Wöhler Straße 65
53117 Bonn
Germany

Single-tube fixed resistor type EfmA 7 82(/2,8A 650 W

Supplied by: Heine Spezialwiderstände GmbH
Schlüterstraße 29
01277 Dresden
Germany

Braking resistors with a higher output are also available from the suppliers named.

Fitting the connecting cable



Please note

Connection to the mains power supply and the fitting of mains switches, transformers, safety devices and network filters may only be carried out by qualified personnel.

3. Installation



Caution

- Do not connect any cable to the electronics and do not disconnect any cable while the system is still connected to the power supply. Otherwise the device will be damaged.
- Before installation, check all the cables once again, as incorrect connection assignments may lead to serious malfunctioning.
- Disconnect the SEC-AC and the motor from the mains power supply and wait 5 minutes (for intermediate circuit discharge) before you connect or disconnect any plugs.
- Always connect the SEC-AC to the protective earth (PE) of the power supply network.
- Always connect the screening cables of the motor to the earth connection of the SEC-AC before you commission the motor.



Caution

Avoid the parallel routing of motor cables and signal cables over long distances. Use only screened cables for connecting the motor and paired twisted cables for the signal cables.



In this way you will avoid electromagnetic interference which can impair reliable operation of the system.



Caution

Make sure that the cables are fitted with strain relief. With beam and multi-axis operation, mechanically stressed cables must be laid in a drag chain.

3. Installation

3.4.3 Summary of connections

- 1 Power connection
1x 230 V AC
(SEC-AC 305)
3x 400 V AC
(SEC-AC 508)
- 2 Main switch
- 3 Automatic cut-out
– SEC-AC-508:
3-phase
– SEC-AC-305:
1-phase
- 4 Fault current protective switch or earth contact monitoring
- 5 24 V DC
- 6 External braking resistor
- 7 SEC-AC
- 8 additional network filter (if necessary), see section 3.7
- 9 Motor with resolver
- 10 Drive unit
- 11 PC with parametrizing program

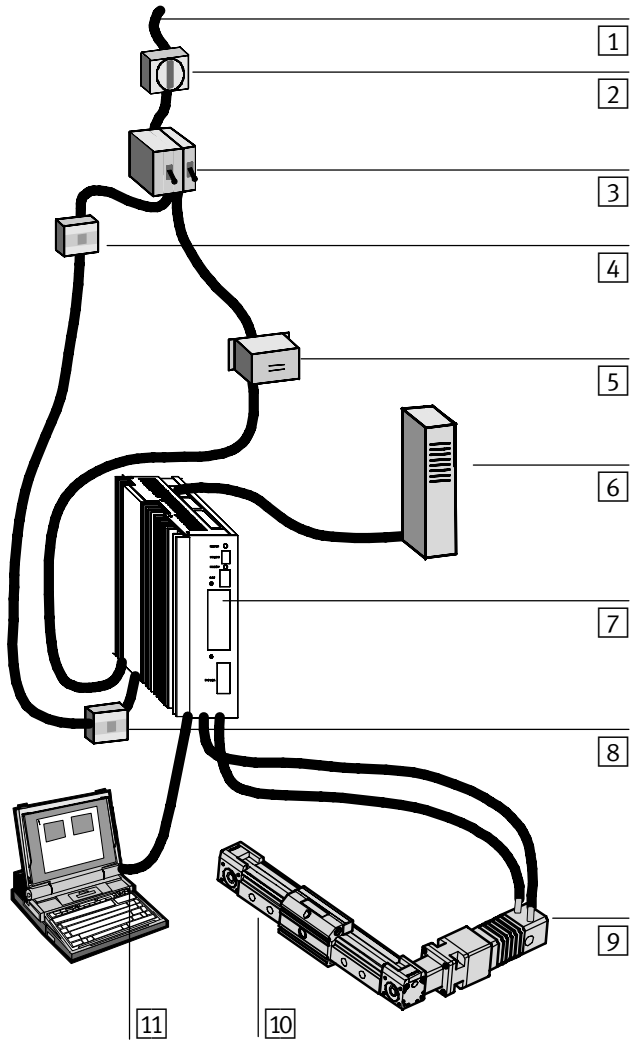


Fig. 3/12: Complete layout of the SEC-AC with motor and PC

3. Installation

3.4.4 SEC-AC complete system

The diagram in Fig. 3/12 on the previous page represents the complete SEC-AC system. The following components are required for operating the SEC-AC:

- Mains power switch
- Automatic circuit breaker
- FI protective switch (depending on design guideline alternative Ground current registering)
- Power supply cable
- Additional network filter (if necessary), see section 3.7
- SEC-AC
- Motor with motor cable and resolver cable
- A PC with serial connecting cable will be required for parametrizing.

3.4.5 Connecting the PC to the SEC-AC (X5)

1. Insert the D-Sub plug of the serial interface cable into the socket for the serial interface of the PC. Tighten the locking screws.
2. Insert the D-Sub plug of the serial interface cable into socket **X5:SER** of the SEC-AC. stecken. Tighten the locking screws.
3. Check all plug connectors again.

3. Installation

3.4.6 Connecting the motor to the SEC-AC

1. Insert the plug for the power cable into the appropriate socket on the motor and tighten it.
2. Insert the PHOENIX plug into socket **X6** on the SEC-AC.
3. Connect the PE cable of the motor and the screening cable to the PE earth terminal of the SEC-AC.
4. Insert the resolver plug into the resolver output socket on the motor and tighten it.
5. Insert the 9-pin D-Sub resolver plug into socket **X2** on the SEC-AC and tighten the locking screws.
6. Connect the screening connection of the resolver cable to the PE earth terminal of the SEC-AC.
7. Check all plug and screening connectors again.

3.4.7 Connecting the external braking resistor to the SEC-AC

1. Make sure that the power supply is switched off (wait at least 5 minutes).
2. Connect the housing of the braking resistor to the PE (e.g. on the SEC-AC).
3. Remove the bridge between RB- and RBI on connector X12.
4. Connect the braking resistor to terminals RB+ and RB- of connector X12.

3. Installation

3.4.8 Connecting the SEC-AC to the power supply

1. Make sure that the power supply is switched off.
2. Insert the PHOENIX plug into socket X9 on the SEC-AC.
3. Connect the PE-cable of the network to the PE earth terminal.
4. Provide earthing via screening cable.

3.4.9 Fitting the control signal plug

1. Insert the control signal plug into socket **X1** on the SEC-AC. Tighten the locking screws.



Warning

When connecting the motor phases, note that different manufacturers of servo motors specify different phase sequences. If necessary, phases U and W must be swapped.

3.5 Complete summary of the SEC-AC system

3.5.1 Wiring the connections

The SEC-AC should be connected to the power supply and to the motor as shown in Fig. 3/13.



Please note

Differences in potential lead to equalizing currents which may cause interference.

Connect the screening connections of all cables with low impedance to the central PE connection point of the SEC-AC-... .

3. Installation

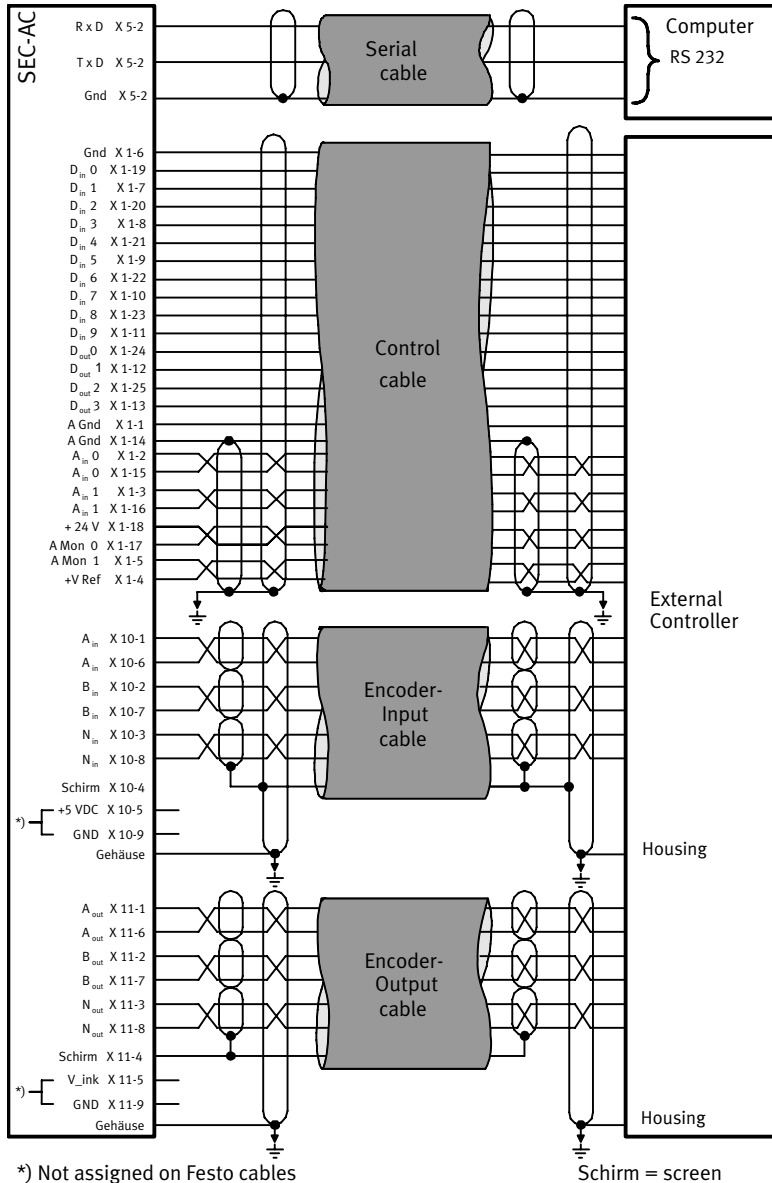
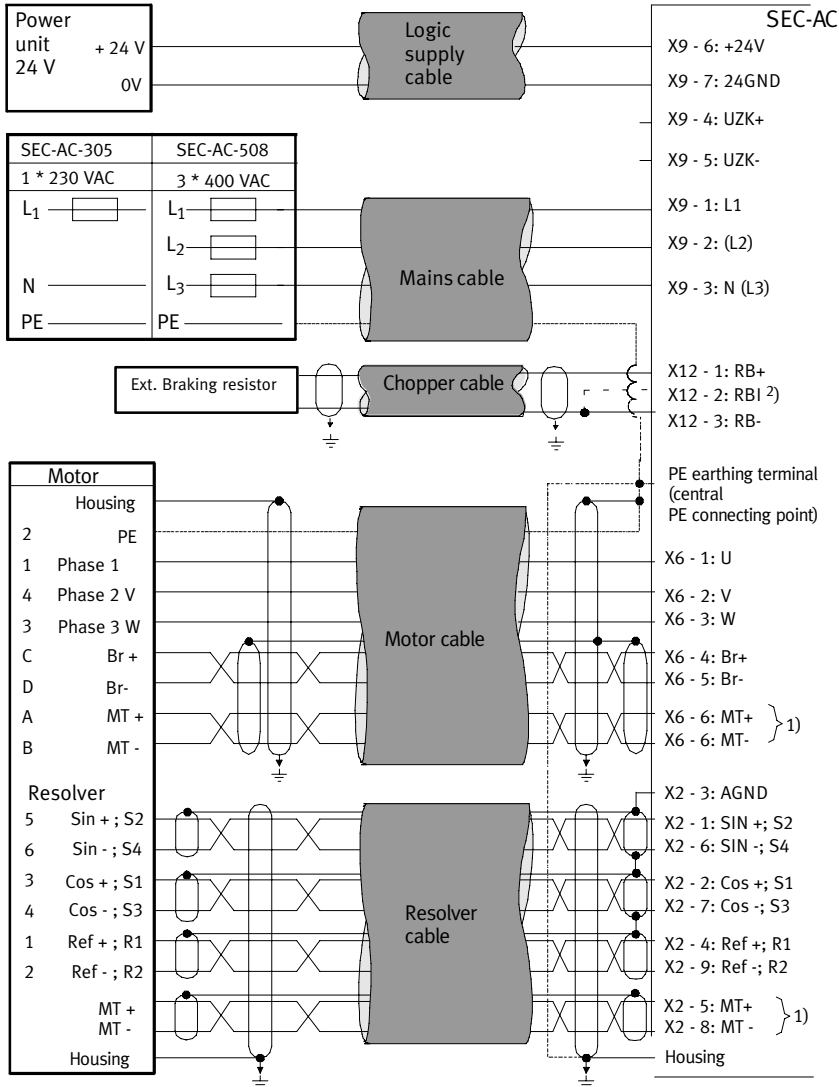


Fig. 3/13: Connecting to the power supply and the motor

3. Installation



- 1) Motor temperature monitoring either via motor or resolver plug. Please note the instructions of the motor manufacturer.
- 2) Bridge for internal braking resistor: See next page

Fig. 3/14: Logical circuitry

3. Installation



Caution

Activate brake resistor (X12)

If no external brake resistor is used, a bridge must be connected between PIN2 and PIN3 of the X12, in order to activate the internal brake resistor!



Caution

The SEC-AC-508 does not have internal fuses for the 400V_{AC}- or 560V_{DC}-inputs. An automatic circuit breaker is therefore provided. If the SEC-AC-508 is operated with only one or two current phases, high PE-leakage currents may occur. Only one automatic circuit breaker, in which all three phases are switched off together, may therefore be used.



Caution

The SEC-AC must first be connected to X1, X10...X12. The operating voltages for the intermediate circuit and the electronic DC voltage supply must not be switched on until commissioning is started. If the operating voltage connections are connected with incorrect polarity, or if there is excessive operating voltage, or if the connections for the operating voltage and the motor are swapped, the device will be damaged. The SEC-AC must be connected to operating earth via the **PE** connection.

A 24 V power supply is required for operating the electronic components of the SEC-AC. This voltage supply must be connected to terminals 24V+ and 24V-. The power supply for the final output stage must then be connected (either AC or DC is possible at the appropriate input). The two power supplies may be switched on simultaneously.

3.6 PE protective conductor and screening connections

3.6.1 Connecting instructions

The screening of the motor cable is wired together with the PE inner conductor of the motor cable to the central PE connecting point on the SEC-AC.

The PE connection to the network as well as the screening for the resolver cable and, if applicable, the encoder cable, is also wired to this star point. This star point must be connected to the central earthing point of the complete control cabinet by means of a cable (copper band) with a large cross-sectional area (short cable to the assembly plate). The Festo motor cable already contains this connecting band in the end piece.

Special EMC protective measures must be observed in the case of longer lengths.



Warning

For safety reasons, all PE protective conductors must be connected before commissioning.

The PE connection to the network is wired to the central PE connecting point on the SEC-AC.

Make sure that the earth connections between the devices and the mounting plate are of sufficient dimensions to enable HF interference to be discharged.

3. Installation

3.6.2 Electrical isolation

In designing the SEC-AC, we have placed great importance on providing a high degree of immunity to interference. For this reason, individual function blocks have been designed as electrically isolated units. Signal transmission within the SEC-AC is made via an optocoupler.

A distinction is made between the following isolated areas:

- the final output stage with intermediate circuit and network input
- the control electronics with analogue signal processing
- the 24V supply and digital inputs and outputs

3.7 Measures for observing EMC guidelines

If correctly fitted and if all connections are correctly wired with Festo cables, the regulators in the SEC-AC product family will comply with the product standard for adjustable speed power drive systems for use in “second environments” (environment, which does not contain residential buildings) EN 61800-3 in the today valid version.

The interference emission and immunity to interference of a device always depend on the complete drive concept, which consists of the following components:

- the power supply
- the SEC-AC controller
- the motor
- the electromechanical parts
- the design and type of wiring
- the higher-order controller



Caution

In a domestic environment this product may cause radio interference in which case supplementary mitigation measures may be required.

In order to increase immunity to interference and to reduce interference emission, motor restrictors and network filters have already been fitted into the SEC-AC, so that the regulator as such fulfils the EMC requirements without additional screening and filter measures, providing a suitable motor cable is used (see chapter 3.1). This cable must not be longer than 25 m.

3. Installation

SEC-AC-305

If longer cables are used (> 25 m in industrial area, > 15 m in residential area), we recommend that additional external network filters be switched in near to the device power supply (e.g. from Schaffner).

SEC-AC-508

If longer cables are used (> 25 m in industrial area), we recommend that additional external network filters be switched in near to the device power supply (e.g. from Schaffner).



Caution

If you touch D-SUB plug connectors which are not assigned, there is a danger of ESD (electrostatic discharge), which can damage the SEC-AC or other parts of the system. In order to avoid such discharges, you should use protective caps which are obtainable from trade dealers.

3. Installation

Diagnosis and error treatment

Chapter 4

4. Diagnosis and error treatment

Contents

4.1	Status display	4-3
4.2	Error messages of the SEC-AC	4-4

4. Diagnosis and error treatment

4.1 Status display

The following states are shown by means of status messages.



Status	Description
	Controller enabled
	Revolving outer segments – Display of relative direction of rotation of motor and of relative motor speed

Fig. 4/1: Status list

4.2 Error messages of the SEC-AC



Caution

- Switch off the power supply before starting error treatment.

The SEC-AC has a error memory in order to save and display short fault signals, e. g. overcurrent. Errors cannot be reset automatically by the SEC-AC, but must be quitted by means of the Reset button above the 7-segment display or the falling edge at Din5 by the operator.

All errors which occur are shown on the 7-segment display. The flashing two-figure error codes clearly indicate the type of error. If there are several errors at the same time, the error with the lowest code will be displayed. The following table lists the error messages which can be displayed on the SEC-AC.

Fault code displayed	Meaning/function	Measures for rectifying fault
0-1	Stack overflow	<ul style="list-style-type: none">• Incorrect firmware?• Load firmware again.• Contact the Festo Service.
0-2	Undervoltage in intermediate circuit	<ul style="list-style-type: none">• Check voltage sources and their connecting cables:<ul style="list-style-type: none">- Do they comply with the specifications?- Is the pin assignment of the connecting cables correct?
0-3	Overtemperature of motor	<ul style="list-style-type: none">• Check motor temperature: If the motor is hot:• Set rated and maximum currents correctly• Check plug connector X6 and connecting cable from SEC-AC and motor• Make sure that the cable is not fractured. Is a motor connected?
0-4	Overtemperature of power output stage	<ul style="list-style-type: none">• Check the fitting dimensions of the SEC-AC: If necessary use a fan

4. Diagnosis and error treatment

Fault code displayed	Meaning/function	Measures for rectifying fault
0-5	Failure in the electronic operating voltage supply	You cannot rectify this fault. Please contact the Festo Service.
0-6	Overcurrent or short circuit in the end stage/motor	<ul style="list-style-type: none"> • Check motor temperature If the motor is hot: <ul style="list-style-type: none"> • check the setting of the current regulator • check the connecting cable to the motor Is there an earth connection or short circuit?
0-7	Overvoltage in intermediate circuit	<ul style="list-style-type: none"> • Check voltage sources and their connecting cables: <ul style="list-style-type: none"> - Do they comply with the specifications? - Is the pin assignment of the connecting cables correct? • Fault occurs when motor is braked: The internal braking resistor is overloaded. Adapt the movement cycle; if necessary an external braking resistor must be used.
0-8	Angle transducer fault	<ul style="list-style-type: none"> • Check plug connector X2 and the angle transducer cable on the SEC-AC and the motor.
1-0	Actual speed is greater than the maximum speed	The overrun protection has responded. Please check the parametrizing.
1-1	Fault in the reference run	Fault in parametrizing or incorrect control.
1-2	Bus fault	<ul style="list-style-type: none"> • The bus system used is not active or there is no bus master. • The bus master was activated too late. • Baud rates or cables defective.
1-4	Automatic identification has failed.	<ul style="list-style-type: none"> • The transducer system does not work faultlessly. • The motor shaft cannot be turned freely. • The motor currents have been parametrized too small. • The motor is blocked mechanically.
1-5	Division by zero	<ul style="list-style-type: none"> • A fault has been ascertained in the parameter set. Load the parameter set again or create a new parameter set. • Fault in the firmware. Load the firmware again. • Possible fault parametrizing of the gear factors.
1-6	Program faulty.	Please contact the Festo Service.

4. Diagnosis and error treatment

Fault code displayed	Meaning/function	Measures for rectifying fault
1-7	Drag error	<ul style="list-style-type: none"> • The positioning deviation is too high. • The load of the drive is too large. • Check the parametrizing.
1-8	Fault in position pre-calculation	Check the parametrizing of the position sets.
2-0	Fault in the incremental transducer input	<ul style="list-style-type: none"> • Check the number of increments per revolution. • Check the transducer circuitry.
2-1	Fault in current measurement	The fault cannot be rectified automatically. Please contact the Festo Service.
2-3	Field bus node exists double.	Please check the field bus configuration.
2-4	The field bus node-guarding has responded	<ul style="list-style-type: none"> • Check the node-guarding. • Check the field bus circuitry.
2-5	Invalid device type	The fault cannot be rectified automatically. Please contact the Festo Service.
2-6	Flash memory Missing user parameter set	<ul style="list-style-type: none"> • Load the default parameter set. If the fault still exists contact the Festo Service.
2-7	Flash memory Checksum fault	The flash memory does not work correctly. <ul style="list-style-type: none"> • Load the firmware and the parameters again. If the fault still exists contact the Festo Service.
2-8	Flash memory Write fault	The flash memory does not work correctly. <ul style="list-style-type: none"> • Load the firmware and the parameters again. If the fault still exists contact the Festo Service.
3-0	Fault in the conversion factors	Modify the parametrizing of the gear factors.
3-1	I2t motor	The motor is blocked mechanically or the friction is too high.
	I2t controller	Check the output characteristics of the drive package.

4. Diagnosis and error treatment



Please note

If error 0-3 occurs, it may be that the motor does not possess a temperature sensor. In this case the relevant input on plug connector X6 must be short-circuited.

RES button

Each error message will be deleted when the cause of the error is rectified and when the error is then quitted. An error is quitted when the RES button is pressed or when there is a falling edge at Din5.



Please note

Please note that all the parameter modifications, which you have carried out, will be lost when you press the RES button, if they have not been saved in the FLASH memory.

When an error has been rectified and quitted, the next error code will be displayed.

4. Diagnosis and error treatment

Technical appendix

Appendix A

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A.1 Technical specifications

A.1.1 SEC-AC-305

SEC-AC-305	
Power supply – V_{rated} [-30 % .. +10%] – V_{CC} [-20 % .. +20 %] – current consumption 24 V	– 230 V _{AC} , 50/60 Hz or 310 V _{DC} with U _{ZK} supply – 24 V _{DC} ± 20 % (Power supply of the electronics) *) **) – approx. 0.35 A ***)
Rated output – with DC supply – with AC supply	1500 VA 1000 VA
Peak power max. 2 s	3000 VA
Intermediate circuit voltage	max. 340 V DC, 5 A
Rated current per phase	5 A _{eff}
Peak current per phase max. 3 s	10 A _{eff}
Internal braking resistor – pulse output – continuous output – response threshold – load tolerance	100 Ω 1,3 kVA 25 W 375 V 0.5 : 25 s
External braking resistor – continuous output – operating voltage	≥ 50 Ω ≤ 1 kW ≥ 400 V
Ambient temperature	0 °C bis 50 °C: ****) at rated output 1 kW; motor current 5 A _{eff} under following conditions: output reduction 30 W/°C as from 35 °C
Storage temperature	-25 °C bis 60 °C
Humidity	0...90 %, non condensing
<p>*) Note the voltage tolerance of a locking brake if one exists. Additional voltage drop in the SEC-AC: approx. 2 V</p> <p>**) Make sure the residual ripple is low (< 100 mV_{pp}). High residual ripple reduces the service life.</p> <p>***) Additional current consumption of a locking brake if one exists.</p> <p>****) Moisture condensation during operation is not permitted.</p>	

A. Technical appendix

SEC-AC-305	
Outer dimensions	H • W • D: approx. 200 mm • 70 mm • 210 mm (without plugs)
Housing, protection class	IP 20
Weight	Approx. 2.5 kg
Connecting cable to motor	max. 50m, screened cable $C < 200 \text{ pF/m}$ Depending on the system additional external mains filters may be necessary in the power supply cables in order to comply with the EMC guidelines. By experience this applies to motor cable lengths $> 25 \text{ m}$.
Voltage endurance for cable	min. 1500 V
Nominal value inputs for speed and current – Ain0, Ain0/ – Ain1, Ain1/	$\pm 10 \text{ V}$, $R_i = 20 \text{ k}\Omega$, offset adjust $\pm 0.1 \text{ V}$ $\pm 10 \text{ V}$, $R_i = 20 \text{ k}\Omega$, offset adjust $\pm 0.1 \text{ V}$
Monitor settings – output level – representable variables	2 analogue outputs with 8-bit resolution at X1 $\pm 10 \text{ V}$ voltage output, short-circuit resistant freely standardized, e.g. nominal and actual current values, rotary angle electric or mechanical, nominal and actual speed value
General logic inputs – Din0 – Din1 – Din2 – Din3 – Din4 – Din5 – Din6 – Din7 – Din8 – Din9 – Reset (electrically)	isolated, 12...30 V, active high – Bit 0 \\ – Bit 1, \ target selection for positioning – Bit 2, / 16 destinations can be selected from – Bit 3 / destinations window – Control input for final output stage enable at high – Regulator enable at high, quit at low – Limit switch input 1 – Limit switch input 2 – Control signal start positioning – Input for additional reference switch – Reset button on the front

A. Technical appendix

SEC-AC-305	
General logic outputs <ul style="list-style-type: none"> – Dout0: ready-to-operate – Dout1: freely configurable – Dout2: freely configurable – Dout3: freely configurable – Dout4: holding brake 	Electrically isolated <ul style="list-style-type: none"> – 24 V, 100 mA via external 24 V supply *) – 24 V, 100 mA via external 24 V supply *) – 24 V, 100 mA via external 24 V supply *) – 24 V, 100 mA via external 24 V supply *) – 24 V, 500 mA via external 24 V supply **)
Monitor settings <ul style="list-style-type: none"> – Overvoltage in intermediate circuit – Undervoltage in intermediate circuit – Overcurrent in intermediate circuit – Supply voltage – Thermo-protection of motor – Thermo-protection of final output stage – Fault in rotary angle sensor 	<ul style="list-style-type: none"> – Approx. 400 V – programmable, can be switched off – short-circuit monitoring – all controller-internal voltages – normally-closed contact – 100 °C heat sink temperature – common error
Displays on device <ul style="list-style-type: none"> – ready-to-operate display – error and status messages 	<ul style="list-style-type: none"> – LED – Seven-segment display
Terminal interface <ul style="list-style-type: none"> – level – plug connector 	Serial <ul style="list-style-type: none"> – RS 232, 9600...57600 bit/s, – 9-pin. D-Sub
EMC conformity	EN 61800-3; Electromagnetic compatibility - product standard for adjustable speed power drive systems for use in “second environments” (environment, which does not contain residential buildings). ***)
*) Outputs not protected against overload or short circuits, not suitable for providing external devices. **) Observe voltage tolerance of a holding brake, if used. Additional voltage drop in SEC-AC: approx. 1.5 V ***) External filters are not necessary.	

A. Technical appendix

A.1.2 SEC-AC-508

SEC-AC-508	
Supply voltage – V_{rated} [-15 % .. +20 %] – V_{CC} [-20 % .. +20 %] – current consumption 24V	– 3 • 400 V _{AC} , 50/60 Hz or 560 V _{DC} at UZK-supply – 24 V DC ± 20% (Power supply of the electronics) *) **) **) – approx. 0.45A ****)
Rated output – with DC supply – with AC supply	4000 VA 4000 VA ****)
Peak power (5kHz/) max. 2 s	9000 VA
Intermediate circuit voltage	Max. 680 V DC
Rated current per phase	8 A _{eff}
Peak current per phase (5kHz intermediate pulse frequency) max. 2 s	16 A _{eff}
Internal braking resistor – pulse output – continuous output – response threshold – ratio of switch-on time to switch-off time (approx.)	150 Ω 3,2 kW 20 W 750 V 0.2 s : 35 s
External braking resistor – continuous output – operating voltage	≥ 60 Ω ≤ 3 kW 750 V
Ambient temperature	0°C bis 50°C: *****) at rated output 4kW; motor current 8A _{eff} under following conditions: output reduction 100W/°C as from 40°C
Storage temperature	-25 °C bis 60 °C
Humidity	0..90 %, non condensing
*) Note the voltage tolerance of a locking brake if one exists. Additional voltage drop in the SEC-AC: approx. 2 V **) Make sure the residual ripple is low (< 100 mV _{pp}). High residual ripple reduces the service life. ***) Additional current consumption of a locking brake if one exists. ****) Forced ventilation required. *****) Moisture condensation during operation is not permitted.	

A. Technical appendix

SEC-AC-508	
Outer dimensions	H • W • D: approx. 223 mm • 70 mm • 210 mm (without plugs)
Housing, protection class	IP 20
Weight	Approx. 2.6 kg
Connecting cable to motor	max. 50m, screened cable C < 200 pF/m. Depending on the system additional external mains filters may be necessary in the power supply cables in order to comply with the EMC guidelines. By experience this applies to motor cable lengths > 25 m.
Voltage endurance for cable	min. 1500 V
Nominal value inputs for speed and current – Ain0, Ain0/ – Ain1, Ain1/	± 10 V, $R_i = 20$ k Ω , offset adjust $\pm 0,1$ V ± 10 V, $R_i = 20$ k Ω , offset adjust $\pm 0,1$ V
Monitor settings – output level – representable variables	2 analogue outputs with 8-bit resolution at X1 ± 10 V voltage output, short-circuit resistant freely standardized, e.g. nominal and actual current values, rotary angle electric or mechanical, nominal and actual speed values
General logic inputs – Din0 – Din1 – Din2 – Din3 – Din4 – Din5 – Din6 – Din7 – Din8 – Din9 – Reset	Isolated, 12..30 V, active high – Bit 0 \\ – Bit 1, \ target selection for positioning – Bit 2, / 16 destinations can be selected from – Bit 3 / destinations window – Control input for final output stage enable at high – Regulator enable at high, quit at low – Limit switch input 1 – Limit switch input 2 – Control signal start positioning – Input for additional reference switch – Reset button on the front

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SEC-AC-508	
General logic outputs <ul style="list-style-type: none"> - Dout0: ready-to-operate - Dout1: freely configurable - Dout2: freely configurable - Dout3: freely configurable - Dout4: holding brake 	Electrically isolated <ul style="list-style-type: none"> - 24 V, 100 mA via external 24 V supply *) - 24 V, 100 mA via external 24 V supply *) - 24 V, 100 mA via external 24 V supply *) - 24 V, 100 mA via external 24 V supply *) - 24 V, 500 mA via external 24 V supply **)
Monitor settings <ul style="list-style-type: none"> - Overvoltage in intermediate circuit - Undervoltage in intermediate circuit - Overcurrent in intermediate circuit - Supply voltage - Thermo-protection of motor - Thermo-protection of final output stage - Fault in rotary angle sensor 	Approx. 800 V programmable (phase failure recognition) short-circuit monitoring all controller-internal voltages normally-closed contact 80 °C heat sink temperature common error
Displays on device <ul style="list-style-type: none"> - ready-to-operate display - error and status messages 	LED Seven-segment display
Terminal interface <ul style="list-style-type: none"> - level, baud rate - plug connector 	Serial RS 232, 9600...57600 bit/s, 9-pin. D-Sub
EMC conformity	EN 61800-3; Electromagnetic compatibility - product standard for adjustable speed power drive systems for use in "second environments" (environment, which does not contain residential buildings). ***)
*) Outputs not protected against overload, not resistant to short circuits, not suitable for supplying external devices. **) Observe voltage tolerance of a holding brake, if used. Additional voltage drop in SEC-AC: approx. 1.5 V ***) External filters are not necessary.	

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