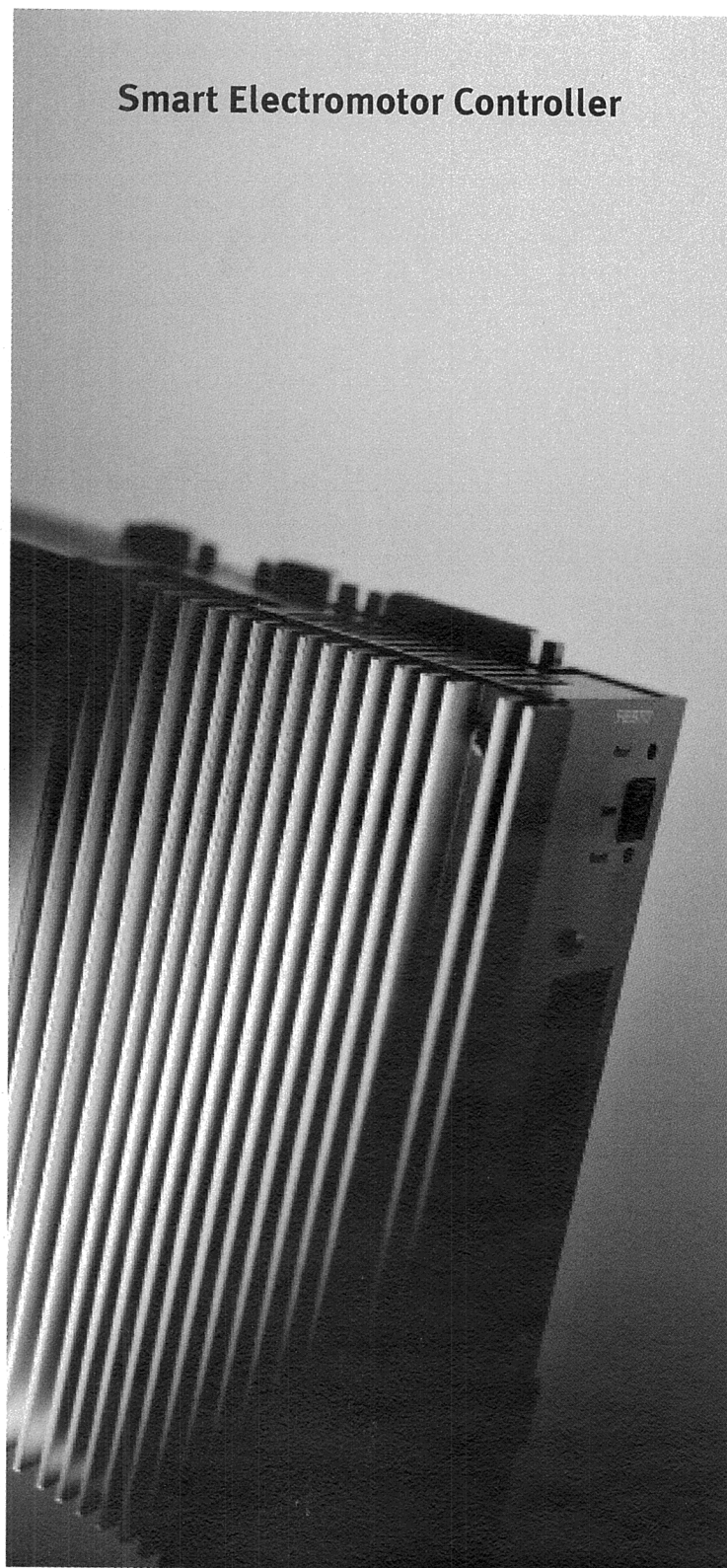


Smart Electromotor Controller

FESTO

Description

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



Description

192 346

en 0007NH

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.

Contents and general instructions

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.

Contents and general instructions

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.

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.

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

Contents and general instructions

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.

Contents and general instructions

Summary of components

Chapter 1

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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 and the connection for an external braking resistor on the SEC-AC-508, 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. A CANopen field bus module as well as a Profibus module are available on request.
- 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. Only SEC-AC-508: External resistors with up to several kW continuous output can be connected for considerable braking energy.
- Only SEC-AC-305:
For increasing the braking output, an additional external chopper with an additional braking resistor can be used.

1. Summary of components

- New 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 or CAN bus (on request).
- 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.

SEC-AC-508

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.

SEC-AC-305

If in a special, seldom used application case, the output of the internal resistors is not sufficient, an additional external braking chopper with additional braking resistor must be connected to the intermediate circuit.

Further information can be obtained from Festo.

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
only SEC-AC-508: 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.

A high-speed sample input can be used for synchronizing tasks (master-slave mode).

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 CAN-OPEN specifications with the CIA-DS 402 positioning profile.

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

1. Summary of components

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

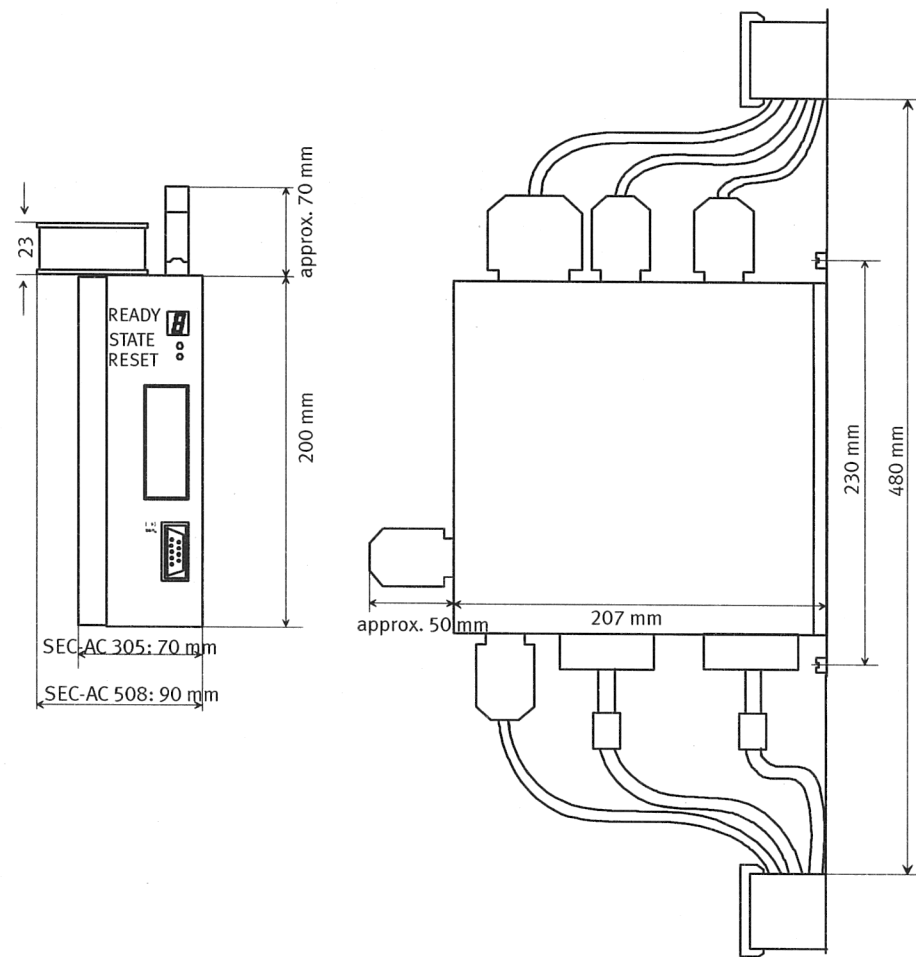


Fig. 2/1: Dimensions of the SEC-AC

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)

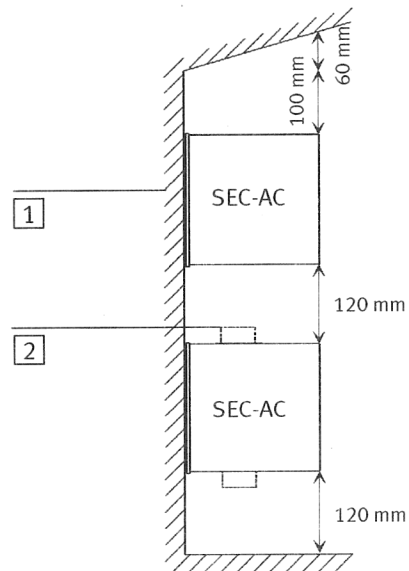


Fig. 2/2: Minimum distances for control cabinet or wall fitting

2. Fitting

2.2 Electromechanics

2.2.1 Front view

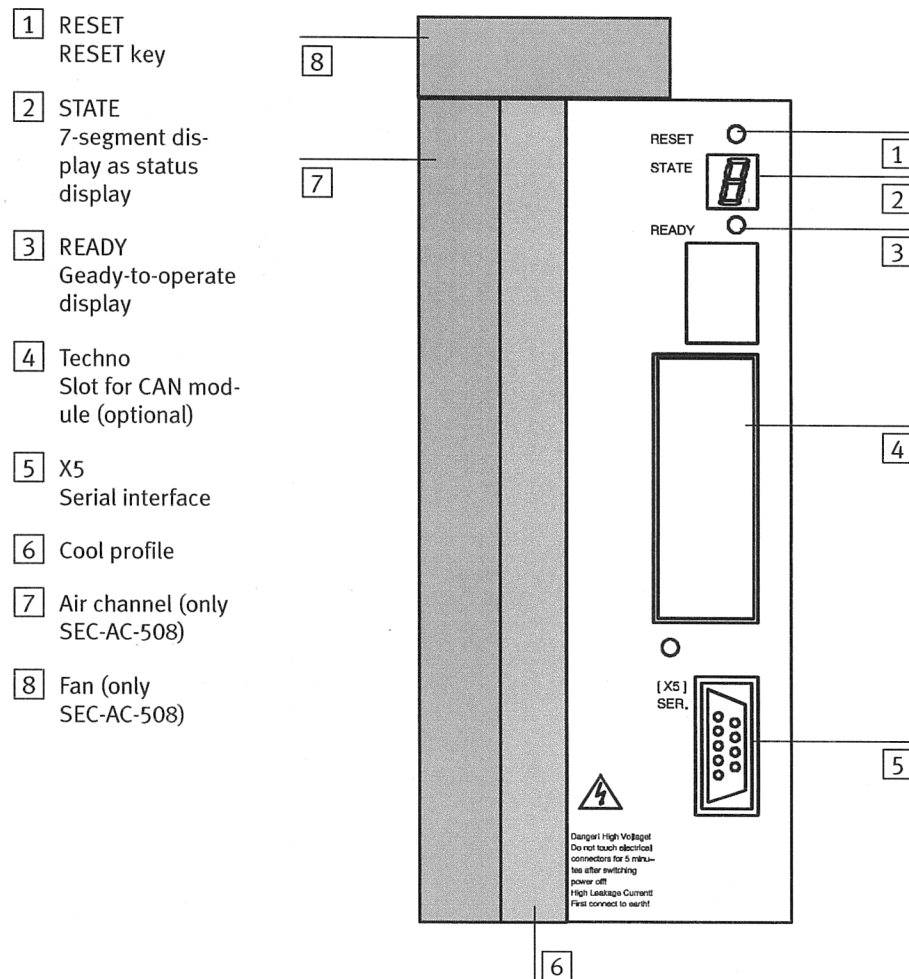


Fig. 2/3: Front view of SEC-AC

2. Fitting

2.2.2 Top view

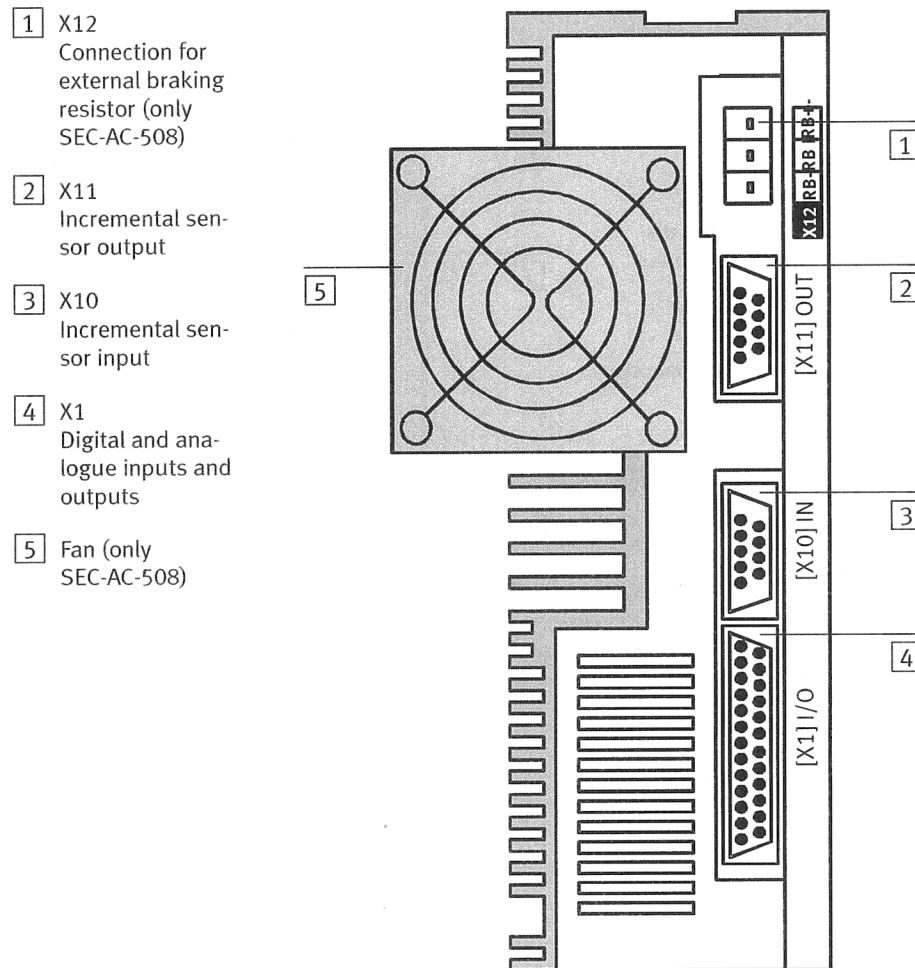


Fig. 2/4: Top view of SEC-AC

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)

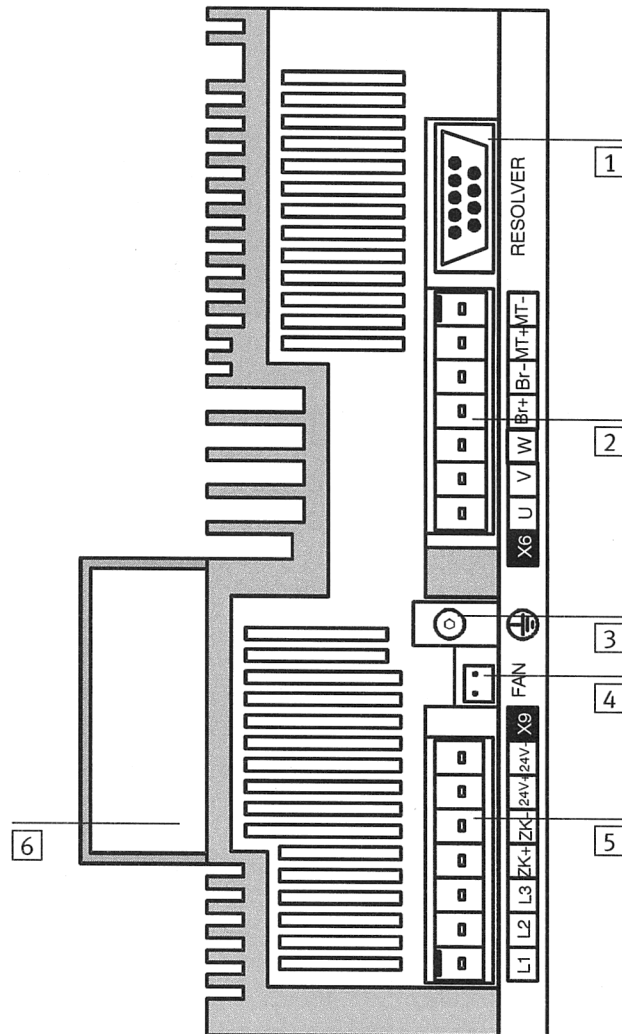


Fig. 2/5: Bottom view of SEC-AC

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

Chapter 3

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3. Installation

3.1 Material

3.1.1 Manufacturer

**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 BSM 50/63/80, consisting of: motor cable KMTR-M-BSM-50/63/80-7 resolver cable KRES-M-BSM-7	KATP-M-BSM-50/63/80-7	00192333
Cable set BSM 90, consisting of: motor cable KMTR-M-BSM-90-7 resolver cable KRES-M-BSM-7	KATP-M-BSM-90-7	00192334
Motor cable (X6)		
Motor cable BSM 50/63/80 length 7 m	KMTR-M-BSM-50/63/80-7	00192335
Motor cable BSM 90 length 7 m	KMTR-M-BSM-90-7	00192336
Motor cable BSM 50/63/80 length x	KMTR-M-BSM-50/63/80-X	00192337
Motor cable BSM 90 length x	KMTR-M-BSM-90-X	00192338
Resolver cable (X2)		
Resolver cable 7 m	KRES-M-BSM-7	00192339
Resolver cable length x	KRES-M-BSM-X	00192340
Encoder cable (X11)		
Encoder cable 2.5 m	KENC-M-BSM-2,5	00192341
Encoder cable length x	KENC-M-BSM-X	00192342
Signal cable		
Null modem cable (cable/PC)	PS1ZK11	160786
Control cable (X10)	KES-SEC-AC-2,5	On request

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. Installation

3.1.2 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.

3.1.3 Plug for external braking resistor (only SEC-AC-508) (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.

3.1.4 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.

3.1.5 PE connection of the SEC-AC



Please use Festo cables.

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

3.1.6 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. Installation

3.2 Plug connectors and their pin assignments

3.2.1 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

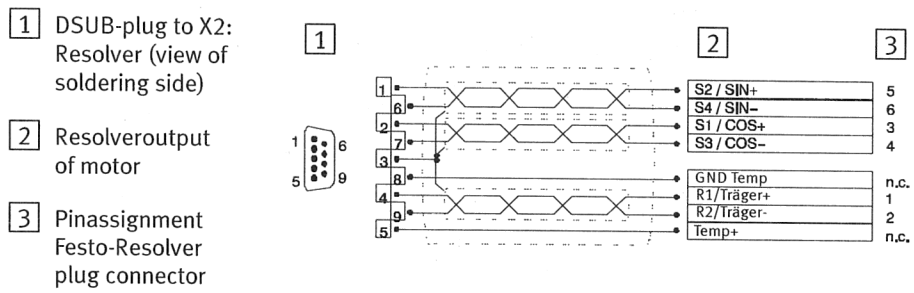


Fig. 3/6: Assignment of plug connector X2 (resolver/encoder input)

3. Installation

3.2.2 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)

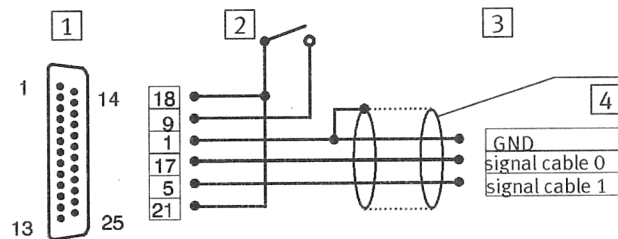
This circuit for plug connector X1 will suffice for the first commissioning. Further details see table.

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 BNC-plug of oscilloscope
- 4 Screening



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

3. Installation

Pin no.	Symbol	Value	Specification
3	Ain1	$\pm 10V \pm 5\%$ $R_i = 20K\Omega \pm 1\%$	Analogue nominal value input (A/B signals) channel 1 Differential max. 25 V input voltage
16	Ain1/		Reference connection, analogue connection channel 1
4	+VREF	$+10V \pm 5\%$	Reference voltage output (for optional nominal value potentiometer)
17	AMONO	$\pm 10V \pm 5\%$	Analogue monitor output 0
5	AMON1	$\pm 10V \pm 5\%$	Analogue monitor output 1
18	+24VDC	$\pm 24VDC \pm 20\%$	24 V DC digital voltage supply output (supply via power unit plug X9)
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
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
14	Dout3	PRG-3	Freely programmable output

Fig. 3/7: Assignment of plug connector X1 (inputs and outputs)

3. Installation

3.2.3 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	5V $R_i \approx 120 \Omega$	Input signal tracer A
6	A/	5V $R_i \approx 120 \Omega$	Input signal tracer A inverted
2	B	5V $R_i \approx 120 \Omega$	Input signal tracer B
7	B/	5V $R_i \approx 120 \Omega$	Input signal tracer B inverted
3	C	5V $R_i \approx 120 \Omega$	Input signal tracer C (zero pulse)
8	C/	5V $R_i \approx 120 \Omega$	Input signal tracer C inverted
4	Schirm	0V	Screening/shield connection
9	GND	0V	Digital earth/ground ^{*)}
5	+5VDC	+5VDC	Auxiliary voltage for external sensor + 5 V DC max. 100 mA ^{*)}
*) Not assigned with Festo cables			

Fig. 3/8: Assignment of plug connector X10 (additional incremental sensor input for special functions)

3. Installation

3.2.4 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	5V $R_a \approx 60 \Omega$	Output signal tracer A
6	A/	5V $R_a \approx 60 \Omega$	Output signal tracer A inverted
2	B	5V $R_a \approx 60 \Omega$	Output signal tracer B
7	B/	5V $R_a \approx 60 \Omega$	Output signal tracer B inverted
3	C	5V $R_a \approx 60 \Omega$	Output signal tracer C (zero pulse)
8	C/	5V $R_a \approx 60 \Omega$	Output signal tracer C inverted
4	Schirm	0V	Screening/shield connection ^{*)}
9	GND	0V	Digital earth/ground ^{*)}
5	+5VDC	+5VDC	Auxiliary voltage for external sensor + 5 V DC max. 100mA ^{*)}
^{*)} Not included in Festo cables 192341 or 132342.			

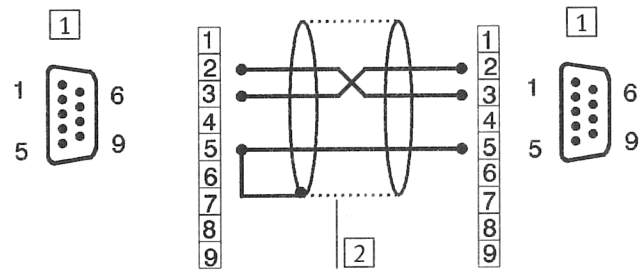
Fig. 3/9: Assignment of plug connector X11 (additional incremental sensor output for special functions and when a separate external position transducer is used)

3. Installation

3.2.5 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		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. 3/10: Assignment of plug connector X5 (serial interface)

3. Installation

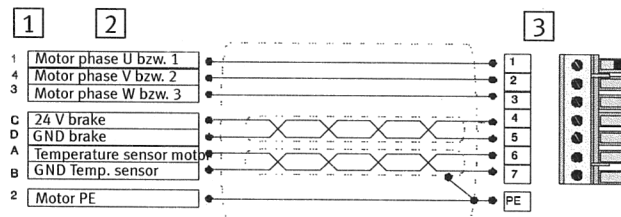
3.2.6 X6 (motor supply, power supply, parking brake and temperature sensor)

- 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-COMBI-CON 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. 3/11: 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 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

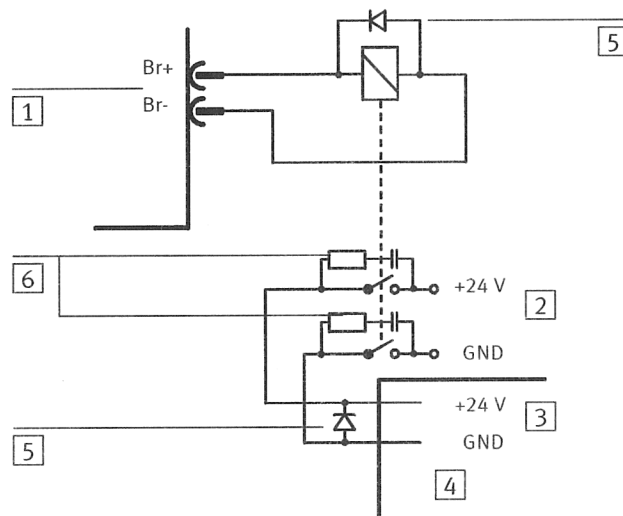


Fig. 3/12: Connecting a parking brake to the SEC-AC

3. Installation

3.2.7 Power supply cable for the SEC-AC

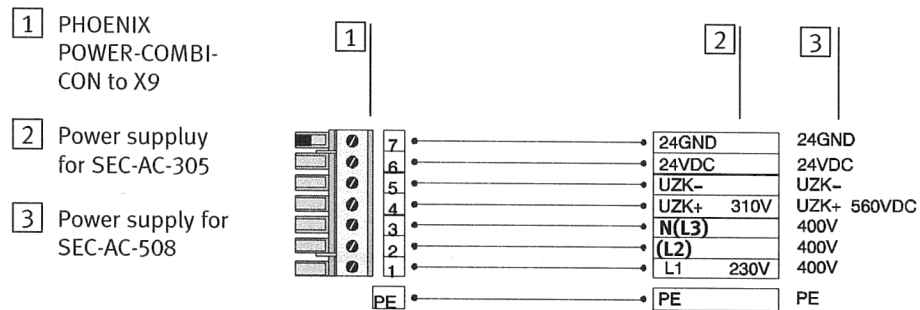


Fig. 3/13:

3.3 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 (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. Installation

3.3.1 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. 3/14: Assignment of plug connector X9 (power unit)

3.3.2 X12 (braking resistors only SEC-AC-508)

- 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. 3/15: Assignment of plug connector X12 (braking resistors)

3. Installation

**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.

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.

3. Installation

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.

**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.

3. Installation



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

3.3.3 Summary of connections

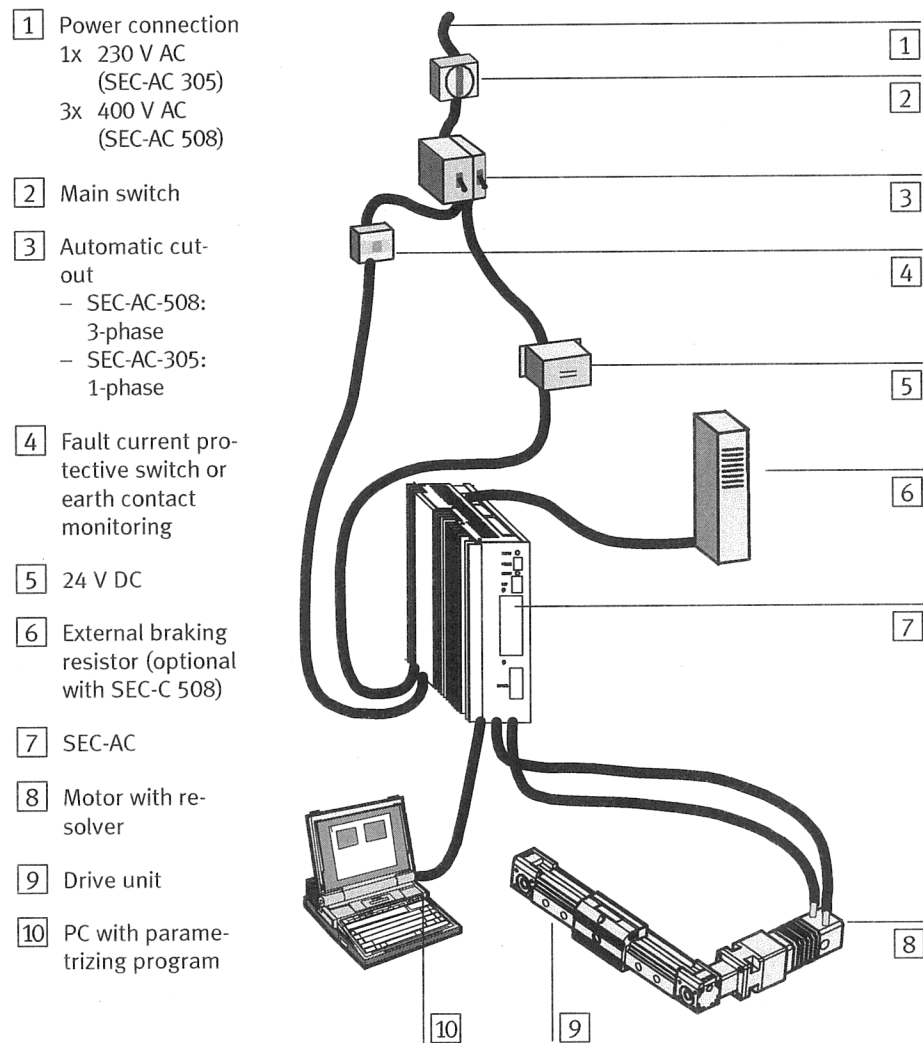


Fig. 3/16: Complete layout of the SEC-AC with motor and PC

3. Installation

3.3.4 SEC-AC complete system

The diagram in Fig. 3/16 on the previous page represents the complete SEC-AC system. The following components are required for operating the SEC-AC:

SEC-AC

- Mains power switch
- Automatic circuit breaker
- FI protective switch (depending on design guideline alternative Ground current registering)
- SEC-AC
- Motor with motor cable
- Network cable
- A PC with serial connecting cable will be required for parametrizing.

3.3.5 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

3.3.6 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.

3.3.7 Connecting the external braking resistor to the SEC-AC (if required, only with SEC-AC-508)

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

3.3.8 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.

3.3.9 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.

3.4 Complete summary of the SEC-AC system

3.4.1 Wiring the connections

The SEC-AC should be connected to the power supply and to the motor as shown in Fig. 3/17.

3. Installation

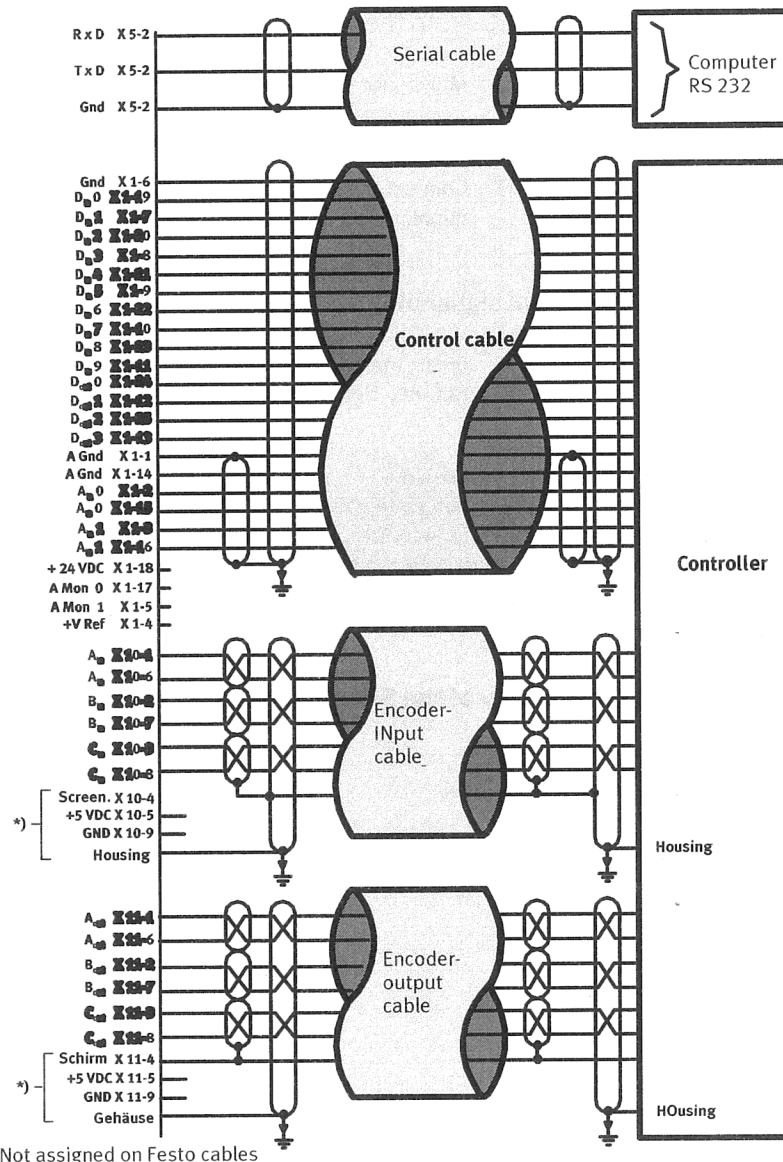
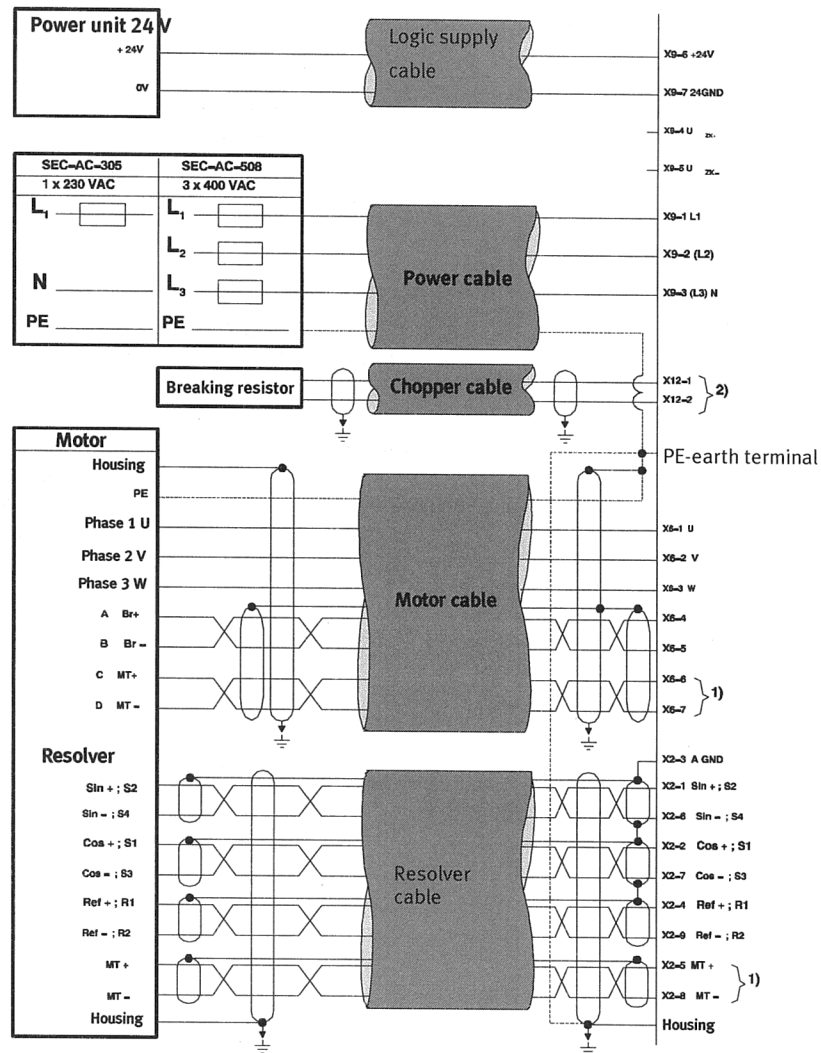


Fig. 3/17: Connecting to the power supply and the motor

3. Installation



1) Monitoring of motor temperature either by motor or resolver plug

2) Only with SEC-AC-508

Fig. 3/18: Logical circuitry

3. Installation



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. Installation

3.5 PE protective conductor and screening connections

3.5.1 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

3.5.2 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. Installation

3.6 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 regulations of the relevant technical standards EN 50081 (interference emission) and EN 50082 (immunity to interference).

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

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 10 m.

If longer cables are used, 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

4.	Diagnosis and error treatment	4-1
4.1	Status display	4-3
4.2	Error messages of the SEC-AC	4-4

4. Diagnosis and error treatment

4.1



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

Fig. 4/1: Status list

4. Diagnosis and error treatment

4.2 Error messages of the SEC-AC



Caution

- Switch off the power supply before starting error treatment.

The SEC-AC possesses an error memory for saving and displaying even short error signals, e.g. overcurrent. Errors cannot be reset automatically by the SEC-AC. They must be quitted by the user by means of the reset button above the 7-segment display.

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.

4. Diagnosis and error treatment

Error code	Meaning/function	Remedy
0-8	Rotary-angle sensor error	<ul style="list-style-type: none"> Check plug connector X2 and rotary- angle sensor cable on SEC-AC and motor
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 fulfil the specifications? - Is the pin assignment of the connecting cables correct? Fault occurs when motor is braked. The internal braking resistor is overloaded. Adapt positioning cycle, if necessary, use an external braking module (SEC-AC-305) or external braking resistor (SEC-AC-508).
0-6	Overcurrent or short circuit in final output stage/motor	<ul style="list-style-type: none"> Check motor temperature. If the motor is hot, Check the current regulator setting. Check the connecting cable to the motor. <p>Is there an earth connection or short circuit?</p>
0-5	Failure in power supply for electronic	You cannot rectify this fault. Please contact your Festo service.
0-4	Excessive temperature in final output stage	<ul style="list-style-type: none"> Check the fitting of the SEC-AC. If necessary use a fan.
0-3	Excessive temperature in motor	<ul style="list-style-type: none"> Check the motor temperature. If the motor is hot, set the rated and maximum currents correctly. Check plug connector X6 and the connecting cable from the SEC-AC and the motor. Make sure the cable is not broken. <p>Is a motor connected?</p>
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 fulfil the specifications? - Is the pin assignment of the connecting cables correct?

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 only be deleted when the cause of the error is rectified and when the error is subsequently quitted. In order to quit an error, press the RES button.

**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.

Technical Appendix

Appendix A

A. Technical Appendix

Contents

A.1	ANPASSEN! Technische Daten Feldbusknoten CP FB13-E	A-3
A.2	Stichwortverzeichnis	A-5

A. Technical Appendix

A.1 Technical specifications

A.1.1 SEC-AC-305

SEC-AC-305	
Power supply – V_{rated} [-30 % .. +15%] – V_{CC} [-20 % .. +20 %] current consumption 24 V	– 230 VAC or 310 VDC with UZK supply 24 V DC*) – approx. 0.35A **)
Rated output – with DC supply – with AC supply	1500 VA 1000 VA
Peak power max. 10 s	3000 VA
Network supply voltage	1 * 230 V AC -30 %...+10 %, 50/60 Hz
Intermediate circuit voltage	max. 340 V DC, 5 A
Rated current per phase	5 A _{eff}
Peak current per phase max. 10 s Δ 10 A _{eff}	10 A _{eff}
Braking chopper Internal resistor (external extension only via additional braking module) – pulse output – continuous output – response threshold – load tolerance	100 Ω 1,3 kVA 25 W 375 V 0.5 : 25 s
Ambient temperature	0 °C bis 50 °C ***); at rated output 1kW; motor current 5A _{eff} under follow- ing conditions: output reduction 30W/°C as from 35 °C
Storage temperature	-25 °C bis 60 °C ***)
*) Observe tolerance of a parking brake, if used. Additional voltage drop in SEC-AC: approx. 2V **) plus current consumption of a parking brake, if used ***) Moisture condensaton is not permitted during operation	

A. Technical Appendix

SEC-AC-305	
Humidity	0...90 %, non condensing
Outer dimensions	H • W • D: approx. 200 mm • 70 mm • 210 mm (without plugs)
Housing	IP 20
Weight	Approx. 2.5 kg
Connecting cable to motor	max. 50m, screened cable C' < 200 pF/m with lengths > 5 m additional EMC components necessary
Voltage endurance for cable	min. 1500 V
Nominal value inputs for speed and current – Ain0, Ain0/ – Ain1, Ain1/	±10 V, R _i = 20 kΩ, offset adjust ± 0.1 V ±10 V, R _i = 20 kΩ, offset adjust ± 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 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 – Control signal Sync for coupling in master-slave mode – 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
Interference emission	EN 50 081 part 2, basic standard industrial area ^{**)}
Immunity to interference	EN 50 082 part 2, basic standard industrial area ^{**)}
^{*)} Observe voltage tolerance of a parking 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} or 560 V _{DC} at UZK-supply 24 V DC *) – approx. 0.45A **)
Network supply voltage	3 • 400 V AC -20 %..+20 %, 50/60 Hz
Intermediate circuit voltage	Max. 680 V DC
Rated output – with DC supply – with AC supply	4000 VA 4000 VA ***)
Rated current per phase	8 A _{eff}
Peak power (5kHz/) max. 2 s	9000 VA
Peak current per phase (5kHz intermediate pulse frequency)	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 – pulse output – continuous output – operating voltage	minimum 60 Ω max. 7,5 kW max. 3 kW 750 V
Weight	Approx. 2.6 kg
Connecting cable to motor	max. 50m, screened cable (C' < 200 pF/m)
	With lengths > 10 m additional EMC components required
*) Observe voltage tolerance of a parking brake, if used. Additional voltage drop in SEC-AC: approx. 2 V. **) plus current consumption of a parking brake, if used. ***) forced ventilation required.	

A. Technical Appendix

SEC-AC-508	
Voltage endurance for cable	min. 1500 V
Ambient temperature	0°C bis 50°C*): at rated output 4kW; motor current 8Aeff under following conditions: output reduction 100W/°C as from 40°C
Storage temperature	-25 °C bis 60 °C *)
Humidity	0..90 %, non condensing
Outer dimensions	H • W • D: approx. 223 mm • 70 mm • 210 mm (without plugs)
Housing	IP 20
Nominal value inputs for speed and current – Ain0, Ain0/ – Ain1, Ain1/	± 10 V, R _i = 20 kΩ, offset adjust ± 0,1 V ± 10 V, R _i = 20 kΩ, offset adjust ± 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 – ResetΔElectrically	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 – Control signal Sync for "flying saw" – Reset button on the front
*) Moisture condensaton is not permitted during operation.	

A. Technical Appendix

SEC-AC-508	
General logic outputs – Dout0: ready-to-operate – Dout1: freely configurable – Dout2: freely configurable – Dout3: freely configurable – Dout4: holding brake	Electrically isolated – 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 – 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 – ready-to-operate display – error and status messages	LED Seven-segment display
Terminal interface – level, baud rate – plug connector	Serial RS 232, 9600...57600 bit/s, 9-pin. D-Sub
Interference emission	EN 50 081 part 2, basic standard industrial area ^{**)}
Immunity to interference	EN 50 082 part 2, basic standard industrial area ^{**)}
^{*)} Observe voltage tolerance of a parking brake, if used. Additional voltage drop in SEC-AC: approx. 1.5 V ^{**) External filters are not necessary.}	

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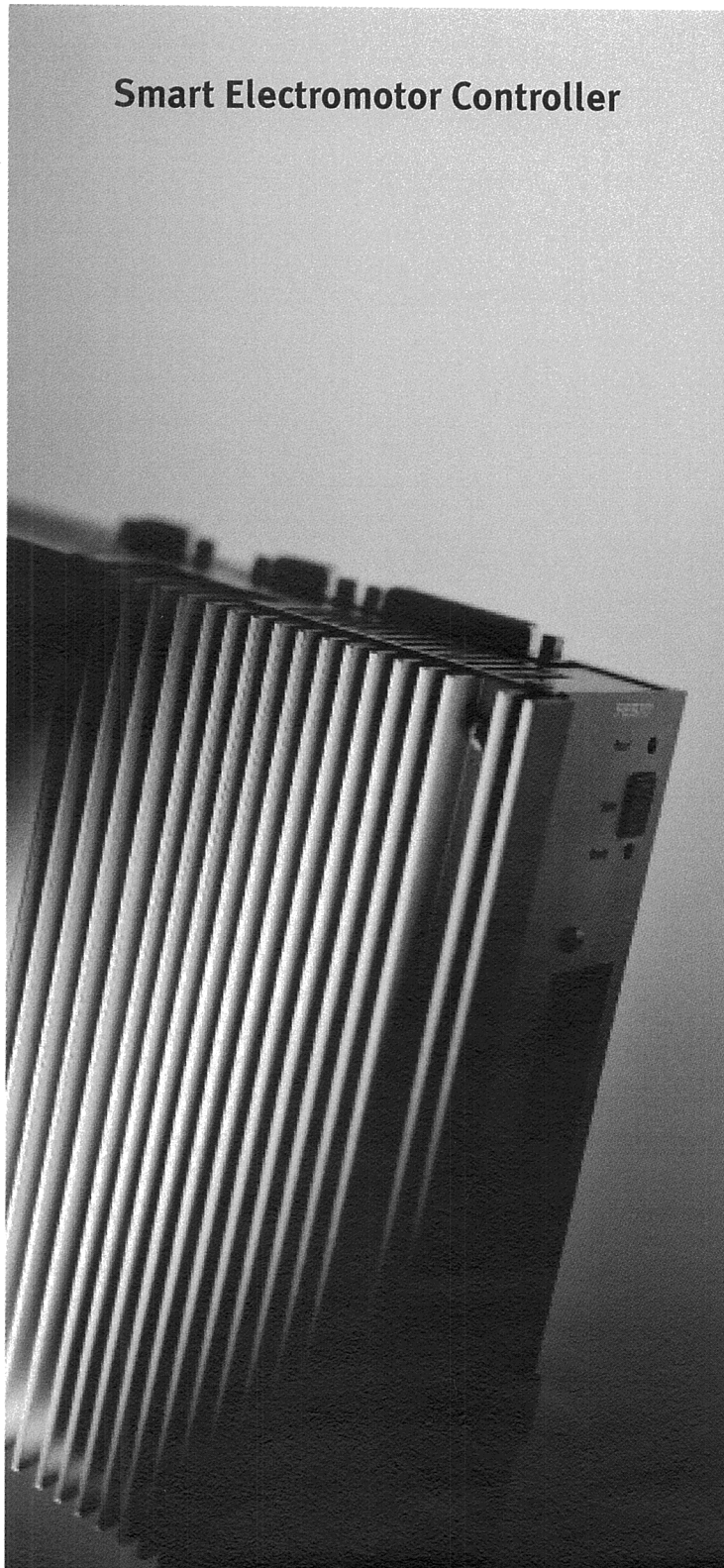
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Smart Electromotor Controller

FESTO

Description

Commissioning
Type SEC-AC-305
Type SEC-AC-508



Description

192 347

en 0007NH

Contents and general instructions

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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.

Contents and general instructions

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.

Contents and general instructions

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.

Contents and general instructions

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.

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

Contents and general instructions

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.

Contents and general instructions

Conventions

Various parts of the program are identified in this manual by the way in which they are written.

Menu entries	Menu entries are framed by square brackets, e.g. menu [File].
Names of windows	Names of windows, dialogue windows and buttons, e.g. "Cancel" as well as designations, e.g. "DGPL-PPV-A-KF-B" are represented in inverted commas.
Examples of programs	Examples of programs are represented in a different type, e.g. "N0010 G00 X250".
Keys	<p>The names of keys on the PC keyboard are represented in the text with upper-case letters, e.g. ENTER key, CTRL, C, F1, etc.</p> <p>Certain functions require two keys to be pressed simultaneously. Hold e.g. the CTRL key pressed down and press the C-key at the same time. This is shown in the text as CTRL+C.</p> <p>The left mouse button is always meant if the manual refers to "clicking" or "double-clicking". If the right-hand mouse button is to be used, this will be mentioned in the text.</p> <p>References to other chapter sections as well as "figurative terms" are in simple inverted commas.</p>

Before commissioning

Chapter 1

1. Before commissioning

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1. Before commissioning

1.1 Installation and fitting

Make sure that the drive is installed and fitted correctly.
Check that:

- the drive is mounted firmly on its base and is free of distortion;
- the working space in which the axis and the work load move is sufficient for operation with the work load;
- the work load does not collide with the motor or the axis gears when the slide moves into the end position.



Warning

Danger of electric shock!

- Make sure that the complete system is disconnected from the mains power supply before carrying out work on the power supply circuit or the system. Use the main switch to disconnect the system from the power supply.

Make sure that all the cables from the power supply to the drive are laid and connected correctly. Make sure also that:

- the cables for the power supply, for controlling the motor and for transmitting signals do not lie on top of each other, as reciprocal electromagnetic effects may impair the functioning;
- the motor cables are connected correctly to the relevant power electronics;
- that the actuators are disconnected for the first commissioning and that the motor is disconnected from the drive shaft.

1. Before commissioning

1.2 Check readiness to operate

1. Make sure that the Controller enable switch is switched off.
2. Switch on the AC/DC voltage supply for the device. The green LED on the front of the SEC-AC should now light up.



Caution

If the green LED does not light up, switch off the power supply immediately. There is a fault.

If the 7-segment display shows a number comprising two figures, it is an error message, the cause of which you must rectify. In this case, read further in the section "Diagnosis and error treatment." If no display lights up on the SEC-AC, you should carry out the following steps:

1. Switch off the power supply.
2. Wait for five minutes to enable the intermediate circuit to discharge.
3. Check all connecting cables.
4. Check that the 24 V power supply functions correctly.
5. Switch on the power supply again.

1. Before commissioning

If the cause of the fault can be rectified, the error must be quitted (menu [Error], [Delete]).

You can do this by pressing the Reset button or software-controlled via the parametrizing program.



Warning

If faults occur during commissioning, high acceleration forces may cause considerable damage. Commission the motor the first time, therefore, without a load connected, e.g. with free-running motor shaft, in order to keep the acceleration forces as low as possible.

1. Before commissioning

The parametrizing program

Chapter 2

2. The parametrizing program

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2. The parametrizing program

2.1 Scope of delivery

CD ROM with:

- programming software Wmemoc
- device files
- parametrizing files
- description of the SEC-AC in electronic form

2.2 What can the parametrizing program do?

With the parametrizing program you can adapt the SEC-AC to optimally suit your application.

The parametrizing program offers the following features:

- All parameters can be set via the PC
- It can be used with Windows
- Automatic recognition of the controller connected
- Parameter sets are recorded on an external data storage device
- New firmware versions can be loaded
- Menus and helps in either German or English
- Online helps
- Oscilloscope function
- The use (download) of pre-optimized parameters for complete Festo positioning axes.

2. The parametrizing program

2.3 Hardware and software requirements

The requirements for installing the parametrizing program are:

IBM-compatible PC-AT, as from 80486 processor with at least 16 MB main memory and at least 3 MB free hard disc memory

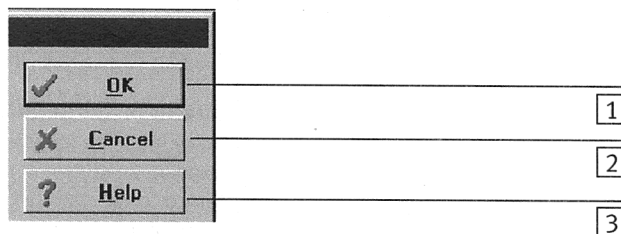
- Windows 95, 98 or NT
- CD ROM drive
- an unused serial interface

2. The parametrizing program

2.4 Using the parametrizing program

2.4.1 Standard available buttons

If you open a window while working with the parametrizing program, you will find the following buttons at the top right in this window:



- 1** OK All the modifications made will be accepted and transmitted to the SEC-AC. The window will be closed.
- 2** Abort All the modifications made will be cancelled, even values already transmitted will be restored. The window will be closed.
- 3** Help This opens a help menu which gives you explanations of the currently opened window.

Fig. 2/1

You can actuate one of these buttons by clicking it with the left-hand mouse key. If the buttons differ in some menus from that described here, please refer to your manual or online help for more detailed information.

2. The parametrizing program

2.4.2 Fields for numerical entries

In the windows of the parametrizing program you will always find fields for numerical entries as shown below.



Fig. 2/2

Entries can be made in the following ways:

1. Directly on the keyboard. Enter the value directly in the entry line. As long as the entry is not yet complete, the text will be shown in thin print and will not yet be transferred to the parametrizing program (see diagram below). To conclude the entry press the ENTER key or switch to another entry field. The numerical value will then be shown in heavy print.



Fig. 2/3

2. Clicking the arrow keys. The value changes in small steps (accurate adjustment).
3. Clicking the surfaces between the grey box and the arrow keys. The value changes in large steps (rough adjustment).
4. Clicking the grey box and moving the mouse with the left-hand key pressed down. The value can easily be preset in the complete value range.

2. The parametrizing program

2.4.3 Window positions

In the basic setting, the command window (top left), the status window (top centre) and the actual value window (top right) are always open. You can reduce these windows to icons (these windows cannot be closed) and open or close others, as in WINDOWS (See figure in the chapter 'Setting communication').

2. The parametrizing program

Installation, first program start and communication

Chapter 3

3. Installation, first program start and communication

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3. Installation, first program start and communication

3.1 Installation



Please note

The parametrizing program consists of two parts: the program part and the device data. Only the installation of the program part is described in the chapter 'Installation'. Before installing the complete parametrizing program, you must work through the chapter '**First program start**'.

The parametrizing program for the SEC-AC must be installed on your hard disc. The installation program "SETUP.EXE" will do this task for you. In order to install the parametrizing program, proceed as follows:

1. Make sure that the diskettes with the parametrizing program are write-protected. The hole underneath the small plastic slide in the diskette must still be visible.
2. Place the data storage device in the drive.
3. Start the WINDOWS Explorer.
4. Switch to the drive containing the data storage device with the parametrizing program.
5. Start the program "SETUP.EXE" (double click).

The installation program now creates a new program group for you with the name "WMEMOC." It automatically copies all the necessary files onto your hard disc and requests you to change the diskette. If installation has been successful, this will be displayed in an appropriate window.

6. The parametrizing program is now ready for the first program start. Please read further in the chapter 'First program start'.

3. Installation, first program start and communication

3.2 First program start

Before the program can become fully functional, the device files must be installed. This is carried out during the first program start. Proceed as follows.

- Start the parametrizing program by double-clicking the appropriate symbol ([Start]/[Programs]/[Parametrizing program]). The following window will appear:

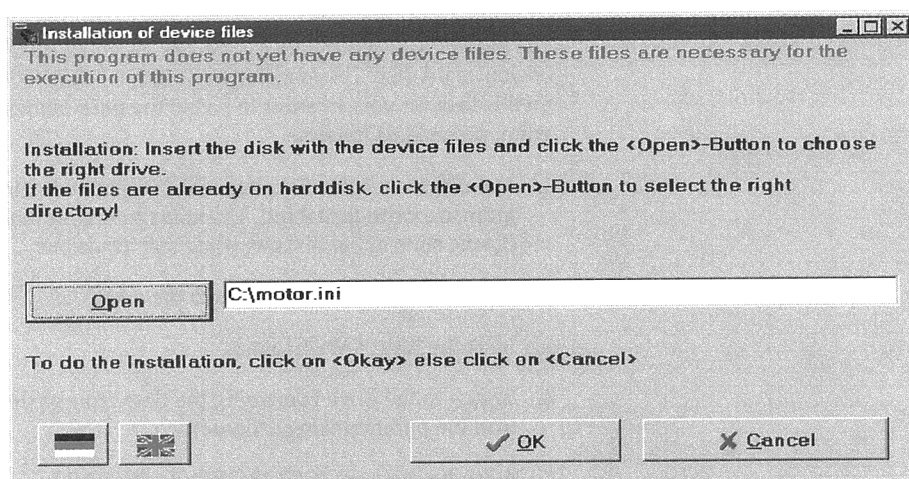


Fig. 3/1

Open

- Insert the data storage device with the device data and click the Open button. Select the drive and click on "OK". Then click the "OK" button in the window shown above.
- Conclude the program. The parametrizing program is now completely installed.

3. Installation, first program start and communication

3.3 Setting communication

Serial interface

The parametrizing program communicates with the servo controller via the serial interface. In order to do this, it needs to know which serial interface (COM port number) is being used.

When supplied from the factory, the parametrizing program is set as follows:

- interface COM1
- baud rate 9600 Baud (factory setting of servo controller)

When it is started, the program tries to communicate with a servo controller. If this fails, an error message will be shown.

Before the data for communication can be set correctly, you must carry out the following steps:

1. Connect the servo controller completely.
2. Connect an unused COM interface on the PC to the servo by means of a zero modem cable.
3. Switch on the servo controller.
4. Start the parametrizing program.

3. Installation, first program start and communication

If the parametrizing interface has a green online button (see diagrams below), the communication parameters are already set correctly and no modifications need to be made.



If, however, you find an error message, please read further in the chapters 'Setting the serial interface' and/or 'Solving problems with serial communication'.

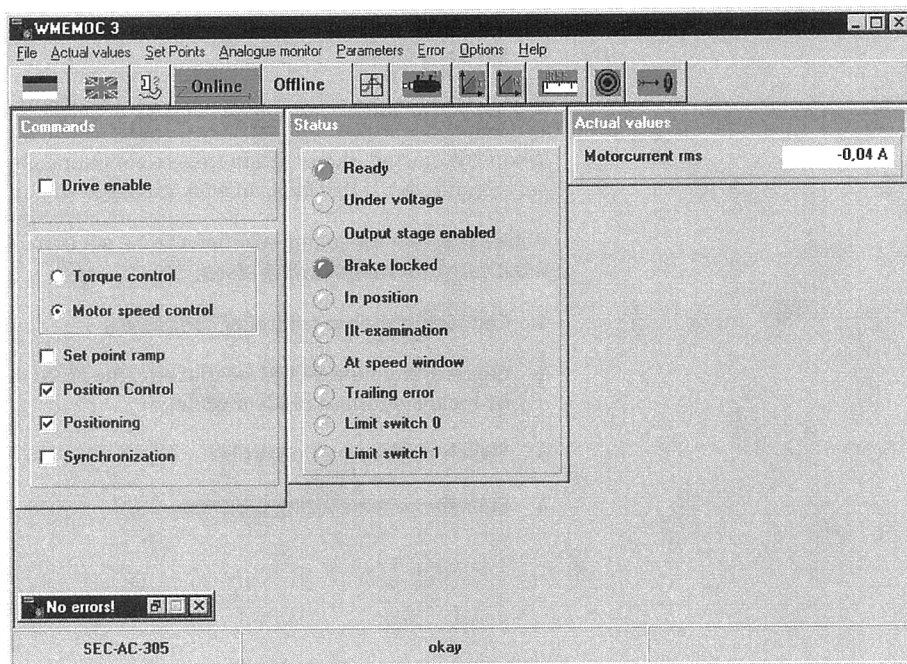


Fig. 3/2

3. Installation, first program start and communication

3.4 Setting the serial interface

If the parametrizing program cannot open the serial interface, the following error window will be shown when the program starts:

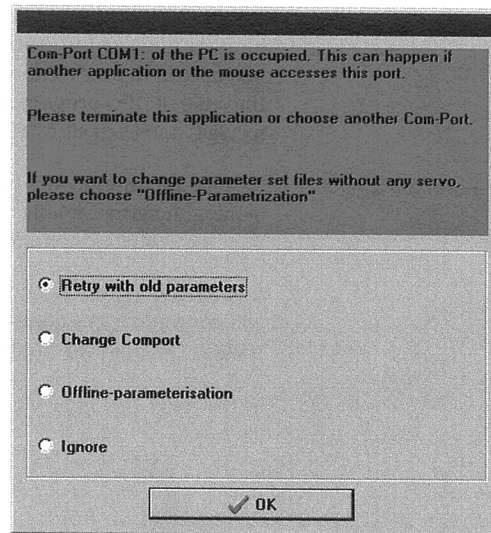


Fig. 3/3

3. Installation, first program start and communication

Incorrectly set interface	This fault can be caused either by an incorrectly set interface (usually the mouse driver) or by another Windows or DOS program which has access to the serial interface.
Change comport	<p>In order to correct an incorrectly set interface, click the menu item "Change comport" and follow the instructions given there.</p> <p>In order to solve the problem of conflict with a program which has access to the interface, conclude the other program (in the case of DOS programs, you must conclude the DOS shell as well) and then click "Retry with old parameters".</p>
Offline parametrizing	"Offline parametrization" is not intended for the first commissioning. It serves simply as a preparation for desk work (see chapter 'Offline programming').
Ignore	If you click "Ignore", the program will become inactive and will not try to make contact with the servo or offline parametrizing. The fault will not be rectified.

3. Installation, first program start and communication

3.5 Solving problems with serial communication

If the parametrizing program cannot establish a connection with the servo controller, the following error window will be shown:

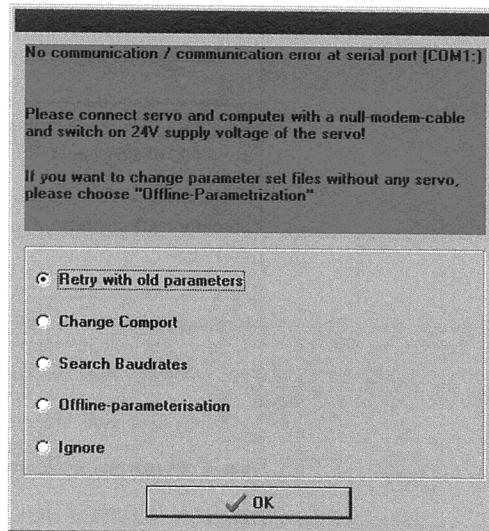


Fig. 3/4

3. Installation, first program start and communication

The table below lists the possible causes of faults and how to rectify them.

Cause	Remedy
Connection cannot be made	Click "Retry with old parameters"
The selected Comport is not correct	Click "Change comport" and follow the instructions there
Baud rates of parametrizing program and of servo are not the same	Click "Search for baudrates"
Communication interrupted from servo side	Carry out reset on servo , then click "Retry with old parameters"
Hardware faults: <ul style="list-style-type: none">– Servo not switched on– Connecting cable not plugged in– Connecting cable broken– Incorrect connecting cable	Rectify faults, then click "Retry with old parameters. See manual 'Installation and fitting', e.g. "RS232 cable"

Fig. 3/5 Causes of faults and how to rectify them

Basic settings

Chapter 4

4. Basic settings

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4. Basic settings

The basic settings of the parametrizing program and of the controller can be undertaken when:

- the program has been installed correctly, and when
- communication with the servo controller has been established.



Caution

Carry out the steps for the basic settings in the sequence stated in the manual. If this sequence is not observed, the motor and/or the servo controller may be damaged.

4.1 Setting the mode of the parametrizing program

In order to be able to work optimally with the parametrizing program, various user modes are offered in which only certain functions can be accessed. The following modes can be set:

- “Beginner”
All the parameters can be set, except positioning module, positioning and synchronizing (available via fast-access buttons)
- “Advanced”
All user-relevant parameters can be set
- “Expert”
Access to controller-internal parameters which cannot be modified by the user without knowledge of the device and its applications

4. Basic settings

Select the mode “Beginner” in order to carry out the first commissioning. Select the mode “Expert” for optimizing the system and for parametrizing the positioning module.

Proceed as follows:

1. Select menu item [Options]/[User mode].

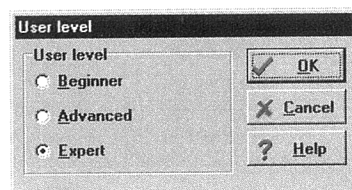


Fig. 4/1

2. Click “Beginner”.
3. Click “OK” to make the settings effective.

4. Basic settings

4.2 Loading preset parameter sets



If you are using Festo positioning axes with the Festo drive packages, you will find in this chapter the procedure for writing the tested parameter sets into the servo controller. If this is not the case, you can omit this chapter.

If you are using a Festo axis with Festo-ATP, you will require the following information for selecting a pre-prepared parameter file:

- the mounting position of the axis (horizontal or vertical)
- Which Festo DGE axis are you using?
- Which Festo drive package are you using?

With this information you can select the name of the appropriate parameter file from the table.

Example

Mounting position	horizontal
Axis	DGE-25-xxx-ZR
ATP	2.3 (motor: BSM63A275AA, gears $i = 4$)
Parameter file	23_25z_h.wpa



The parameter files can be found on the diskette supplied.

The parameter set contains all the important setting data to enable you to adapt the SEC-AC to a certain motor or application.

4. Basic settings

You can recognize parameter sets by the file name extension “*.wpa.

The control parameters of the files for the ATPs are ‘all-round settings’, i.e. an optimization of the control parameters to your particular application is possible in most cases. See the chapter ‘Optimizing the motor’.

You must carry out the following steps in order to transfer a parameter set to the SEC-AC:

1. Select menu item [File]/[Parameter set]/[Read from file and store into servo].

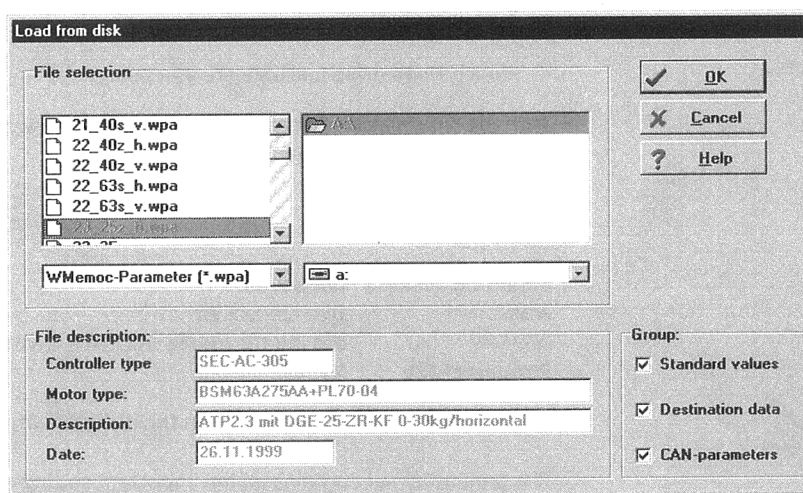


Fig. 4/2

2. Select the desired parameter set. Parameter sets end with “*.wpa.

4. Basic settings

3. Under "Groups": mark the ranges of the parameter set which are to be transmitted to the controller. Mark everything.
4. Click "OK" in order to transfer the parameter set to the SEC-AC.

The parameter set is now written into the SEC-AC. A bar indicates the status of the transmission. If the transmission is successful, the "File/Open" window will disappear and the following message will be displayed:

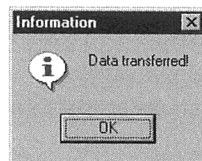


Fig. 4/3

The following window will be displayed if there is a fault in the data transmission:

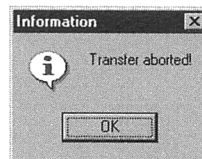


Fig. 4/4

In this case, faultless operation cannot be guaranteed. Repeat, therefore, data transmission of the parameter set.

4. Basic settings

If data transmission is successful, check the setting of the limit switch logic under [Parameters]/[Device parameters]/[Limit switch logic].

If your drive configuration is to run in speed-control mode, you must cancel the positioning module and the position controller in the command window. This concludes your software settings.

If your application is to run with position control, you must check the following settings:

- Position values:
[Parameters]/[Positioning]/[Destination parameters]
- Reference travel:
[Parameter]/[Positioning]/[Reference-position]



Please note

- Save the parameter set in the menu [Parameters]/ [Save parameters].
- Reset the SEC-AC by pressing the RES button.

The complete parameter set is now in the controller which is now ready to operate.

4. Basic settings

4.3 Setting the current limit values

The permitted current limit values for the motor must first be set.



If Festo parameter sets are used, the values adapted to the drive package are already pre-set.

1. Select menu item [Parameters]/[Motor data]. The menu shown below will be displayed.
2. Please refer to the manufacturer's data sheet or to the type plate on the motor for the maximum current values and for the rated current of the motor.

Motor Data

Limit value

Maximum current in A, rms value: 4,2 A

Nominal current in A, rms value: 2,2 A

The maximal current limits depend on the clock frequency of the power stage!

Power Stage

Number of pole pairs

Number: 3

Auto detect

Torque constant: 0,00 Nm/A

OK Cancel Help

Fig. 4/5

4. Basic settings



Please note

- The values to be entered for the maximum and rated currents are the **effective values**.

If the currents are too high, the motor will be damaged, as the permanent magnets in the motor will be demagnetized. The current limits specified by the manufacturer must not, therefore, be exceeded.

3. Enter the effective values for the maximum current and the rated current.
4. You can determine the number of pole pairs by activating the button "Auto detect".
5. Entry of the correct torque constant is only relevant for the correct monitor display in the "Torque control" mode.
6. In order to exit the window, click the "OK" button.
7. Save the set values with [Parameters]/[Save Parameters].

The current limit values of the motor used are now made known to the SEC-AC.

4. Basic settings

4.4 Setting the regulator enable logic

In order to enable the controller, you must set the regulator enable logic. The controller enable logic decides on the conditions which must be fulfilled before the controller can be enabled.

1. Select menu item [Parameters]/[Device parameters]/[Regulator enable logic].

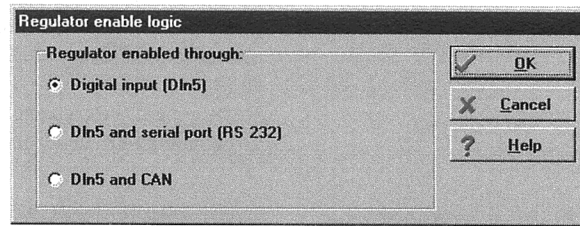


Fig. 4/6



With possibility no. 2, the “and” must be interpreted as “logical and”, i.e. the command over the serial interface is only effective when DIn 5 is active.

2. For the first commissioning select Only through digital input DIn5).
3. Click “OK” .

4. Basic settings

4.5 Setting the offset angle, phase sequence and number of pole pairs



A more detailed explanation of this theme can be found in the chapter Information on the offset angle, phase sequence and number of pole pairs.

The correct setting of the above mentioned variables is an important prerequisite for the correct functioning of the complete system.

The servo controller ascertains the named values automatically. Before this can be done, the motor must carry out a few test movements. It is therefore essential that the motor is operated in idling mode; no load may be coupled to the drive shaft.

In the case of Festo parameter sets, the values adapted to the drive package have already been set.



Caution

- Before starting the motor identification, you must set the current limit values (menu item [Parameter]/[Motor data]/[Current limits]), as otherwise the motor may be damaged.
- Do not enable the controller until the program requests this.

Carrying out the automatic identification

1. Select the command [Parameter]/[Motor data] from the menu bar.
2. Click the button "Auto detect" in the field "Number of pole pairs".

4. Basic settings

3. The window shown below will be displayed. Click "OK".
The motor shaft begins to turn; the complete procedure takes approximately 30 seconds.

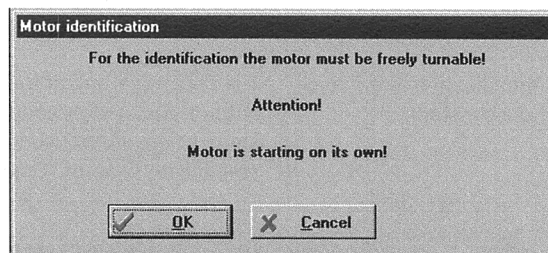


Fig. 4/7

4. If identification is successful, the following window will be displayed:

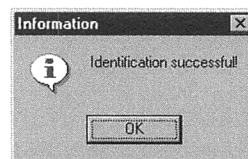


Fig. 4/8

5. Setting is then concluded. Save the settings with]Parameters]/[Save Parameters].

4. Basic settings

4.6 Setting the current controller



A more detailed explanation of this theme can be found in the chapter 'Information on the current controller'.

Amplification factor and
time constant

The correct setting of the “current controller” is an important prerequisite for adapting the speed controller at a later stage to the motor used. The parameters to be set are the amplification factor “Gain” and the “time constant”.



The servo controller ascertains the named values automatically. Before this can be done, the motor must carry out a few test movements. It is therefore essential that the motor is operated in idling mode; no load may be coupled to the drive shaft.

In the case of Festo parameter sets, the values adapted to the drive package have already been set.

4. Basic settings

Carrying out the automatic identification

1. Activate the menu [Parameters]/[Device parameters]/[Current controller]. The menu shown below will be displayed.

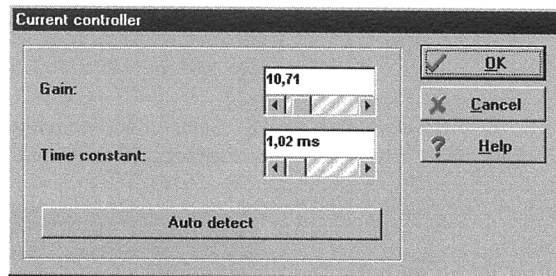


Fig. 4/9

2. Click "Auto detect".
3. After carrying out automatic determination, click "OK".
4. Save the settings with [Parameters]/[Save parameters].



If the automatic parameter determination is carried out again, the current regulator can and may deliver slightly different values.

4. Basic settings

4.7 Pre-setting the speed controller



In this step the speed controller is assigned with sensible basic values. The actual optimization takes place later in the further course of first commissioning (see chapter 'Optimizing the speed regulator').

In the case of Festo parameter sets, the values adapted to the drive package have already been set.

1. Select menu item [Parameters]/[Device parameters]/[Speed controller].

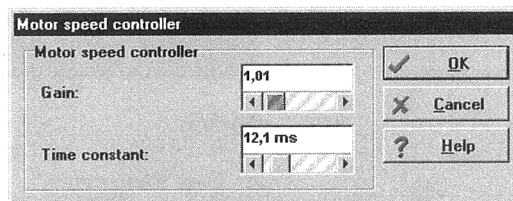


Fig. 4/10

2. Set the following output values:
amplification "1.0"
time constant "12.0 ms"
3. Click "OK" in order to exit the menu.
4. Save the settings with [Parameters]/[Save parameters].

4. Basic settings

4.7.1 Determining the limit switch logic

The SEC-AC can evaluate two limit switches which can be used for determining the positioning range. Each limit switch determines the positioning limit for a certain direction of rotation.

The limit switch logic describes the correlation between the logical and the physical positions of the limit switches. In technology, a normally-closed contact (protected against cable fracture) is usually used as a limit switch. However, with the SEC-AC it is also possible to use a normally-open contact. You can make this selection as follows:

1. Select menu item [Parameters]/[Device parameters]/[Limit switch logic].
2. Select the logic.

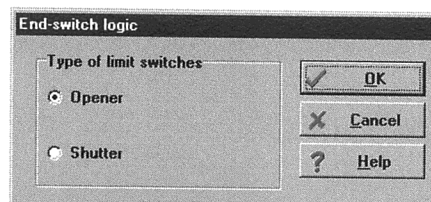


Fig. 4/11

3. Click "OK".
4. If the limit switch logic is set correctly, the limit switch LEDs in the status window will light up, but only when the limit switches are actuated.

4. Basic settings

4.8 Selecting the operating mode

4.8.1 Summary

The SEC-AC can control the motor in

- speed-control mode
- position-control mode
- torque-control mode

The operating modes can be switched over in the “commands window”. This window can be found at the top left of the screen when the program starts.

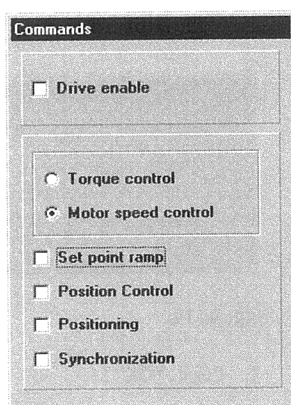


Fig. 4/12

You can switch from one operating mode to the other with the mouse.

Positioning and synchronization are alternative 'position-control modes'. "Position control" and "Motor speed control" must always be activated here. Only "Torque control" is activated selectively.

4. Basic settings

4.8.2 Torque control/speed control

With the torque-control mode, the mechanically loaded motor maintains the specified torque. The speed sets itself automatically depending on the load applied. With the speed-control mode, the motor maintains the specified speed irrespective of the load.

Speed control

The first commissioning requires first of all only the speed-control mode. In order to activate this, click the field "Motor speed control".

4.8.3 Additional options

The additional options "Setpoint ramp" to "Synchronization" should not be active for the first commissioning (option not marked with a cross). By clicking the box, you can delete any crosses entered.

4. Basic settings

4.9 Setpoint-selectors

The SEC-AC can select one of six different setpoints by means of two setpoint-selectors. Both setpoints are then added together and are entered in the controller as the total setpoint (torque control or speed control). Both setpoint-selectors can be parametrized with the parametrizing program.

1. Select the menu [Setpoints].
2. Select the menu [Setpoint-selectors].

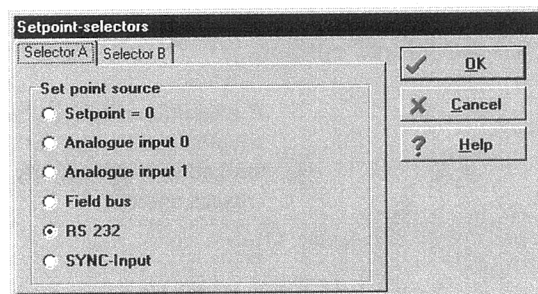


Fig. 4/13

3. Set "Selector A" to "RS232" (=serial interface).
4. Set "Selector B" to "Setpoint = 0".
5. Click "OK".

4. Basic settings

4.10 Configuring the actual value display

Speed and Motor current The parametrizing program offers you the possibility of displaying all the measured values numerically and simultaneously on the PC screen. For the first commissioning, you should display at least Speed and Motor current.

The actual value display can be set in the actual value menu (see below). All the values which are to be displayed must be marked with a tick. You can do this with the mouse key on the left. When clicked a second time, the selected actual value will be deleted from the display window (the tick will be deleted).

1. Click the menu [Actual values] in the upper menu bar.
2. Mark the entries "Motorspeed" and "Motor current" with a tick.

The actual value display now appears as follows:

Actual values	
Motorspeed	
Actual value:	0 RPM
Reference value:	0 RPM
Motorcurrent rms	
	0.00 A

Fig. 4/14

4. Basic settings

First start and optimizing the motor

Chapter 5

5. First start and optimizing the motor

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5. First start and optimizing the motor



Caution

You should not read this chapter before reading completely through the chapter “Basic settings”, especially the section on the current limit values of the current controller. Incorrect basic settings can cause damage to the servo controller/motor and to the mechanical drive.

5.1 Testing the controller enable



Caution

The motor can run at very high speeds during the controller enable.

- Block the controller enable, therefore, after each test and wait until the drive shaft comes to a stand again.

If the controller is parametrized incorrectly, it may be possible for you to bring the motor to a stand simply by switching off the final stage enable. If you have wired this input firmly and not included a switch, you must press the RES button.

Parameter/
Save parameterst

Before testing the controller enable, you must save the parameters and reset the controller. You can do this with the menu command [Parameters]/[Save parameters].

5. First start and optimizing the motor

In order to test the controller enable, proceed as follows:

1. Select the operating mode "Motor speed control" in the command window.
2. Set the setpoint-selectors "Selector A" to serial interface ("RS232") and "Selector B" to "Setpoint = 0".
3. Select menu item [Setpoints]/[Setpoint-value].
4. Specify a low speed (e.g. 100 rpm) (see figure below).
5. Switch on the final stage enable and the controller enable via the digital 24 V input.

The controller enable will be shown as a vertical bar in the 7-segment display of the SEC-AC. The six outer segments revolve in the form of running bars around the vertical bar, depending on the direction of rotation of the motor and on the speed.

When the controller is enabled, the motor must begin to turn. If this is not the case, there is either a fault or the controller has been parametrized incorrectly. In the table below, you will find typical faults and how to remedy them.

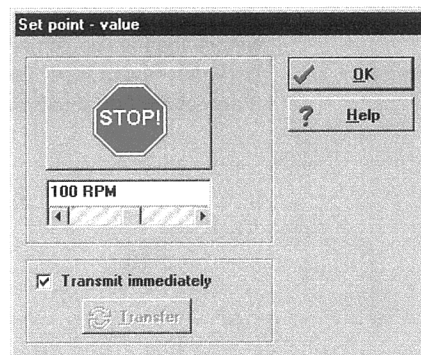


Fig. 5/1

5. First start and optimizing the motor

Fault	Remedy
No transverse bar appears in the display.	Check the 24 V power supply, see the controller enable logic.
An L, S or P appears in the display. These symbols flash.	The operating modes "position control", "synchronizing" and/or "positioning" are switched on. Deactivate these in the command window.
A two-figure error code flashes in the display.	Read how to rectify this error in the chapter "Diagnosis and Error treatment".
The brake cannot be released.	Check plug connector X6 and the motor plug as well as the cable. Does the voltage source fulfil the specification? See sections 'Power supply of the SEC-AC' and 'Power supply of parking brake' in the chapter 'Electromechanics'.
The motor develops a holding torque, it "locks" in various positions.	The number of pole pairs and/or the phase sequence is incorrect. Set the correct number of pole pairs (chapter 'Setting the offset angle and the number of pole pairs') and/or swap the motor phases.
The motor vibrates or runs unevenly.	The resolver offset angle and/or the controller parameters are not set correctly. Carry out the automatic identification again as described in the section 'Setting the offset angle and the number of pole pairs'.



Please note

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

5. First start and optimizing the motor

5.2 Setting the actual speed value filter

In order to improve the control behaviour, the actual measured speed value must be smoothed. This is accomplished with an actual speed value filter. The effective filter time constant can then be parametrized.

In the case of Festo parameter sets, the values adapted to the drive package have already been pre-set.

1. Select menu item [Parameters]/[Device parameters]/[Motor speed actual value filter].

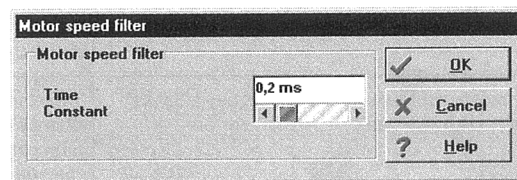


Fig. 5/2

2. Set the "Time constant" to "0.2ms".
3. Click "OK".
4. Save the settings with [Parameters]/[Save parameters].

As the actual speed value filter is entered as an additional time constant in the speed closed loop, it should be as small as possible. A value of 0.2 ms is therefore recommended for the first commissioning.

5. First start and optimizing the motor

5.3 Optimizing the speed controller

5.3.1 Summary

You can set the speed controller by specifying a setpoint jump.

With the PC oscilloscope function you can observe the reaction of the speed controller to the setpoint jumps and then set the control parameters.



The speed controller should be set so that only **one** overshoot of the actual speed value occurs. The overshoot should not be more than 10% above the nominal speed value. The falling edge of the overshoot should not or only just drop below the nominal speed value, before reaching the nominal speed value. This setting applies to most motors which can be operated with the SEC-AC. If a harder control behaviour is requested, the amplification of the speed controller can be further increased. The limit of amplification is reached when the drive starts to vibrate at high speeds. The amplification which can be achieved in the speed control circuit depends on the load conditions on the motor shaft. You must therefore check the setting of the speed controller again when the drive is fitted into place.



If you parametrize the speed controller when the motor shaft is in idling mode, you only have to adapt the control amplification, usually by increasing it, when the drive has been fitted.

5. First start and optimizing the motor

5.3.2 Carrying out the optimization



The implemented oscilloscope function of the parametrizing program can be used for optimizing the speed controller. More detailed information can be found in the chapter 'Extended functions of the parametrizing program'.

You have the possibility of reversing the motor over a certain path. It is important here that the motor is at first uncoupled from the mechanical drive.



Caution

The reversing operation can cause damage to a drive coupled to the motor. Therefore, disconnect the motor.

1. Start the oscilloscope by activating the menu item [Options]/[Oscilloscope].
2. Select the register card "Channels" and set the configuration as shown in the figure below.

5. First start and optimizing the motor

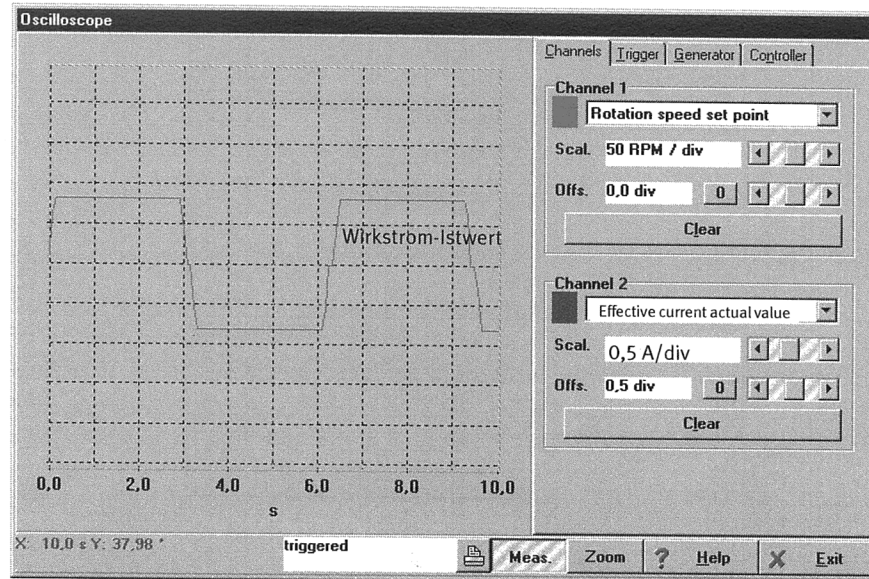


Fig. 5/3

3. Select the register card "Trigger" and set the configuration as shown in the diagram below.
4. Select the register card "Generator" and set the configuration as shown in the diagram below. Select a low reversing speed (less than 100 rpm).
5. Select the register card "Controller" and set the speed controller as shown in the diagram below.

5. First start and optimizing the motor

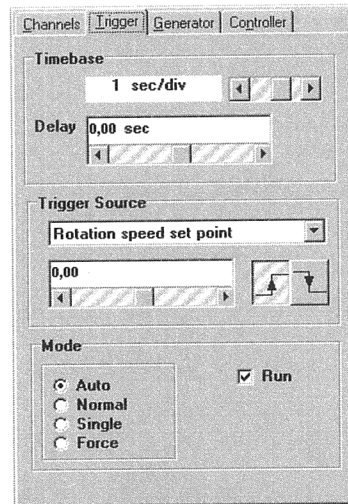


Fig. 5/4

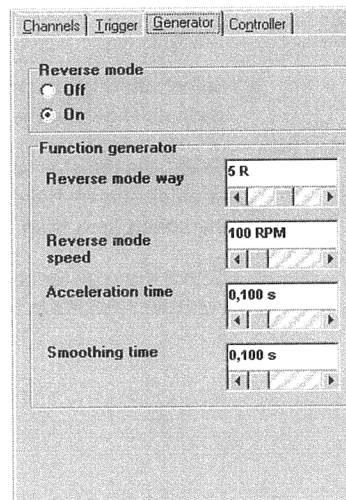


Fig. 5/5

5. First start and optimizing the motor

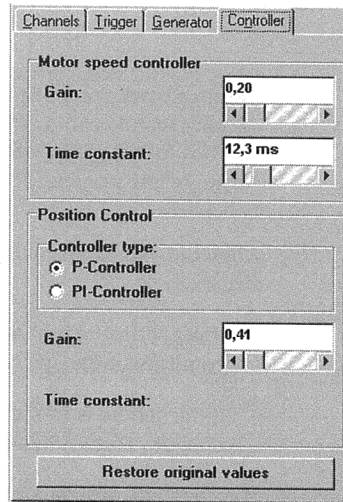


Fig. 5/6

6. Switch on the final stage enable and the controller enable. The motor now reverses within the specified limits.
7. Observe the oscillograms which are produced. Compare them with the samples in the next chapter. If the speed controller is set too 'soft' or too 'hard', use the measures specified. Experiment with various settings in order to find the optimum. An additional criterion is the actual current value which can set itself without a limit and without oscillation.



You can access the parameters of the speed controller by clicking the register card "Controller".

5. First start and optimizing the motor

5.3.3 Strategies for optimizing



Please note

A general rule is that you should not modify the numerical values for the amplification factor and for the time constant in large jumps, but only in small steps.

When the numerical values have been modified, two cases can arise:

- If the setting is too 'hard', the speed controller will become instable.
- If the setting is too 'soft', the drive will not be stiff enough. This will result in drag faults later in operation.

The speed control parameters are not independent of each other. A measured curve which looks different from test to test can have several causes. Therefore, modify **only one parameter** at a time. Start to vary and optimize the P-amplification with fixed, large time constants. Then reduce the time constants to an optimum.

In order to adapt the speed controller, increase the amplification until the motor vibrates, then reduce the amplification in small steps until the vibration disappears. Finally, reduce the time constant until vibration occurs, then increase the time constant in small steps until the controller is stable at "Set-point = 0" and is 'stiff' enough.

Due to their short cycle times, the controllers in the SEC-AC family do not begin to vibrate until unbalance is very rough, but tend to produce noise at an early stage depending on the degree of unbalance. You must then find a compromise between stiffness of the drive, stability and the production of noise.

5. First start and optimizing the motor

Case 1: Speed controller set too 'soft'

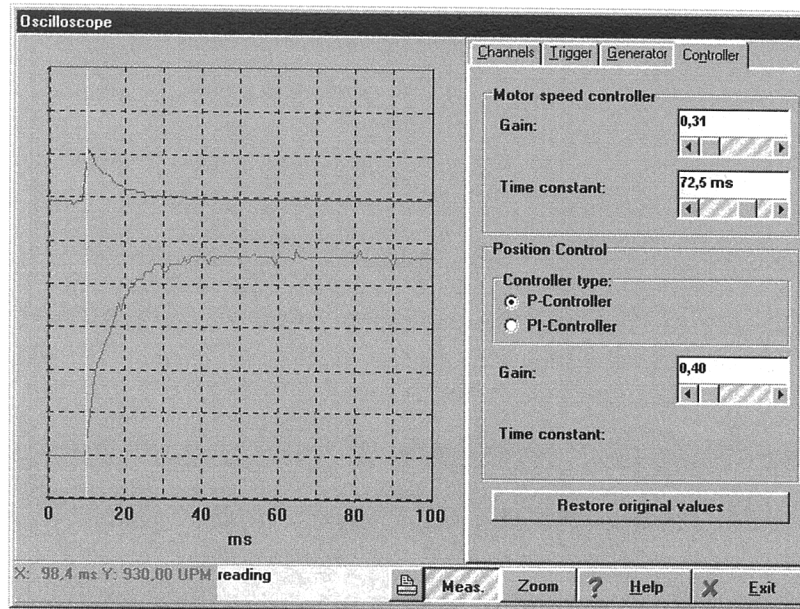


Fig. 5/7

Remedy

Increase the amplification factor by 2 to 3 tenths of a point /
reduce the time constant by 2 to 3ms.

5. First start and optimizing the motor

Case 2: Speed controller set too 'hard'

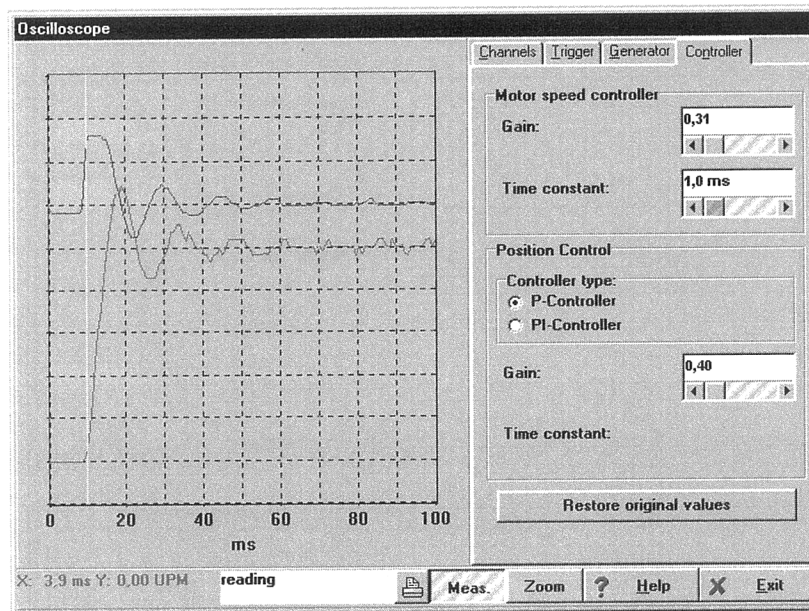


Fig. 5/8

Remedy

Reduce the amplification factor by 2 to 3 tenths of a point /
increase the time constant by 2 to 3ms.

5. First start and optimizing the motor

Case 3: Speed controller set correctly

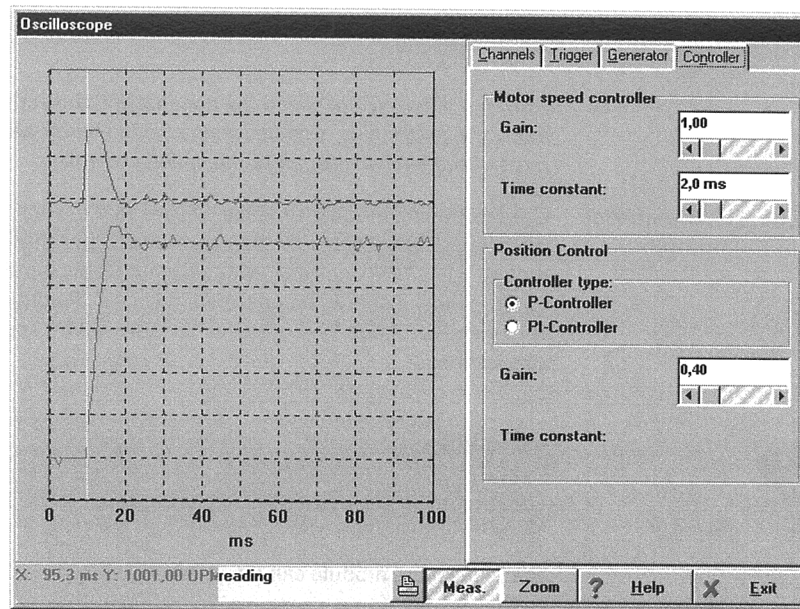


Fig. 5/9

5.3.4 Further optimizations

When you have adapted the speed controller, you can fit the motor into the system. You must then check the speed controller again. Usually, the amplification factor must be increased due to the higher system load.

If you are using the SEC-AC as a speed controller, the setting of the controller will suffice for your application.

If you are using the SEC-AC for positioning tasks, you must also parametrize the positioning module in addition to adapting both the current and speed controller. Characteristic values for a positioning movement are positioning times, positioning accuracy and position overswing at the destination.

5. First start and optimizing the motor

5.4 Optimizing the positioning module

5.4.1 Setting the positioning module

From the difference between the nominal and the actual positions, the positioning module forms a speed result which is transmitted as the setpoint to the speed controller.

PI-controller/P-controller The positioning module can only be operated in conjunction with the position control or the synchronization control. Although it is a “PI-controller” with parametrizable input and output limits, it should be operated only as a “P-controller”. The operating mode “PI-controller” is reserved for special applications.



Please note

Correctly set current and speed controller are a prerequisite for adapting the positioning module.

The positioning module can be parametrized in one of two methods:

- via the menu item [Parameters]/[Positioning control]
- via the menu item [Options]/[Oscilloscope], Register card “Controller.”



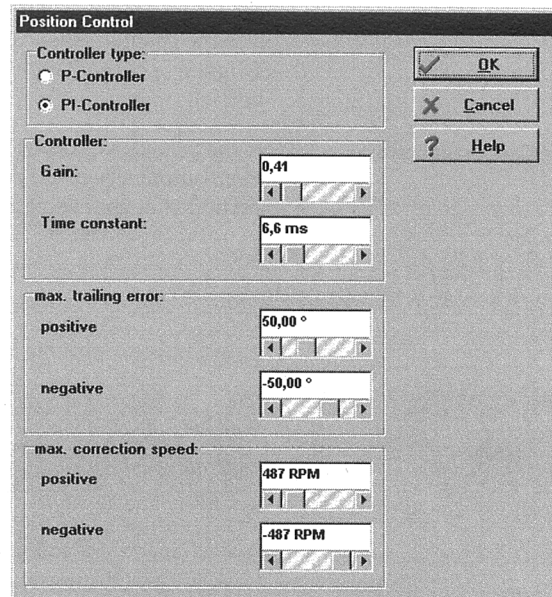
Please note

Do not open both menus at the same time, otherwise parametrization will be inconsistent.

5. First start and optimizing the motor

Parameter/
Positioning module

The command [Parameters]/[Positioning controller] generates the following window:



The image shows a 'Position Control' dialog box with the following fields and controls:

- Controller type:** Radio buttons for 'P-Controller' and 'PI-Controller'. 'PI-Controller' is selected.
- Controller:** A label for the next section.
- Gain:** A numeric field with the value '0,41' and a slider below it.
- Time constant:** A numeric field with the value '6,6 ms' and a slider below it.
- max. trailing error:** Two fields for 'positive' and 'negative' values, both set to '50,00 °' with sliders.
- max. correction speed:** Two fields for 'positive' and 'negative' values, both set to '487 RPM' with sliders.
- Buttons:** 'OK', 'Cancel', and 'Help' buttons on the right side.

Fig. 5/10

Controller type

In the field "Controller type", you can determine whether the positioning module is to operate as a P-controller or a PI-controller. Select here the operating mode "P-controller".

Amplification

In the field "Gain", you can specify the amplification factor of the controller.

Time constant

In the field "Time constant", you can specify the time constant (only with the PI-controller).

5. First start and optimizing the motor

Drag fault	In the field “Max. trailing error”, you can set the limits for recognizing drag faults. The limits can be set at maximum half a motor revolution. With the aid of the drag fault monitoring you can ascertain whether the dynamic position deviation has exceeded a certain value during a positioning movement. See also the chapter ‘Extended functions of the parametrizing program’, section Parameter/Device parameter/Digital outputs’.
Correction speed	In the field “Max. correction speed”, you can limit the maximum output size of the positioning module. This should be set at first at approximately ± 500 rpm.

5.4.2 Carrying out optimization

Please observe also the instructions in the previous chapter.



Please note

Optimization of the positioning module can also be carried out in the reversal mode. Make sure that the mechanical parts can turn freely and that the drive cannot be damaged. In addition to observation of the rotor position, observation of the nominal speed value and the drag fault also represents a possibility of optimizing the positioning module. The drag fault must disappear as soon as possible during the initial response, but must not tend to oscillate (see also the diagrams below).

Overswing of the rotor position can be further minimized in later operation by smooth acceleration.

5. First start and optimizing the motor

The following steps are necessary for optimizing the positioning module:

- | | |
|--|---|
| Speed control/Positioning/Position control | 1. Activate the operating modes "Motor speed control", "Positioning" and "Position control" in the command window. |
| Options/Oscilloscope | 2. Start the oscilloscope under menu item: [Options]/[Oscilloscope]. |
| Channel | 3. In the register card "Channel" set: "channel 1 = trailing error; channel 2 = actual speed value". |
| Generator | 4. In the register card "Generator" set: "reverse mode = OFF; reverse mode way = e.g. 5 turns; reverse mode speed (approx. 20%) = half the rated speed; acceleration time = 0, smoothing time = 0. |
| Trigger | 5. In the register card "Trigger" set: "time base = 100 ms; delay = -200 ms; trigger source = rotation speed set-point; trigger level = half the reverse speed; falling trigger edge; mode = normal"; "run" activated. |
| Controller | 6. Switch to the register card "Controller" and set the controller type on the positioning module to P-controller and the amplification to "0.5". |
| Generator | 7. Start the reverse procedure by switching again to the register card "Generator" and set: "reverse mode = ON". The motor should now operate in reverse.

8. In order to optimize, evaluate the speed and the rotor position during the stop process. If the initial speed adjustment takes too long, the amplification must be increased. |

5. First start and optimizing the motor

If the speed begins to oscillate during the stop process, the amplification must be reduced, See also the diagrams below.

Case 1: Drag fault is reduced too slowly →
Increase amplification of positioning module

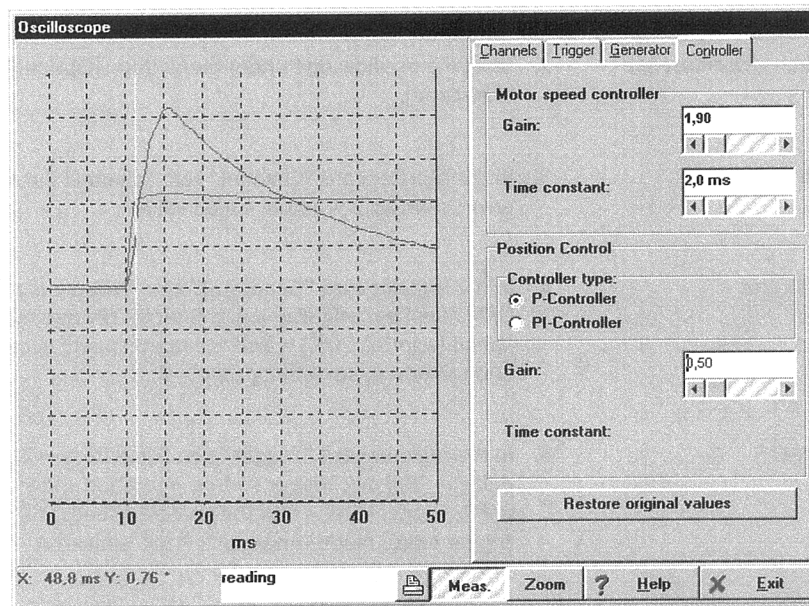


Fig. 5/11 Lower (smaller) curve: actual speed value
Upper (pointed) curve: trailing error

5. First start and optimizing the motor

Case 2: Tendency of drag fault and nominal speed to oscillate
→ Reduce amplification of positioning module

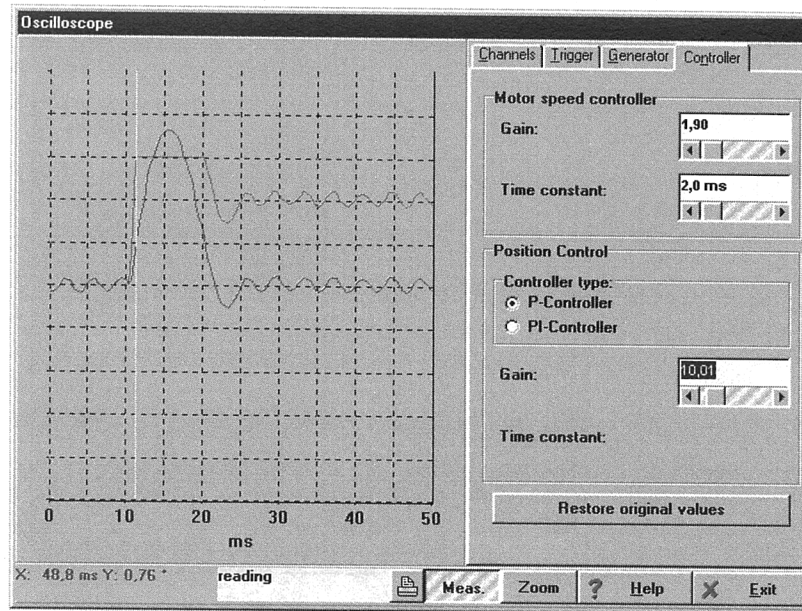


Fig. 5/12

5. First start and optimizing the motor

Case 3: Positioning module set correctly

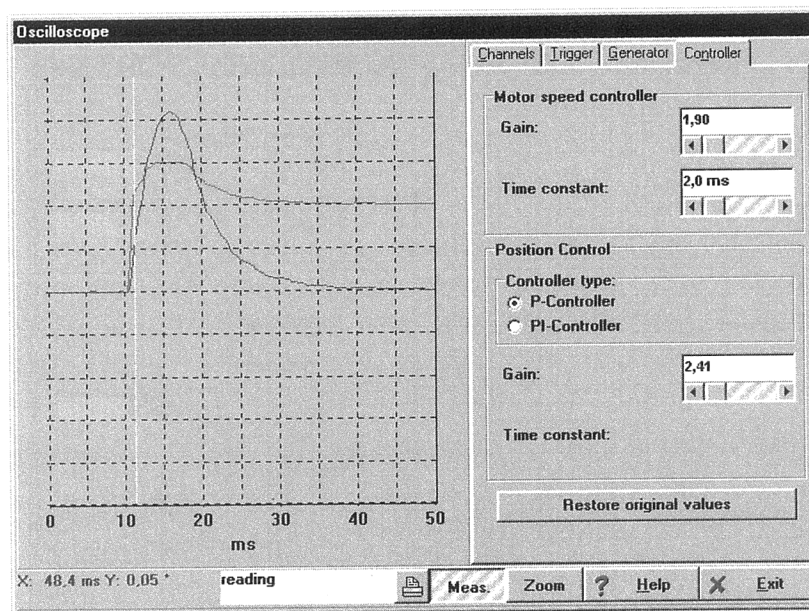


Fig. 5/13

Working with parameter sets

Chapter 6

6. Working with parameter sets

6.	Working with parameter sets	6-1
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6.2	Loading and saving parameter sets	6-5
6.3	Offline parametrizing	6-6

6. Working with parameter sets

6.1 General information



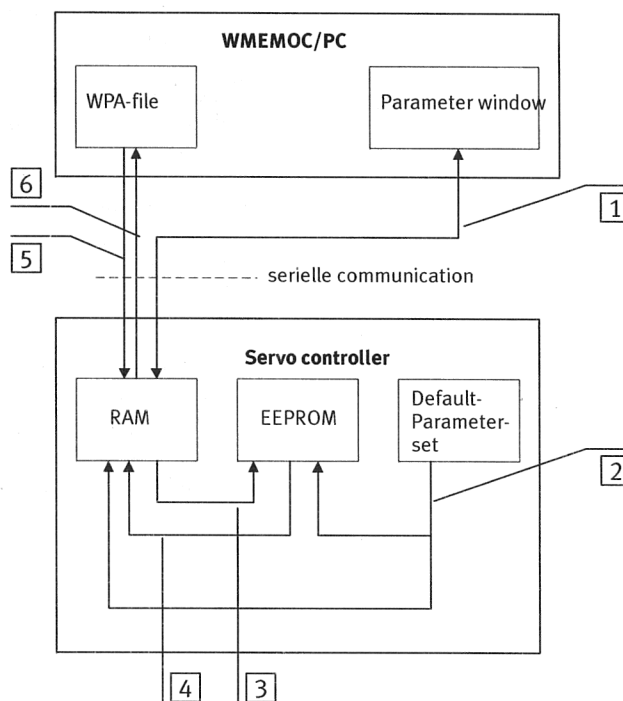
In order that the servo controller can operate the motor faultlessly, the characteristic values described in the chapter 'Basic settings' must be set correctly.

Parameter/
parameter set

The individual characteristic value is described in the following as a "parameter"; all the parameters together for a controller/motor combination are described as a "parameter set".

The drawing below shows how parameter sets are managed.

- 1 Read out / Modify
- 2 Load standard parameter set
- 3 Save parameter set
- 4 Reset parameter set
- 5 Read file and store in servo
- 6 Read from servo and store in file



6. Working with parameter sets

Parameters/ Save parameters

The current parameter set of the servo controller is available in the RAM memory (RAM = Random Access Memory). The RAM will lose its contents if the power supply is switched off. In order to save the parameter set permanently, it can be copied into the EEPROM with the command Save parameter/parameter set. The EEPROM (Electrical Erasable Programmable Read Only Memory) will also lose its contents if the power supply is switched off.

Each time the controller is reset, the contents of the EEPROM are copied into the RAM. A controller “reset” can be triggered when:

- the 24V power supply is switched off and then on again
- the reset button on the servo controller housing is pressed
- the command “RESET” is entered in the “transfer” window of the parametrizing program (see chapter ‘Transfer window’).

Standard parameter set

Every servo controller possesses furthermore a standard parameter set. This parameter set is integrated in the firmware and cannot be overwritten. If, for reasons unknown, parametrization is not successful, the standard parameter set can be loaded, in order to provide an ‘organised basis’.

You can activate the standard parameter set by entering the command DSP in the transfer window of the parametrizing program (see the chapter ‘Functions of the parametrizing program’, section ‘File/Transfer window’). The parameter set will then be copied into the EEPROM and the RAM.

6. Working with parameter sets

6.2 Loading and saving parameter sets

*.wpa

With reference to the previous chapter, it is also possible to save and manage parameter sets externally (i.e. on the hard disc or on a diskette). For this purpose, the parameter set is read by the servo controller and saved in a file (or read by a file and saved in the servo controller). The file extension for the parameter files on the PC is "*.wpa". Writing and reading the WPA files is carried out in the parametrizing program in the menu items:

- [File]/[Parameter set]/[Read from servo and store in file]

or

- [File]/[Parameter set]/[Read from file and store in servo]



Motor type/Description

Further information can be found in the chapter 'Loading basic settings/ preset parameter sets'.

Please note that, when writing a parameter set into a file, you have the possibility of filling in the fields "Motor type" and "Description". We urgently recommend you to do this, in order to avoid later confusion of parameter sets. A sensible name should also be chosen for the parameter set.



WPA files can be sent per diskette, CD, E-mail.

6. Working with parameter sets

6.3 Offline parametrizing

The parametrizing program offers you the possibility of accessing parameter sets, even when there is no serial communication with the servo controller. The requirement here is that there must be an appropriate WPA file (see previous chapter). You can also :

- read out control parameters
- modify control parameters
- save modified values in the same or in another WPA file.

In order to make the modifications effective, you must load the modified parameter set into the servo controller (see previous chapter).

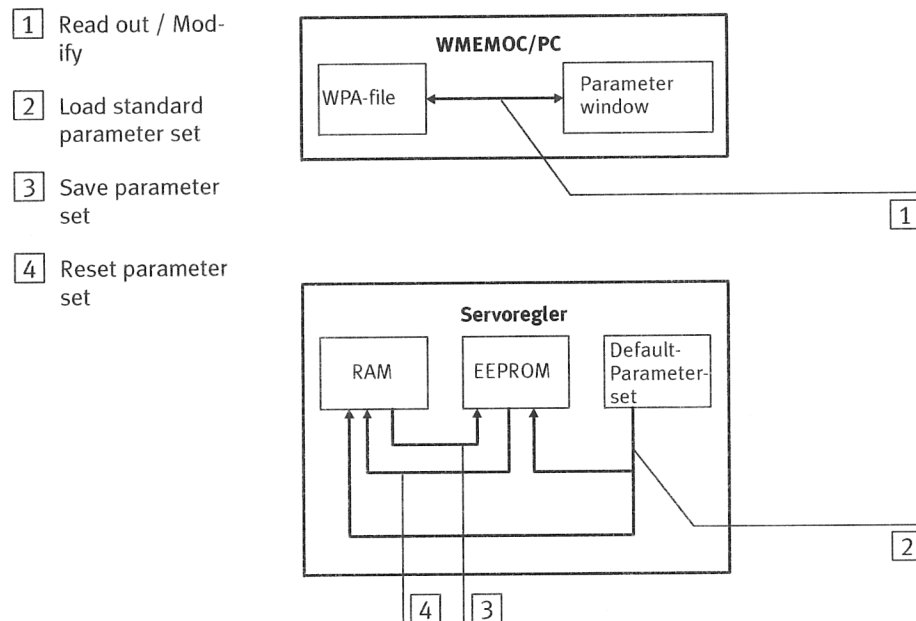


Fig. 6/14 Prinziple of Offline-Parametrizing

6. Working with parameter sets

Options/ Offline parametrizing

In order to activate the offline parametrizing, click the menu item [Options]/[Offline parametrization].

You will be asked to specify the WPA file which is to be opened. Select the desired file.

The file has been created for a specific type of controller. If it is to be used for a different controller type, select the new controller type.



Caution

If you use a WPA file for a different type of controller, you should always check the settings for rated current, maximum current, current controller and speed controller, as there is a danger that the servo controller/motor may be damaged.

The parametrizing program for offline parametrizing differs slightly from online parametrizing as follows:

- certain menus (e.g. Firmware download) are blocked
- the menu [File]/[Parameter set] has other submenus:
 - [Open file]
 - [Save file]
 - [Save file as...]
- When you exit the program, you will be asked if you wish to save the parameter file just opened.

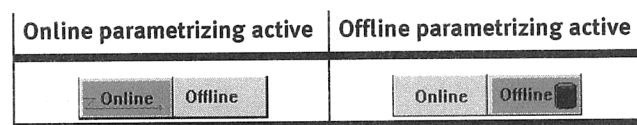
File/Parameter set

6. Working with parameter sets

Options/
Online parametrizing

You can conclude offline parametrizing by clicking menu item [Options]/[Online parametrizing].

Whether the offline or online parametrizing is active at the moment can be seen in the icon bar underneath the menu bar.



The mode currently active is shown in green.

Information on the automatic identification

Chapter 7

5. Information on the automatic identification

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7.1.1	Summary	7-3
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7.2	Information on the current controller	7-5

5. Information on the automatic identification

7.1 Information on the offset angle, phase sequence and number of pole pairs

7.1.1 Summary

The offset angle is the angle between the mechanical zero position of the resolver used and the electrical zero position of the rotor, resulting from the arrangement of the motor windings.

The setting of the correct offset angle is an important prerequisite for the faultless functioning of the complete drive. The angle between the resolver and the electrical zero position of the motor windings is generally the same for all the motors of a certain class from one manufacturer. If, therefore, you have ascertained the offset angle of a certain type of motor from a particular manufacturer, you can use the offset angle for all other motor types from the same manufacturer, providing these motor types have the same number of pole pairs.

Correct setting of the offset angle is necessary for the following reasons:

- for implementing the set nominal speed and torque
- for optimizing the degree of effectiveness of the complete drive

If the number of pole pairs set in the servo controller is not matched to the motor, there can be no correct commutation of the phase currents. In this case, the motor will not run smoothly. It will lock in certain positions and develop a strong holding torque.

5. Information on the automatic identification

7.1.2 Automatic identification

Most problems arise in setting the resolver offset angle and in cabling with the correct phase sequence. The phase sequence problem arises because there are no uniform assignments or designations and each manufacturer makes his own decision (for both motor and resolver phase sequences). In addition, the number of pole pairs of a motor is not usually noted on the type plate.

The SEC-AC ascertains these values automatically. The following parameters are recognized:

- the number of pole pairs of the motor
- the sequence of the motor phases (UVW)
- the sequence of the resolver phases (swapping + and -, swapping sine and cosine), carrier and track may not be swapped, neither may the tracks be swapped amongst each other (the pairs must always remain together)
- the offset angle of the resolver

In order to determine the motor parameters, the motor must carry out a few test movements. It is therefore necessary for the motor to be operated in idling mode. No load may be coupled to the shaft.

5. Information on the automatic identification

7.2 Information on the current controller

The current controller is used for optimally specifying the nominal current in the windings of the connected motor. The setting of the current controller depends on the electrical characteristics of the motor. The inductivity of the motor and the internal resistance of the motor windings determine the setting of the current controller.

The correct setting of the current controller is an important prerequisite for adapting the speed controller at a later stage to the motor used.

The parameters to be set are the amplification factor and the time constant.

Amplification factor

The amplification factor determines the intensity with which the actual value is adjusted without delay to the setpoint. Higher amplification factors cause a 'harder' reaction of the current controller to modifications of the setpoint.

Current controller which are set too 'hard' also cause instability in the current flow to the motor. In extreme cases this can be clearly heard as a loud whistling.

Time constant

The time constant determines the speed at which the actual current value is adjusted stationarily to the nominal current value. Higher time constants cause a softer reaction of the current controller to modifications of the setpoint.

Current controller which are set too 'soft' lead to the dynamics of the motor not being used.

The Festo SEC-AC controller ascertains the optimum current control parameters automatically.

5. Information on the automatic identification



Please note

If a current controller is set too 'hard', this can cause considerable overswing of the motor current in excess of the setpoint. There is then a danger of the motor being damaged as the permanent magnets in the motor will be demagnetized.

Standard applications and settings of the parametrizing program

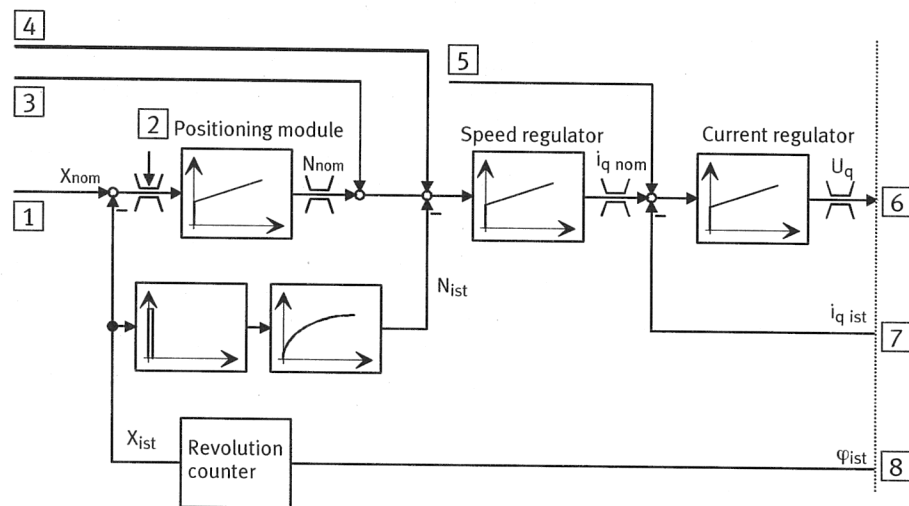
Chapter 8

8. Standard applications and settings of the parametrizing program

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8. Standard applications and settings of the parametrizing program

8.1 Layout of the controller



- | | |
|-------------------------------------|---|
| 1 From position setpoint management | 5 From torque management |
| 2 Trailing error recognition | 6 Coordinate transform. and modulator |
| 3 From positioning control | 7 Current measurement and coordinate transformation |
| 4 From speed setpoint management | 8 Angel encoder evaluation |

Fig. 8/1

The diagram shows the basic control layout of the SEC-AC. The current controller, speed controller and positioning module are arranged in the form of a cascade control. Due to the rotor-orientated control principle, the current can be specified separately in the effective share (i_q) and the idle share (i_d). There are therefore two current controller, each of which has been designed as a PI controller. In Fig. 8/3, the i_d -controller is not shown for reasons of clarity. The speed controller and the positioning module have also been designed as PI controller and can be switched on/off individually.

8. Standard applications and settings of the parametrizing program

8.2 Torque-control mode

Torque-control mode does not occur very often, as the motor can reach infinitely high speeds when there is no load. In torque-control mode a certain nominal torque, that the servo motor generates in the motor, is specified. As the torque is proportionate to the motor current, only the current controller is active in this operating case. Below is a diagram explaining the control process in simplified form.

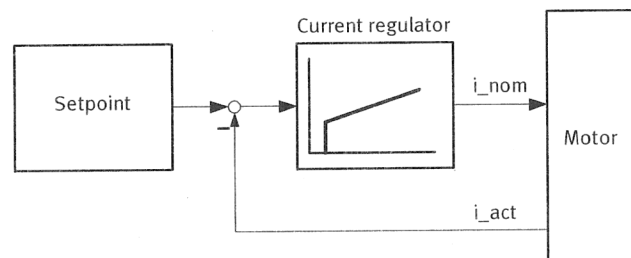


Fig. 8/2

In order to set the torque-control mode, you must configure the command window as follows:

Command window	
Torque control	ON
Speed control	OFF
Setpoint ramp	Optional ^{*)}
Positioning module	OFF
Position control	OFF
Synchronization	OFF
^{*)} If the setpoint ramp is actuated, setpoint jumps will be converted into ramp functions. For parametrizing these ramps, please refer to the chapter 'Extended functions of the parametrizing program', section 'Parameters/ Device parameters/SWI ramp'.	

8. Standard applications and settings of the parametrizing program

For the various possibilities of specifying the setpoint see the chapter 'Extended functions of the parametrizing program', section 'Setpoint/Setpoint specification'.

Options/Torque

The actual setpoint can be specified in A or Nm. This can be set with menu item [Options]/[Torque in Nm]. A tick in front of the menu item means that the torque is calculated in Nm. The menus for the actual and setpoints then adjust themselves automatically to the new unit.

Torque constant

If the torque is to be specified in Nm, the torque constant, i.e. the conversion factor between current and torque, must be made known.

Parameters/Motor data

The torque constant is entered in the menu [Parameters]/[Motor data] and can usually be ascertained from the specifications on the type plate on the motor. The rated torque must be divided here by the rated current.



Please note

A torque constant of "0 Nm/A" is not permitted, if [Torques in Nm] is activated.

8. Standard applications and settings of the parametrizing program

8.3 Speed-control mode

In speed-control mode a certain nominal speed is specified. The servo controller tries to specify this speed to the motor. The actual speed is attained from the information in the internal incremental sensor. The adjusting variable from the speed controller is passed on to the current controller.

The diagram below shows this process in simplified form.

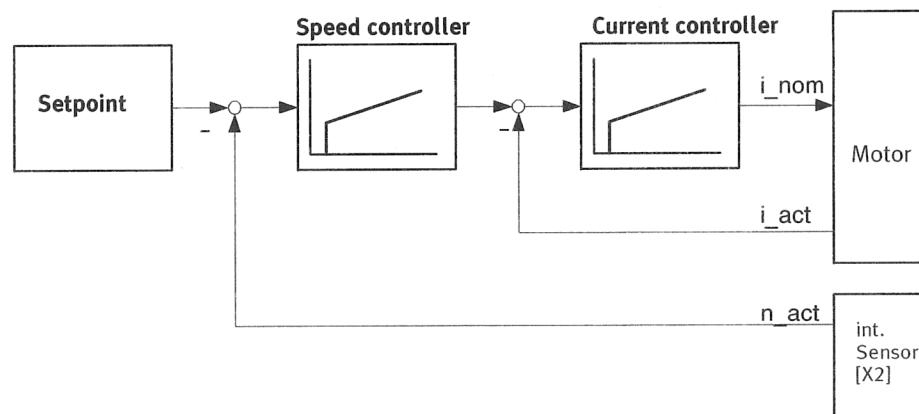


Fig. 8/3

8. Standard applications and settings of the parametrizing program

In order to set the speed-control mode, you must configure the command window as follows:

Command window	
Torque control	OFF
Speed control	ON
Setpoint ramp	Optional
Positioning module	OFF
Position control	OFF
Synchronization	OFF



If the setpoint ramp is actuated, setpoint jumps will be converted into ramp functions. For parametrizing these ramps, please refer to the chapter 'Extended functions of the parametrizing program', section 'Parameters/Device parameters/SWI ramp'.



When a specified speed is reached, it is possible to set a digital output which sends a reply message to a higher-order controller or which triggers other actions. See also the chapter 'Extended functions of the parametrizing program', section 'Parameters/Device parameters/Speed signal'.

8. Standard applications and settings of the parametrizing program

8.4 Positioning

In the positioning mode, a certain position is specified to which the motor must move. The current position is attained from the information from the internal incremental sensor. Deviation from this position is processed in the positioning module and passed on to the speed controller. The diagram below shows this process in simplified form.

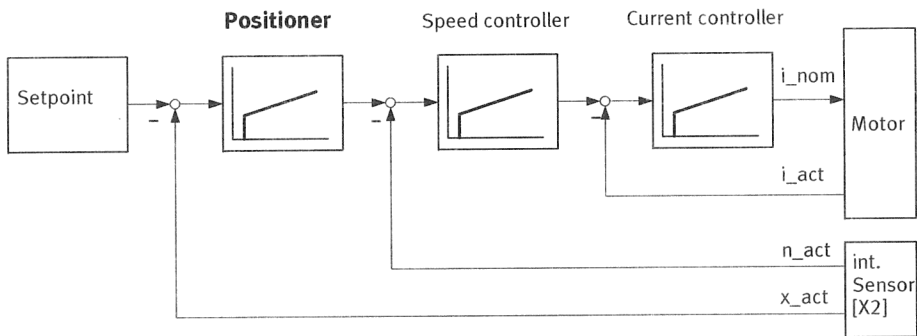


Fig. 8/4

In order to set the positioning mode, you must configure the command window as follows:

Command window	
Torque control	OFF
Speed control	ON
Setpoint ramp	No significance
Positioning module	ON
Position control	ON
Synchronization	OFF

➔

Please note

The setpoint ramp is not active in the positioning mode.

8. Standard applications and settings of the parametrizing program

8.4.1 Reference travel



The settings for the command window can be found in the chapter 'Standard applications and settings of the parametrizing program', section 'Positioning'.

The reference position is the zero point to which all further positions refer.

When the 24 V power supply is switched on or after a RESET, the current resolver position is used as the actual position. The zero position which arises therefrom is used as the reference position if reference travel is not carried out.

Normally, reference travel is carried out in order to determine the reference position. The drive usually moves to the limit switch and evaluates this signal as described below. You can start reference travel with an explicit command via the serial interface, field bus or automatically with controller enable.

Reference position / Reference travel

In most applications in which the servo controller works in the positioning mode, an agreement must be made on a zero position to which the positioning module can refer. This position is called the reference position and must be determined each time the controller is switched on. This takes place in the so-called 'reference travel'.

8. Standard applications and settings of the parametrizing program

Parameters/Positioning/Reference position The reference travel can be parametrized in the menu [Parameters]/[Positioning]/[Reference position]. The following window will be shown:

Fig. 8/5

Maximum search path During reference travel, the motor turns until the limit switch signal is activated. A maximum search path can be specified. If the limit signal is not recognized within this search path, the servo controller will send an error message.

8. Standard applications and settings of the parametrizing program

Search/crawl/running speed

The motor now moves to the limit switch at the set search speed. At the limit switch it reverses and moves back slowly from the switch at creep speed. In this way the contact threshold can be accurately defined. The drive then moves to the actual reference position at positioning speed.

Position

The actual reference position is situated at a defined offset from the limit switch position. This can be set in the field "Position".

If "Mode" "Method 1" is active, the drive will move to the reference position via the offset specified in the field "Position" after the falling edge of the limit switch evaluation.

If "Mode" "Method 2" is active, the drive will reference at the first zero pulse of the position sensor after the falling limit switch edge. As in method 1, it will then move to the reference position via the offset specified in the field "Start Position", "Position". The figure below explains the course of reference travel using the example of a linear axis.

8. Standard applications and settings of the parametrizing program

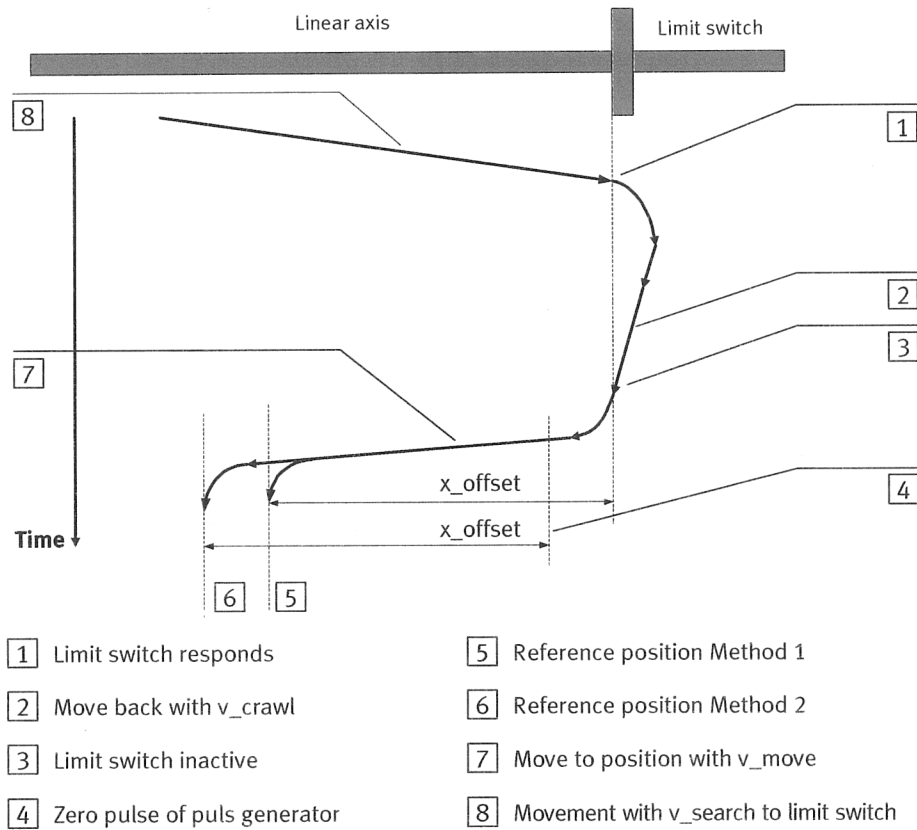


Fig. 8/6

8. Standard applications and settings of the parametrizing program

Acceleration/ Deceleration

In the fields "Acceleration" and "Deceleration" you can define the acceleration and braking ramps. They influence all three movement processes equally (search, crawl, running).

Direction

In the field "Direction" you can determine the direction of search and thereby select the limit switch to be used for reference travel.

Start reference travel

The field "Start reference run" will be triggered after final stage enable and controller enable. Mark a cross if reference travel is to be started automatically at the first controller enable. After a second controller enable, reference travel will not be started again until the final stage enable is cancelled.

In this way, reference travel is not necessary after controller block and new enable.

You can use the "GO!" button to trigger reference travel.

8. Standard applications and settings of the parametrizing program

8.4.2 Setting positions

The servo controller possesses a table of 16 positions and individual positioning profiles which can be used for parametrizing destinations in advance. There is also a position block for the RS232 interface.

Parameters/Positioning/
Destination parameters

You can parametrize the destination positions in the menu [Parameters]/ [Positioning]/[Destination parameters]. The following window will appear:

Fig. 8/7

Select

In the field “Select” you can select the destination to be parametrized.

Destination, Position

In the field “Destination”, ”Position“ you can specify the destination position. The destination position will be interpreted differently, depending on whether absolute or relative positioning has been selected. (See field “Positioning run”)

8. Standard applications and settings of the parametrizing program

Speed

In the field "Speed" you can specify the speed at which movement to the destination is to be carried out.

The "final speed" specifies the speed at which the drive is to reach the destination position. In most cases this is zero. If a final speed not equal to zero is set, the positioning profile will be calculated so that the drive continues to move at the specified speed when the destination is reached (in order then to process the next positioning command).

The figure below shows a positioning profile in which the final speed is set at "v1" when position 1 is reached.

1 Position 1

2 Position 2

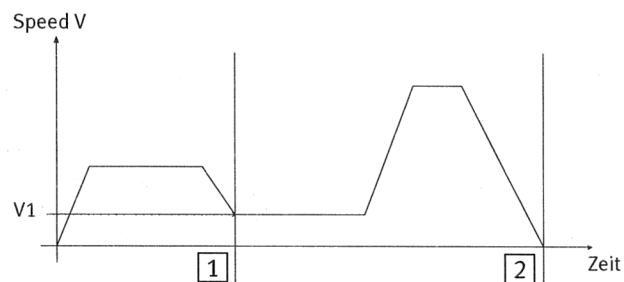


Fig. 8/8

Acceleration/ Braking time

In the fields "Acceleration" and "Deceleration" you can parametrize the ramps for accelerating and braking the drive. If the times in the field "Smoothing" are set to "0", this will result in linear ramps, otherwise movement will be a parabola-shaped speed function. If the setting "Total time" equals "Smoothing", the result will be a sinus-shaped acceleration curve.

8. Standard applications and settings of the parametrizing program

Positioning

In the field “Positioning” you can specify whether the destination is to be interpreted as absolute (related to the reference point) or relative. The option relative, related to last destination calculates the new position on the basis of the destination position currently reached or to be reached. The option relative is the current actual position. If current positioning is not yet completed, the two options will produce different results.

Start with current positioning

The field “Start” with current positioning specifies the behaviour of the servo controller when positioning is still taking place and the starting command for a new destination is received. The following options exist:

- Wait for the end: current positioning is completed and the new positioning started (this can already be transmitted).
- Interrupt positioning: current positioning is interrupted and movement is made to the new position.
- Ignore starting command: the positioning task for the new position is not accepted until the current destination is reached.

Instant pre-control

The field “Instant pre-control” enables increased dynamics with the positioning procedures. The variable must be ascertained by experiment, as default value it should be set to 0.



Please note

A rebound switch at the digital starting input can lead to problems, if “Wait for the end” or “Interrupt positioning” are permitted during relative positioning. The drive may move a little too far.

8. Standard applications and settings of the parametrizing program

Checkbox synchronized : Checkbox synchronized is required e.g. for the application "Flying saw." Normally the checkbox is not marked with a cross.

Messages : In the field "Messages" you can parametrize trigger messages which can be transmitted via a digital output. These trigger messages show the remaining path or the remaining time to the end of current positioning.



See also the chapter 'Extended functions of the parametrizing program', section 'Parameters/Device parameters/Digital outputs'.

GO! : With the "GO!" button you can start positionierung with the destination currently shown.

Copy : With the "Copy" button you can copy all the settings for a destination to another destination. In the dialogue thus accessed you can specify both the source and the destination positions.

Moving to positions

The following possibilities exist for moving to positions:

- via digital inputs
- with the RS232 command (serial interface)
- via the field bus (optional)

8. Standard applications and settings of the parametrizing program

Positioning via digital inputs

The individual destinations can be selected via digital inputs. A rising edge at digital input DIN8 causes the destination to be accepted and starts the positioning movement.

Controllers in the SEC-AC family have 4 digital inputs (DIN0...DIN3) for selecting the destination.

SEC-AC controller family				
DIN3	DIN2	DIN1	DIN0	Destination no.
0	0	0	0	0
0	0	0	1	1
...
0	1	1	1	7
1	0	0	0	8
1	0	0	1	9
...
1	1	1	0	14
1	1	1	1	15

8. Standard applications and settings of the parametrizing program

Positioning with the RS232 (serial interface)

By means of the serial interface, movement can be made to all 16 positions, as well as to a temporary “RS-232 position” with controllers of the SEC-AC family.



Parameters/Positioning/
Goto destinations

The command structure can be found in the Appendix.

Movement to the 16 destination positions and reference travel can be triggered via the parametrizing program. To do this, activate the menu item [Parameters]/[Positioning]/[Goto destinations]. The following window will then appear:

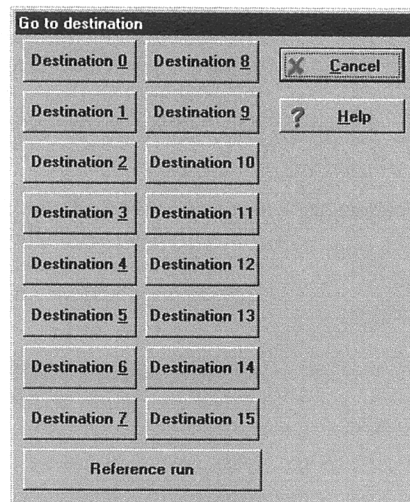


Fig. 8/9

You can move to the relevant destination by clicking the appropriate button.

8. Standard applications and settings of the parametrizing program

8.4.3 Setting digital outputs

By setting digital outputs in positioning mode, you can inform a higher-order controller that positioning is/will be concluded.

1. Nominal position = destination position
2. Actual position = destination position
3. Remaining time to end of positioning procedure reached
4. Remaining path to end of positioning procedure reached
5. Reference travel active



Configuration of the digital outputs is described in the chapter 'Extended functions of the parametrizing program', section 'Parameters/ Device parameters/ Digital outputs'. Possibilities 3 and 4 are described in more detail in the section "Setting positions" in this chapter.

Parameters/Positioning/
Messages

For possibility 2, you must define a tolerance window, in the limits of which the digital output is to be set. You can do this in menu item [Parameters]/ [Positioning]/[Messages]. The following window will appear:

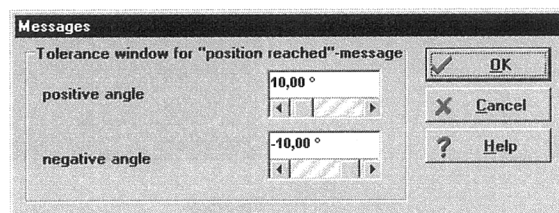


Fig. 8/10

Here you can set the tolerance window for the "Xactual = Xdestination" message.

8. Standard applications and settings of the parametrizing program

8.5 Master-slave operation

In master-slave operation two servo controllers are coupled together. The master passes the position information onto the slave via the incremental sensor output (plug X11). The slave reads this information via the external incremental sensor input (plug X10). The plugs must be connected for this purpose with a 1:1 cable (pin 1 with pin 1, pin 2 with pin 2,). The diagram below shows the configuration.

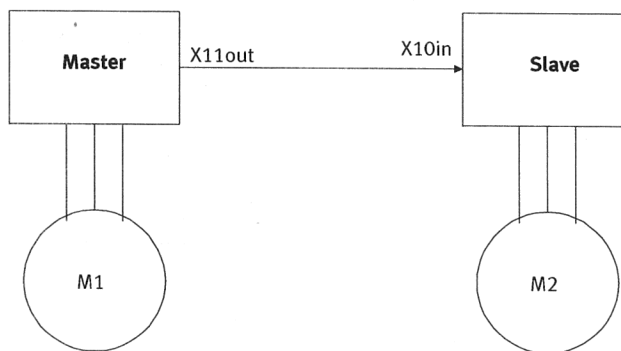


Fig. 8/11

The master operates in one of the previously described modes (speed control, positioning), while the slave operates in the synchronized mode.

The following operating modes are possible with this configuration:

- Speed-synchronous positioning
- Position-synchronous movement
- Electronic gears
- Special applications, e.g. “flying saw” (after consultation).

8. Standard applications and settings of the parametrizing program

8.5.1 Speed-synchronous positioning

Speed-control

In the speed-synchronous mode, the master specifies a certain speed to the slave. Movement must be made at this speed. The master is normally in the speed-control mode.



Please note

The position of the axes is not controlled in this case.

The diagram below shows a simplified control circuit for the slave.

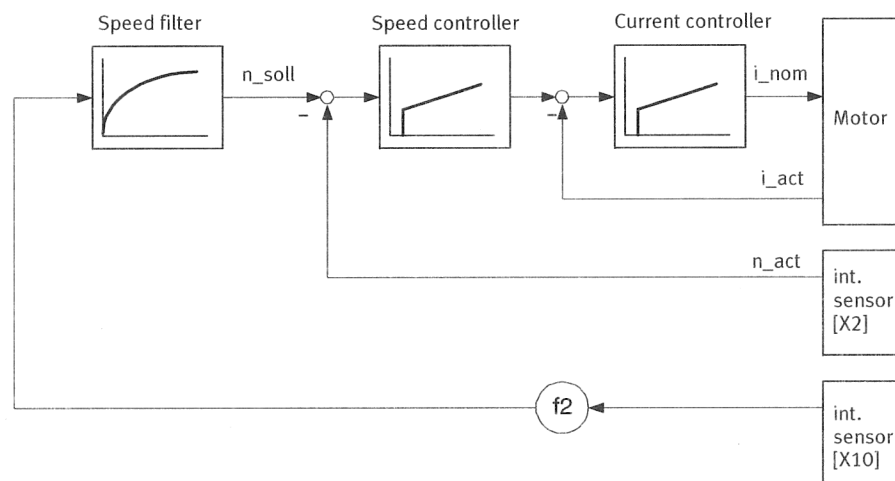


Fig. 8/12

As can be seen in the drawing, the speed specified by the master can contain a proportionality factor.

8. Standard applications and settings of the parametrizing program

In order to set speed-synchronous positioning, you must configure the slave as follows:

Command window	
Torque control	OFF
Speed control	ON
Setpoint ramp	Optional*)
Position control	OFF
Positioning module	ON
Synchronization	OFF
*) In most cases the setpoint ramp is switched off in this operating mode.	

Setpoint/Setpoint-selection

In the menu [Setpoint]/[Setpoint-selection] either "Selector A" or "Selector B" must be set to "Sync input".

8. Standard applications and settings of the parametrizing program

Parameters/
Synchronization

The synchronizing menu must be configured correctly. It can be accessed with [Parameters]/[Synchronization]. The following window will then appear:

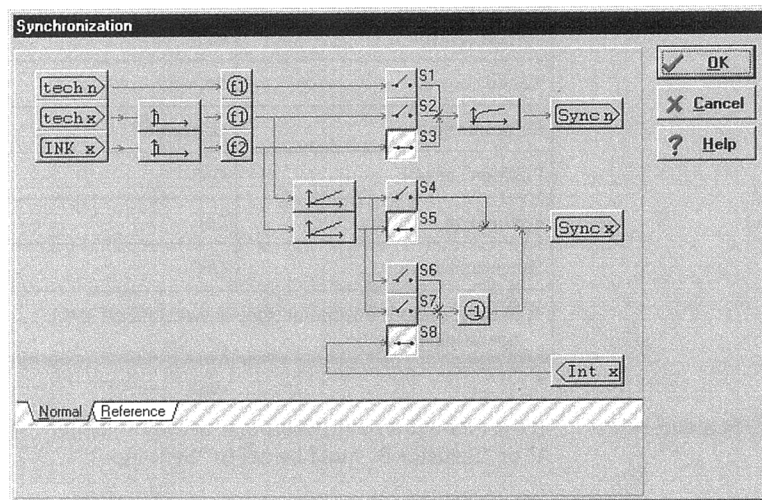


Fig. 8/13

The switches must be configured as follows:

Switch configuration	
S1	Open
S2	Open
S3	Closed
S4	Open
S5	Open
S6	Open
S7	Open

8. Standard applications and settings of the parametrizing program

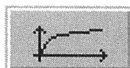
INK_x

With a click on the “INK_x” button, you can set the bar code of the external incremental sensor.

f2

With the “f2” button, you can enter the proportionality factor for the speed specification (see also the control circuit diagram). The proportionality factor must be specified with counter and denominator.

The externally supplied speed can also be filtered. You can set the external speed filter by clicking the button shown below.



8. Standard applications and settings of the parametrizing program

8.5.2 Position-synchronous movement

Positioning

In the position-synchronous mode, the master specifies a certain position to the slave. Movement must be made to this position. The master is normally in the positioning mode.

The diagram below shows a simplified control circuit for the slave.

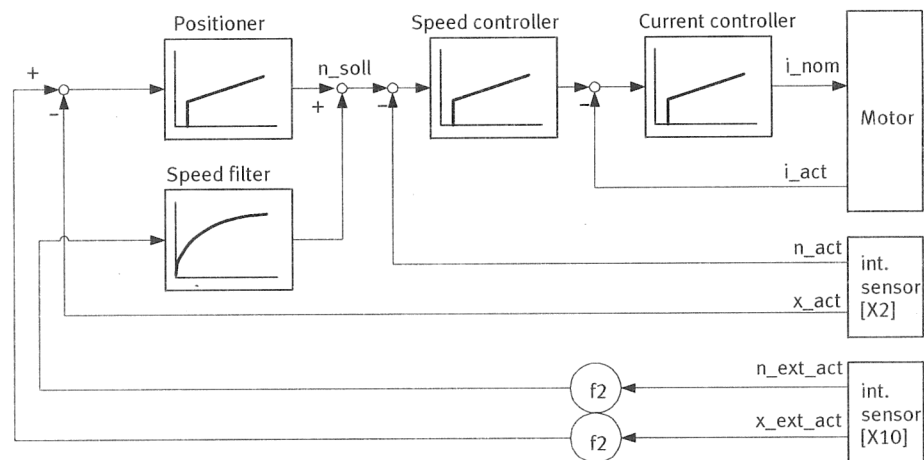


Fig. 8/14

The speed feedback from the external sensor is not absolutely necessary, but is to be recommended, as the positioning module would operate very slowly, due to its very high time constant.

As can be seen in the drawing, the position and speed specified by the master can contain a proportionality factor.

In order to set position-synchronous movement, you must configure the slave as follows:

8. Standard applications and settings of the parametrizing program

Command window	
Torque control	OFF
Speed control	ON
Setpoint ramp	OFF
Position control	ON
Positioning module	OFF
Synchronization	ON

Setpoint/
Setpoint-selection

In the menu [Setpoint]/[Setpoint-selection] either “Selector A” or “Selector B” must be set to “Sync input”.

Parameters/
Synchronizing

The synchronizing menu must be configured correctly. It can be accessed with [Parameters]/[Synchronizing]. The following window will then appear:

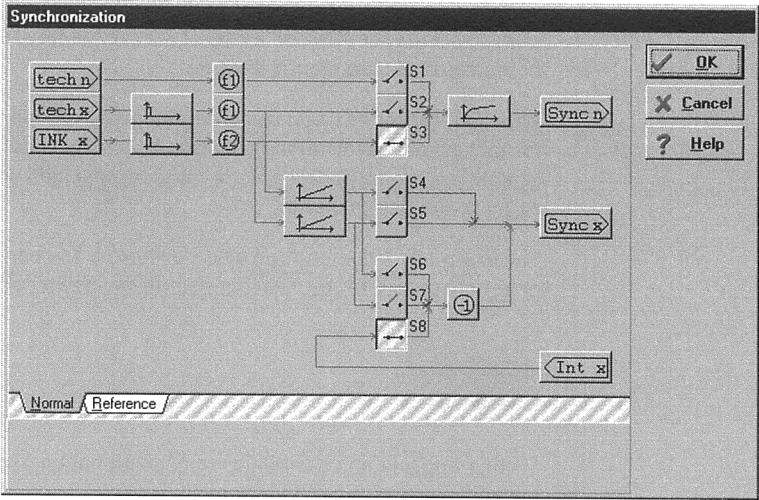


Fig. 8/15

8. Standard applications and settings of the parametrizing program

The switches must be configured as follows:

Switch configuration	
S1	Open
S2	Open
S3	Closed*)
S4	Open
S5	Closed
S6	Open
S7	Open
S8	Closed
*) recommended	

INK_x

With a click on the “INK_x” button, you can set the bar code of the external incremental sensor.

f2

With the “f2” button, you can enter the proportionality factor for the speed specification (see also the control circuit diagram). The proportionality factor must be specified with counter and denominator.

The externally fed speed can also be filtered. You can set the external speed filter by clicking the button shown below.



Further application possibilities (e.g. combination of positioning and synchronizing) on request.

8. Standard applications and settings of the parametrizing program

8.6 Timing the digital signals

8.6.1 Digital inputs

At the beginning the program undergoes basic parametrizing. This is followed by Controller enable with ENA-PWR (Enable-Power) and ENA-CI (Enable-Controller). The digital inputs used are described in the table below.

Input/output	Value	Function
Din0 - Din3	Pos-Bit0 - Pos-Bit3	Destination selection
Din4	ENA_PWR	Input for final stage enable
Din5	ENA_CI	Input for controller enable
Din6 - Din7	END-0 - END-1	Limit switch
Din8	START	Start positioning in positioning mode
Din9	SAMPLE	Input for additional reference switch

Fig. 8/16

8. Standard applications and settings of the parametrizing program

8.6.2 Timing the final stage enable and controller enable

The time relationships are described in the graph and table below.

Parameter		Delay time			Unit
T	Description	Min	Typical	Max	
t1	Gap between rising edges	0	–	–	ms
t2	Delay after controller enable on	2	7	14	ms
t3*)	Delay after controller enable off	tFast stop/at least 100	tStop	–	ms
t4	Delay after final stage enable off. The motor coasts	2	–	15	ms
t5	Minimum duration controller enable off	15	–	–	ms
t6	Minimum duration controller enable off	15	–	–	ms
*) tFast stop: applies to setpoint specification,parametrizing					

Fig. 8/17

For calculating the braking time during speed regulation or tStop: The following formula applies for the positioning mode without controller enable:

$$t_{\text{Stop}} = (\max(v_{\text{max}}/a_{\text{max}}, 100\text{ms}) + t_{\text{filt}}) v_{\text{nominal}}/v_{\text{max}}$$

The larger of the two values, either 100 ms or $v_{\text{max}}/a_{\text{max}}$, is added to the actual speed value filter constant and then multiplied by the ratio of the nominal speed value v_{nominal} and the maximum speed v_{max} .

Maximum braking delay: a_{max} (parametrizing is made via the CAN object "6510" Subindex "15").

8. Standard applications and settings of the parametrizing program

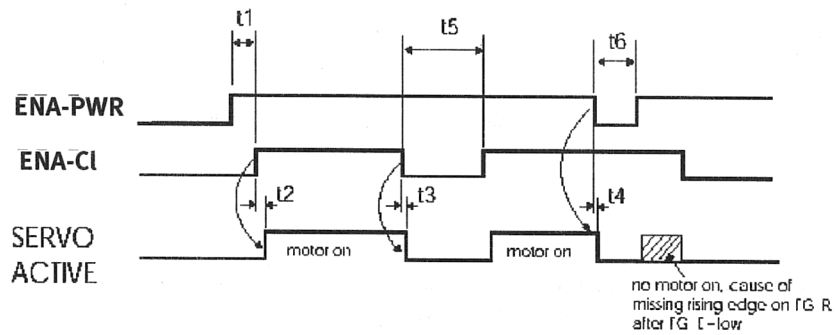


Fig. 8/18 Timing the final stage and controller enable: After ENA-PWR at high, a rising edge is required At ENA-CL

8. Standard applications and settings of the parametrizing program

8.6.3 Timing the limit switches

The limit switches serve for limiting the positioning path of an axis. If a limit switch is actuated, a so-called 'quick stop' will follow. This means that the axis is brought to nominal speed value "0" at maximum acceleration.

Parameter T	Description	Delay time			Unit
		Min	Typical	Max	
t7	Delay after actuation of limit switch	100	t _{Stop}	–	ms
t8	Delay after limit switch enable	100	t _{Stop}	–	ms

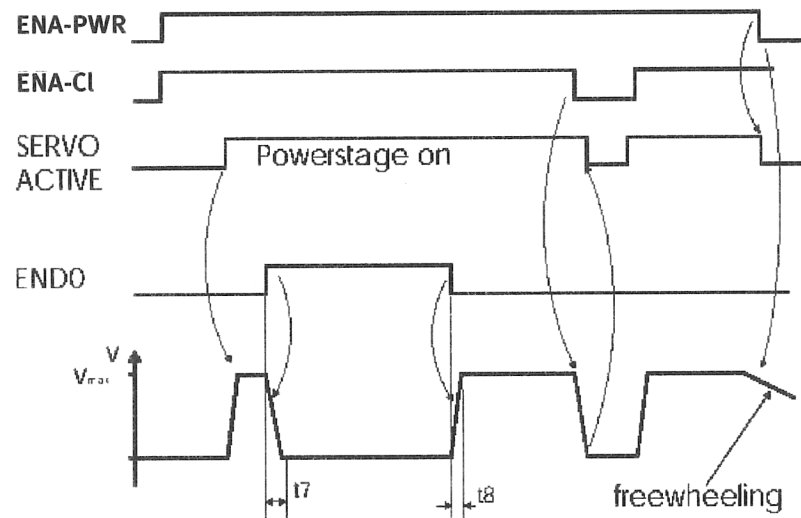


Fig. 8/19 Timing the limit switches

8. Standard applications and settings of the parametrizing program

8.6.4 Timing the control signals for the positioning module

You can carry out positioning by creating a bit combination with "Din0-Din3" and then enabling the positioning with "Din8" (START). The positioning controller has three modes for transferring the position Data record.

8. Standard applications and settings of the parametrizing program

Positioning after current positioning

A feature of this parametrizing is that new positioning cannot be loaded or actuated before previous positioning is completed.

Parameter T	Description	Delay time			Unit
		Min	Typical	Max	
t9	Duration of start signal	13	–	–	ms
t10	Position selection until actuation by Start ^{*)}	13	–	–	ms
t11	Duration of actuation after start high	13	–	–	ms
t12	New start after positioning completed	13	–	–	ms

^{*)} Positioning control is parametrized to "IGNORE START COMMAND"

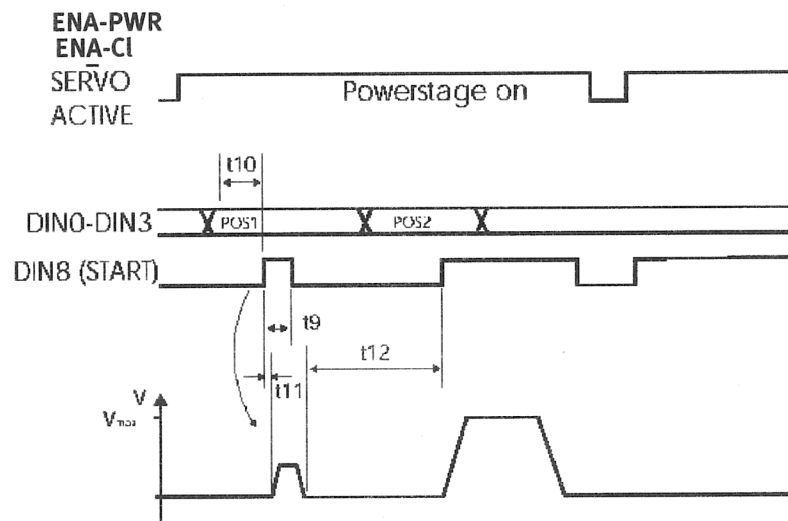


Fig. 8/20 Positioning by position selection and starting new positioning when previous positioning is completed: The new position cannot be preloaded by Start

8. Standard applications and settings of the parametrizing program

New positioning during current positioning

A feature of this parametrizing is that new positioning can be loaded and actuated before previous positioning is completed. The positioning thus loaded and actuated will be started automatically when previous positioning is completed.

Parameter T	Description	Delay time			Unit
		Min	Typical	Max	
t13	Delay of start after Din0-Din3 ready*)	13	–	–	ms
t14	Duration of start signal*)	13	–	–	ms
t15	Create new position after start low*)	13	–	–	ms

*) Positioning control is parametrized to "WAIT FOR END"

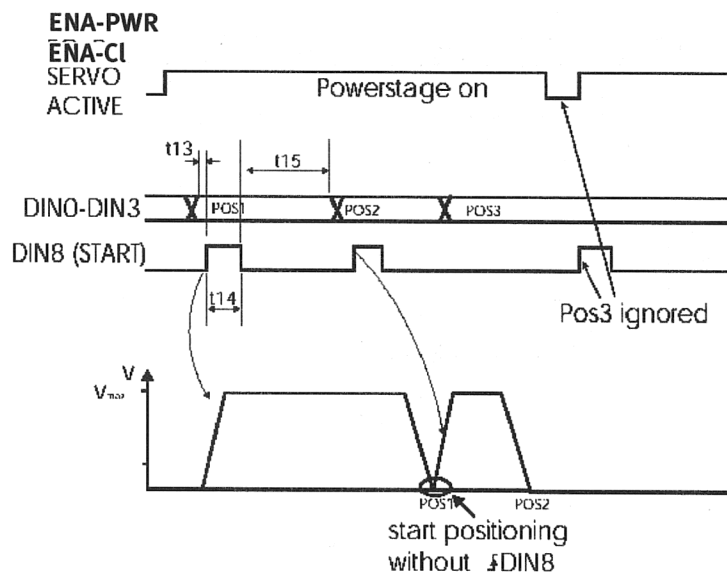


Fig. 8/21 Positioning by position selection and starting new positioning if previous positioning is not completed. The new position can be loaded with Start.

8. Standard applications and settings of the parametrizing program

New positioning by interrupting current positioning

A feature of this parametrizing is that new positioning can be loaded and actuated before previous positioning is completed and current positioning can be interrupted.

Parameter		Delay time			Unit
T	Description	Min	Typical	Max	
t16	Delay of start after Din0-Din3 ready	13	–	–	ms
t17	Create new position after start low ^{*)}	13	–	–	ms
t18	Duration of the start signal ^{*)}				

^{*)} Positioning control is parametrized to "INTERRUPT THIS"

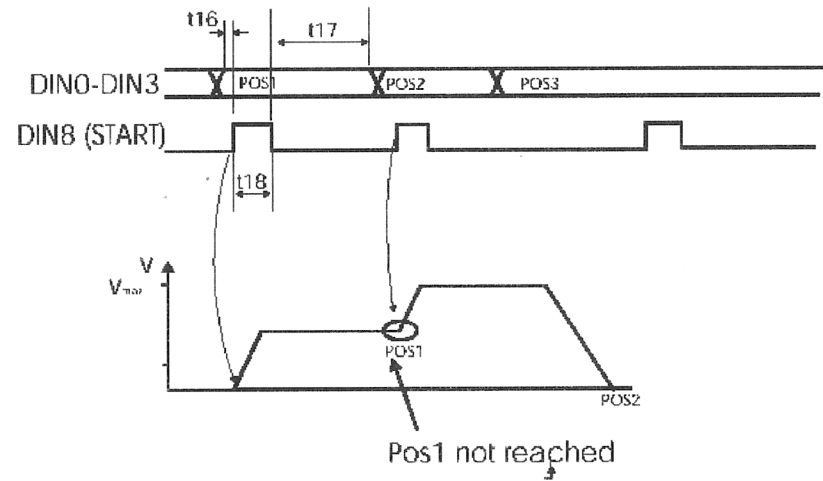


Fig. 8/22 Positioning by position selection and starting new positioning by interrupting current positioning.

8. Standard applications and settings of the parametrizing program

8.6.5 Feedback messages from the servo controller

Positioning ready messages (Xnominal=Xdestination, Xactual=Xdestination)

For feeding back the status to higher-order controllers during the processing of positioning profiles, you can use signals which can be parametrized as desired on one of the 3 digital outputs ([Parameters]/[Device Parameters]/[Digital Outputs]).

- “Xnominal=Xdestination” comes when the positioning profile of the positioning control has been processed. This signal can be used for switching further the positioning data records.
- “Xactual=Xdestination” is configured via the tolerance window ([Parameters]/[Positioning]/[Messages]). This signal comes when the position lies within the tolerance window. It can also trigger when a load moves the motor shaft out of its position.

8. Standard applications and settings of the parametrizing program

Parameter		Delay time			Unit
T	Description	Min	Typical	Max	
t19	Delay after start high	2	–	13	ms
t20	Minimum impulse duration ^{*)}	13	–	–	ms
t21	Delay after positioning ready	2	–	13	
*) With a very small tolerance window or large load disturbances					

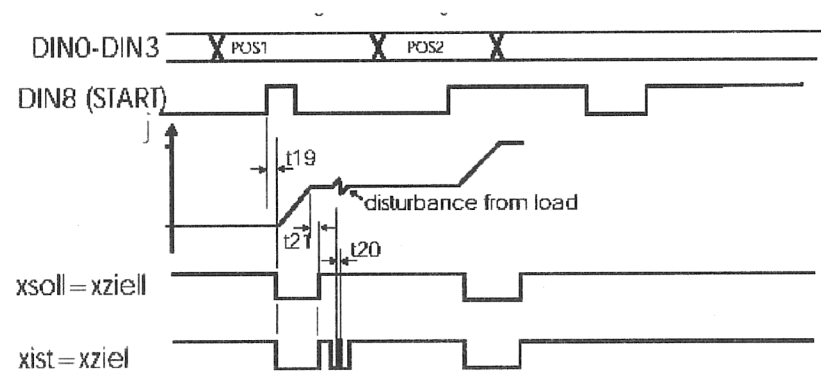


Fig. 8/23 Fig. 11/19 Ready messages “Xnominal=Xdestination” and “Xactual=Xdestination” after positioning.

8. Standard applications and settings of the parametrizing program

Rest time and rest path messages

In addition to the ready messages, which cannot be parametrized separately for each positioning data record, there are two parameters for displaying the path still to be traversed and the time still required ([Parameters]/[Positioning]/[Destination Parameters]).

If the condition is fulfilled, the relevant outputs will switch to high level.

([Parameters]/[Device Parameters]/[Digital Outputs]).

- “Rest path” comes when the positioning profile of the positioning controller still has to traverse the stretch entered in the rest path.
- “Rest time” comes when the positioning profile of the positioning controller still requires the time entered in the rest time. This signal can also be used for further switching the positioning data records.

8. Standard applications and settings of the parametrizing program

Parameter		Delay time			Unit
T	Description	Min	Typical	Max	
t22	Delay after start high Rest path LOW after start*) **) Rest time LOW after start *)	2	–	13	ms
t23		2	–	–	ms
t24		2	–	100	ms
*) With a long rest path (rest path longer than positioning length) the rest path display remains constantly active. **) The calculations refer to the setpoints from the positioning controller, not to the actual values measured. If the measurements cannot follow the positioning profiles specified by the positioning controller, deviations may occur.					

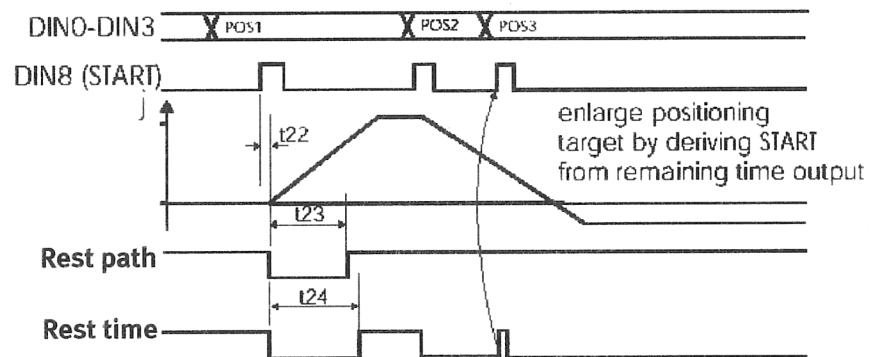


Fig. 8/24 Rest path and rest time messages during positioning.

Extended functions of the parametrizing program

Chapter 9

9. Extended functions of the parametrizing program

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9. Extended functions of the parametrizing program

9.1 File/Transfer window



The “Transfer” window is only accessible in the “Expert” mode. For switching on the Expert mode see the chapter “Setting the basic settings/mode of the parametrizing program”.

The parametrizing program communicates with the servo controller via the serial interface. A certain protocol, in which the individual commands are determined, is used for this purpose. The “Transfer” window enables you to send the commands directly to the servo controller and to observe the reply.

File/Transfer

You can activate the transfer window with the menu command [File][Transfer]....



Please note

While the “Transfer” window is active, other open windows are not operated (e.g. Actual values, Oscilloscope). Close the “Transfer” window if you no longer require it.

The “Transfer” window serves for commands which are of no interest for normal operation. Furthermore, memory locations can be read and written. This, too, is only necessary in special cases.

9. Extended functions of the parametrizing program

9.2 File/Installation device files



Festo has the possibility of sending additional information by diskette or E-mail. This information can be:

- motor selection list (not yet implemented)
- special parametrizings
- if necessary, special firmware (not yet implemented)

File/
Installation device files

In order to incorporate the additional information in the parametrizing program, select the menu item [File]/[Installation of device files].



The actual installation is carried out exactly as already described in the chapter 'Installation', first program start and communication, sub-chapter 'Installation'.

9.3 File/Concluding the program

You can conclude the program as follows:

- by selecting menu item [File]/[Exit]
- by the key combination ALT+F4
- by the key combination ALT+X
- by clicking the cross at the top left of the main window.

9. Extended functions of the parametrizing program

9.4 Setpoints/Setpoint specification

RS232

In order to specify a setpoint via the parametrizing program, one of the two setpoint-selectors must be set to "RS232" (=serial interface). (See previous chapter). This is usually setpoint-selector A. With the setpoint specification you can specify speeds (in speed-control mode) or torques (in torque-control mode).

Setpoints/Setpoint specification

In order to specify the setpoint via the parametrizing program, activate menu item [Setpoints]/[Setpoint specification]. The following window will appear:



Fig. 9/1

9. Extended functions of the parametrizing program

You can enter setpoints:

- by entering a value in the entry line and by pressing ENTER
- by actuating the slide controller.

STOP

In order to transfer setpoint 0 (emergency stop function), click the “STOP” icon.

Transfer

In order to implement setpoint jumps, you must delete the tick in the checkbox “Transfer immediately” by clicking it. The new setpoint will not be transferred until you click the “Transfer” button.

9. Extended functions of the parametrizing program

9.5 Analogue monitor

The servo controller possesses two analogue outputs for displaying control variables. These can be represented with an external oscilloscope or they can also be used as processing signals.

Analogue monitor

In order to configure the analogue monitor, you must select the menu item [Analogue monitor], and the appropriate channel as sub-menu.

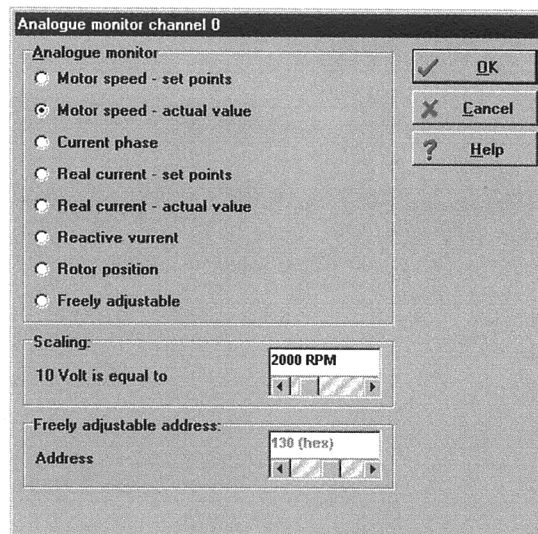


Fig. 9/2

Select the appropriate variable which is to be output by the analogue monitor.

Freely set address

The option “Freely adjustable address” is reserved for special applications.

9. Extended functions of the parametrizing program

9.6 Parameters/Device parameters/Setpoint scaling

The servo controller can process analogue setpoint specifications in both torque-control and speed-control modes. (See also the chapter 'Setpoints/Setpoint-selectors'). The controller has two analogue inputs for this purpose. With this menu you can assign an input voltage to a setpoint (speed or torque).

Parameters/
Device parameters/
Setpoint scaling

You can activate the menu with: [Parameters]/[Device parameters]/[Setpoint scaling]. The following window will appear:

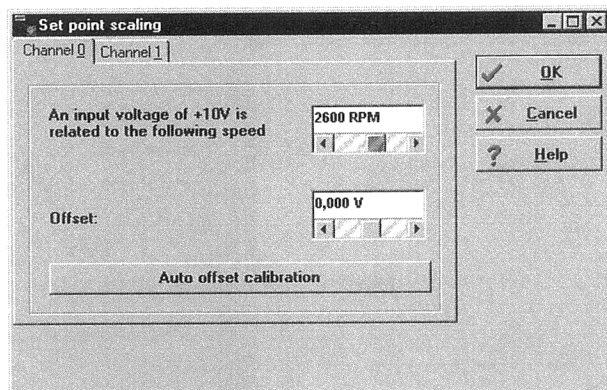


Fig. 9/3

The 'conversion factor' between the input voltage and the setpoint is specified with the upper value. The lower value is the zero point reference of the setpoint.

9. Extended functions of the parametrizing program

Automatic offset comparison

There is usually the problem that only a very small setpoint can be generated with an externally specified voltage of "0 V". The offset must be adapted here by a certain amount of millivolts. You can do this manually by setting the offset value accordingly. However, we recommend that you carry out an automatic offset comparison. To do this, you must click the "Auto offset calibration" button.

9.7 Parameters/Device parameters/Setpoint integrator ramp

The servo controller can process setpoint jumps in different ways. It can pass the jump onto the torque controller or speed controller unfiltered, or it can calculate a function which will combine the different setpoints by means of a ramp with an adjustable gradient (setpoint integrator).



nt ramp

The setpoint ramp is only available for setpoint-selector A.

The ramp function is available when the box "Setpoint ramp" in the "command" window is marked with a tick.

Parameters/Device parameters/SPI-ramp (Setpoint integrator)

The menu itself can be activated with [Parameters]/[Device parameters]/[SPI-ramp]. The following window will then appear:

9. Extended functions of the parametrizing program

The screenshot shows the 'SPI-ramp' dialog box. It has a title bar 'SPI-ramp'. Inside, there's a 'Connections' section with three checkboxes: ☐ t1 = t3, ☐ t1 = t2 = t3 = t4, and ☐ t2 = t4. To the right of these are three buttons: 'OK' (with a checkmark), 'Cancel' (with an 'X'), and 'Help' (with a question mark). Below the connections section are three sections: 'Turn right', 'Turn left', and 'Quick stop'. Each section contains two time input fields with spinners. 'Turn right' has t1: 0 to 6000 RPM (0,426 s) and t2: 6000 to 0 RPM (0,426 s). 'Turn left' has t3: 0 to -6000 RPM (0,000 s) and t4: -6000 to 0 RPM (5,971 s). 'Quick stop' has t5: 6000 to 0 RPM (0,200 s). At the bottom, there's an attention message: 'Attention: The times will only be altered after the regulator has been enabled once!'.

Section	Parameter	Value
Turn right	t1: 0 to 6000 RPM	0,426 s
	t2: 6000 to 0 RPM	0,426 s
Turn left	t3: 0 to -6000 RPM	0,000 s
	t4: -6000 to 0 RPM	5,971 s
Quick stop	t5: 6000 to 0 RPM	0,200 s

Attention: The times will only be altered after the regulator has been enabled once!

Fig. 9/4

The ramps can be set separately for clockwise and anti-clockwise running, also for rising and falling speeds/torques. If the ramp times are almost the same, the entry procedure can be shortened if the checkboxes (t1=t3; t2=t4; t1=t2=t3=t4) are used.

9. Extended functions of the parametrizing program

Fast stop

Controller behaviour in certain cases

In the following cases the positioning process is stopped and the drive is stopped in quick stop mode:

- if a limit switch is triggered during a positioning movement
- if the controller disable is activated during the movement (e.g. emergency stop).

Controller enable is not deactivated here in order to permit controlled braking of the drive.

In the fast stop mode the drive is braked either with maximum braking force or with a defined braking ramp. To do this you must set the entry "Quick stop" in the menu [Parameters]/[setpoint scaling] to a value greater than "0". This value corresponds to the braking time for the quick stop. The greater this time, the more slowly the motor will be braked.

When the device comes to a stand in the latter case, the controller disable becomes active. The device is then without power.



Please note

The quick stop setting is necessary in order to limit the mechanical stress on the axes coupled to the motor to within the permitted tolerances. If the quick stop time is too brief, the drive system may be damaged in the event of a quick stop being triggered.

The "quick stop" ramp should be set so that neither the axis nor the motor are damaged in an emergency stop. In practice, a time value is used corresponding to a delay of 10 m/s.



Please note

The times set do not become effective until there is a new controller enable.

9. Extended functions of the parametrizing program

9.8 Parameters/Device parameters/Speed message

For monitoring the speed, there is a device in the servo controller which sets a bit in the status word when the current motor speed is in a parametrizable speed range. The speed message can be parametrized in this window.

The menu can be activated with [Parameters]/[Device parameters]/[Motor speed message]. The following window will then appear:

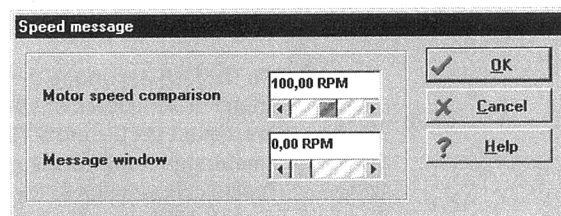


Fig. 9/5

In the field “Motor speed comparison” you can specify the speed at which the speed message is to be triggered.

In the field “Message window” you can specify a hysteresis. The speed may exceed or be lower than the parametrized value here, up to a maximum value, in order that the speed message can still be triggered.

If the hysteresis is too small, it will cause a wobbling output signal.

The status of the bit for the speed message can be shown on a digital output, if this is configured accordingly. See also the following chapter.

9. Extended functions of the parametrizing program

9.9 Parameters/Device parameters/Digital outputs

The servo controller possesses a total of five digital outputs. Three of these outputs can be freely configured, i.e. various status messages from the controller can be placed on these outputs and information thereby sent to a higher-order controller. Digital output 0 cannot be parametrized, it is used for displaying the readiness to operate. This signal is also shown by the LED on the front of the servo controller.

If your motor has a parking brake and if this is to be switched via a digital output, then a special output is available which must not be parametrized.

The menu can be activated with [Parameters]/[Device parameters]/[Digital outputs]. The following window will then appear:

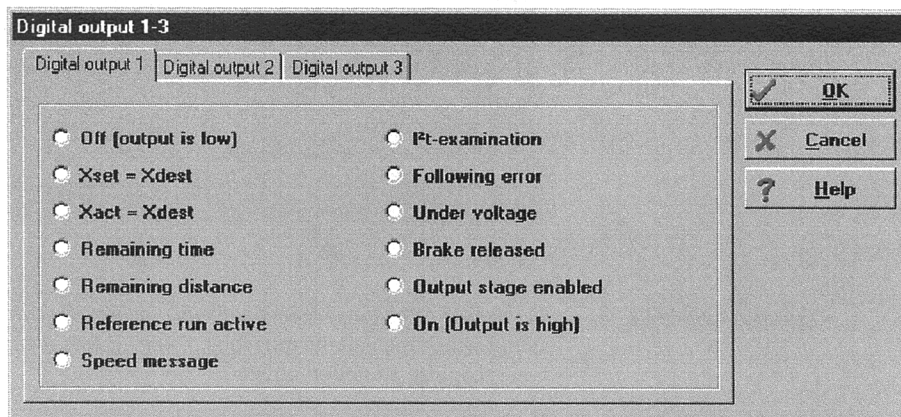


Fig. 9/6

All status messages which can be shown on the digital outputs can be set in the appropriate menu of the parametrizing program. With the settings "On (output is high)" and "Off (output is low)" you can assign a certain value to the output.

9. Extended functions of the parametrizing program

9.10 Parameters/Device parameters/Intermediate circuit voltage

In special applications, it may happen that the intermediate circuit voltage is either too high or too low.

If the intermediate circuit voltage is too high (overvoltage), an integrated brake chopper will switch in a parallel resistor, so that the voltage can be reduced via this brake resistor. This brake resistor is incorporated in the SEC-AC. If the voltage rises again, the controller will switch itself off. This function cannot be parametrized.

If the intermediate circuit voltage has been parametrized too low by the user, faults may be triggered. The menu can be activated with [Parameters]/ [Device parameters]/[Intermediate circuit control]. The following window will appear:

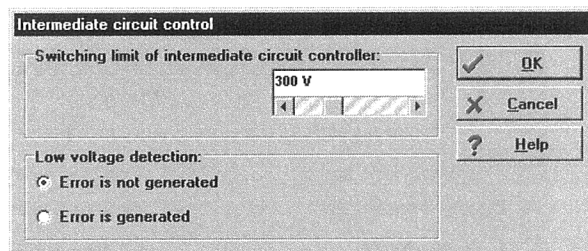


Fig. 9/7

Response threshold

In the field "Response threshold" you can specify the value under which the voltage must sink, in order that the controller can recognize an undervoltage.

Parameters/Device parameters/Digital outputs

The flag, which is set in the controller, can be read by various status interrogations, e.g. a digital output can be parametrized so that it displays the event "Undervoltage in the intermediate circuit". (See also the section 'Parameters/Device parameters/Digital outputs').

9. Extended functions of the parametrizing program

Error signal

In the field “Error signal,” you can specify whether an error message with controller switch-off is to be generated in the event of undervoltage.

9.11 Parameters/Device parameters/Automatic brake

If your motor has a parking brake, this can be supplied with power by the servo controller. The controller can only switch parking brakes which operate at a rated voltage of 24 V DC. In order to activate the parking brake, you must activate the menu [Parameters]/[Device parameters]/[Automatic brake]. The following window will appear:

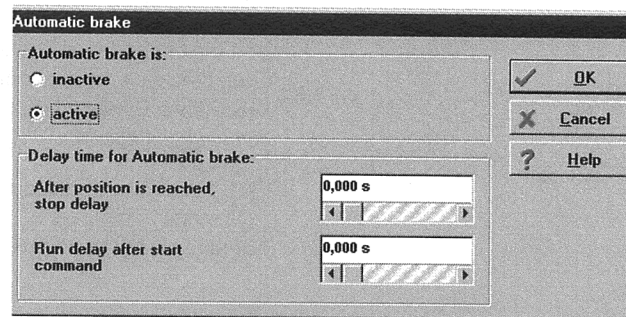


Fig. 9/8

A digital output is provided in the servo controller for switching the brake. The brake is always switched as soon as the controller enable is switched on. The servo controller also has an automatic brake, for which various times can be parametrized. These times are only effective when the automatic brake mode is activated.

9. Extended functions of the parametrizing program

You can parametrize a positioning start delay. In the speed-control mode, this delay time causes the brake to be switched and the nominal speed value to be maintained at zero for the parametrized time when the controller enable is switched on. In the positioning mode, this delay time causes positioning to be started with a delay after a new start command.

This delay time is necessary for compensating the mechanical inertia of the brake. If your axis is under load (e.g. a vertical axis), this time must be parametrized at all costs, as otherwise the motor cannot hold its position when the brake is applied/released.

In the field "Start delay", you can parametrize a further time. If positioning is carried out in the position control mode and if the axis has reached its destination, the brake will be applied and the controller will be disabled after this delay time. However, the synchronizer control must be switched off. If new positioning is started during this delay time, the brake will remain unswitched.

This delay time is provided to enable you to switch off the final stage in the case of axes under load, if positioning does not take place for long periods.

9. Extended functions of the parametrizing program

9.12 Error window

The error window is a permanent window in the user interface of the parametrizing program. If there is no fault, the window will remain in minimized form (see drawing).



Fig. 9/9

The error window can be represented in its full size as a result of three events:

1. When the menu item [Error] in the user list is clicked.
2. When the "Error" field (second field from the left in the lower status bar) is clicked.
3. Automatically when a fault occurs.

As soon as a fault occurs, two changes take place in the user interface of the parametrizing program:

1. The error window becomes larger and is shown full-size.
2. The fault is shown in red in the lower bar.

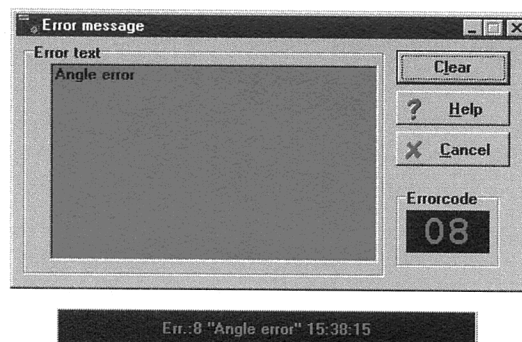


Fig. 9/10 Error messages

9. Extended functions of the parametrizing program

Error treatment takes place in three steps:

Help

1. Fault analysis: If the error text does not contain enough information and you would like to have further tips on how to rectify this fault, click "Help" in the error window. (In this example the fault has probably been caused by a broken/non-inserted connection to the phase-angle sensor).
2. Fault remedy: Rectify the cause of the fault. (In this example the phase-angle sensor must be connected correctly).

Delete

3. Fault acknowledgement: Click the "Delete" button in the error window. If the fault can be rectified successfully, the window will be minimized again. If the fault still exists, the window will be shown full size again.

Abort

You can minimize the window by clicking the "Cancel" button. Any error messages which still exist will remain in the error window of the status bar.



The "Cancel" button does not rectify the fault.

9. Extended functions of the parametrizing program

9.13 Options/German - English

The language of the parametrizing program can be set with a click on the menu item [Options]/[Deutsch] or [Options]/[English].

9.14 Options/User mode



The setting of the user mode is described in the chapter 'Basic settings', section 'Setting the mode of the parametrizing program'.

9. Extended functions of the parametrizing program

9.15 Options/Window for RS232 transmission

When this menu item is accessed, a window is generated in which communication via the serial interface can be observed. This window serves mainly for debugging purposes and is not of interest for the “normal user”.

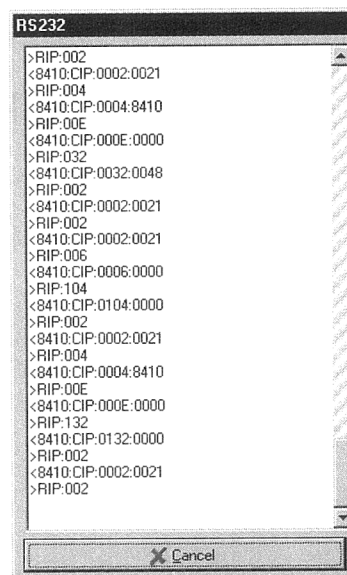


Fig. 9/11

9. Extended functions of the parametrizing program

9.16 Options/Torque in Nm



Information on this theme can be found in the chapter “Standard applications and settings of the parametrizing program”, section “Torque-control mode”.

9.17 Options/Oscilloscope

The oscilloscope function incorporated in the parametrizing program enables signal curves to be represented. It also permits the optimization of the current controller and the positioning module in reverse mode.

The oscilloscope can be activated with menu item [Options]/[Oscilloscope]. After an initialization phase, the following window will be shown:

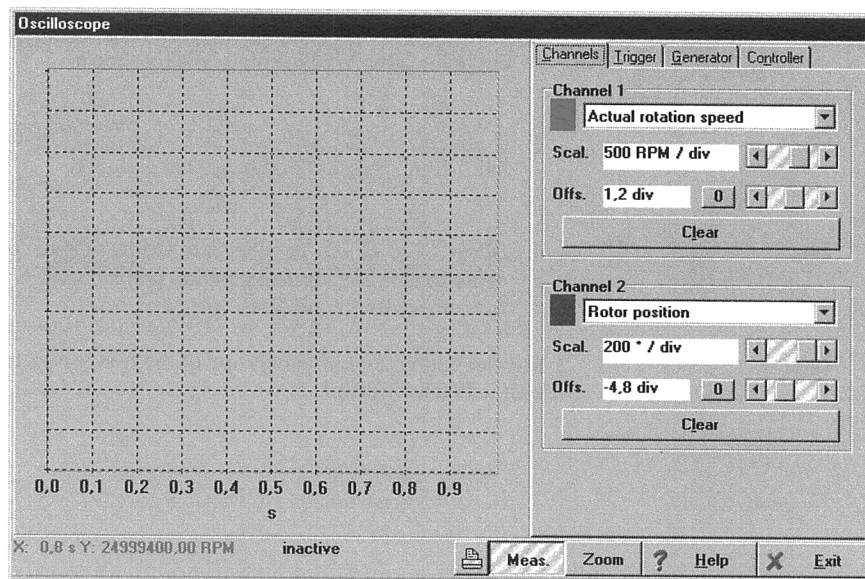


Fig. 9/12

9. Extended functions of the parametrizing program

In the right-hand half of the oscilloscope window there are four register cards for more exact settings:

- for selecting and representing the channels
- for setting the trigger
- for setting the reversing generator
- for setting the positioning module and the speed controller.

9.17.1 Register card “Channel representation”

The oscilloscope possesses two channels. The following settings can be made in the register card:

1. The measured variable to be represented: Click the selection box of the relevant channel.
 2. The colour of the channel: Click the coloured box. A dialogue for selecting the colour will be shown.
 3. Y-scaling: Use the slide switch next to “Scal”, in order to set the enlargement in the vertical direction.
 4. Offset / Y-position: Use the slide switch next to “Offs”, in order to shift the vertical position of the curve. A click on the box resets the offset to “0”.
- Scal
- Offs
- Clear
- You can delete the representation of the two curves by clicking the “Clear” button.

9. Extended functions of the parametrizing program

9.17.2 Register card “Trigger”

The trigger controls the recording process in the oscilloscope. Recording begins as soon as the “trigger event” occurs.

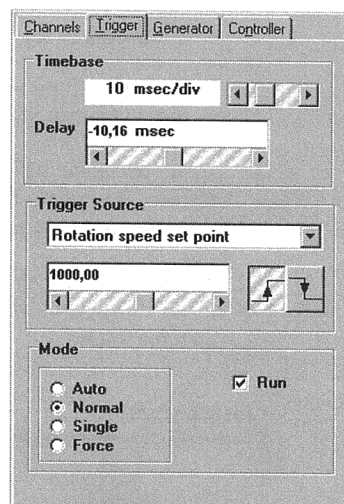


Fig. 9/13

Time base

1. You can specify the time resolution with the upper slide switch in the box “Timebase”. A value of 10 msec/div means that a box width in the oscilloscope representation corresponds to a time period of 10 milliseconds.

Delay

2. You can specify the position of the trigger event in the oscilloscope screen with the slide switch “Delay”. A delay value of “0” indicates that the trigger event is recorded at the left-hand edge of the oscilloscope screen. A negative delay value shifts the trigger event to the right.

9. Extended functions of the parametrizing program

3. The trigger source can be selected in the selection list in the box "Trigger source" in the selection list. A distinction is made between digital and analogue trigger sources.
 - Digital trigger source: This can only assume the status Yes or No. An example is the controller enable.
 - Analogue trigger source: This assumes a numerical value. An example is the actual speed value.
4. Trigger threshold: Only visible with analogue trigger sources. The trigger process begins as soon as the analogue trigger exceeds or falls below the threshold.
5. Trigger edge: Use both the buttons in the box "Trigger source". You can specify the moment of triggering. See the table below.



Rising edge	Falling edge
	
Digital trigger: event occurs Analogue trigger: threshold is exceeded	Digital trigger: event disappears Analogue trigger: threshold not reached

Fig. 9/14

9. Extended functions of the parametrizing program

6. Trigger mode: The moment of triggering can be set here. There are four different trigger modes:
- “Auto”: Triggering is carried out and displayed continuously, whether the triggering condition is fulfilled or not.
 - “Normal”: Triggering is carried out and displayed as soon as the triggering condition is fulfilled. Triggering continues after the display and when the triggering condition occurs again.
 - “Single”: Triggering is carried out only once when the triggering condition is fulfilled. The status is then switched inactive when the checkbox **Run** (see below) is deactivated.
 - “Force”: Triggering is carried out whether the triggering condition is fulfilled or not. The status is then switched inactive.



Please note

The trigger mode and the oscilloscope are only active when the checkbox “Run” in the box “Mode” is marked with a cross.

9. Extended functions of the parametrizing program

9.17.3 Register card “Generator”

In this menu you can set the reversing generator. This does not serve for normal operation, but simply for optimizing the speed controller and the positioning module. The reversing mode enables the controller to move backwards and forwards continuously between two positions.

The reversing generator is handled with low priority in the firmware. This can lead to delays in operation.

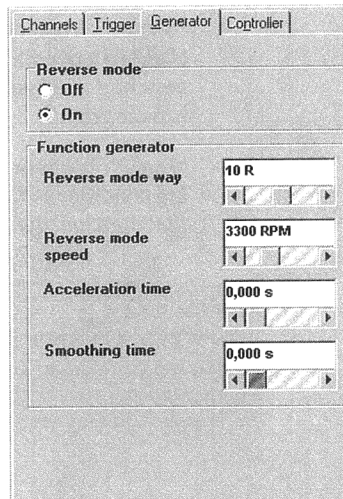


Fig. 9/15

The reversing mode can be switched on and off.



Caution

Before exiting the reversing mode, you must switch it off.

9. Extended functions of the parametrizing program

Reversing path/
Reversing speed

In the field "Reversing path" you can determine the difference between the two positions. In the field "Reversing speed" you can set the positioning speed.

Acceleration time

For normal cases, a square-wave function is required for the nominal speed. In this case, you must assign the field "Acceleration time" with 0. If a ramp function is required, you must enter a value larger than 0.

The field "Smoothing time" is only of interest when an acceleration time >"0" is specified. If the value of the field "Smoothing time" is "0", this will result in a linear acceleration ramp; otherwise a smoothing function will be used.

9.17.4 Register card "Controller"

In this menu you can test various settings of the current controller and positioning module. This should be carried out in the reversing mode.



The button "Restore" will only be visible if you have modified the controller settings.



Notes on setting the speed controller can be found in the chapter 'First start and optimizing the motor', section 'Optimizing the speed controller'.

9. Extended functions of the parametrizing program

9.17.5 Lower status bar

Measuring values

In order to ascertain the value of a measured variable, simply move the mouse to the appropriate point in the oscilloscope interface. In the lower status bar you will find information on the timing point and the value of the measured variable:

X: 6.3 ms Y: 0.00 UPM

Status of the oscilloscope

On the right next to the X/Y-display in the lower status bar you will find a field with information on the current status of the oscilloscope.

waiting for trigger

The most important messages are:

Message	Meaning
Inactive	Oscilloscope is switched off; the box "Run" in register card "Trigger" is not activated.
Waiting for trigger	Oscilloscope is activated and waits for the trigger event. The trigger event is not found.
Triggered	Trigger event is found; recording begins.
Reading	Read data are transferred to the parametrizing program by the servo controller.
OK	Recording is ready.

Fig. 9/16

9. Extended functions of the parametrizing program

Printing

The oscillogram can be printed out if the button shown below is pressed.



Representation mode

The oscilloscope possesses two representation modes: the Measuring mode and the Zoom mode. The mode currently active can be recognized in the lower status bar.



The standard mode is the measuring mode. You can switch from one mode to the other by clicking the appropriate button.

In the measuring mode, the XY-display is operated (see above). In the zoom mode, a part of the recorded curve can be enlarged. To do this, you must press down the left-hand mouse key and mark the field in the oscilloscope window which is to be enlarged. You can return to the original size by clicking the oscilloscope window with the right-hand mouse key.

9. Extended functions of the parametrizing program

9.18 Help/Using help

Under the menu item [Help]/[Help for help] you will find a general Windows help.

9.19 Help/Themes



See the chapter “Online helps”.

9. Extended functions of the parametrizing program

9.20 Helps/Information

Under the menu item [Helps]/[About] you will find the following window:

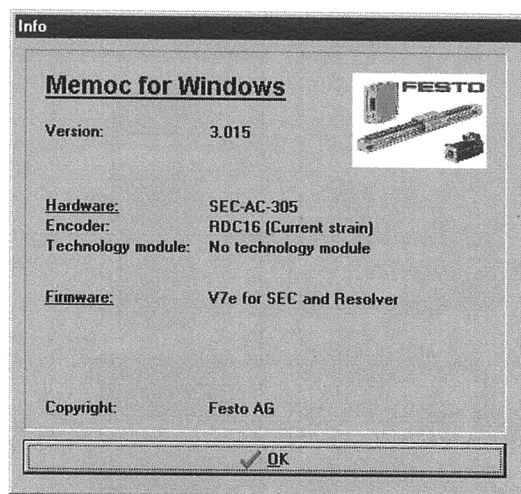


Fig. 9/17




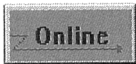
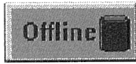





The window contains the following information:

- the version number of the parametrizing software
- the device type of the servo controller
- the type of angle sensor used
- the type of technology module used (if available)
- firmware: version and specifications for angle sensors
- copyright note.

9. Extended functions of the parametrizing program

9.21 Fast access via the icon bar

Some of the functions of the parametrizing program can be accessed directly in the icon bar underneath the menu bar:

Symbols	Function
	Set German
	Set English
	Search for communication
	Online parametrizing
	Offline parametrizing
	Oscilloscope
	Motor data menu
	Current controller
	Speed controller
	Reference travel

9. Extended functions of the parametrizing program



Symbols	Function
	Set positions
	Move to positions

Fig. 9/18

9. Extended functions of the parametrizing program

Diagnosis and error treatment

Chapter 10

10. Diagnosis and error treatment

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10.1	Status display	10-3
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10.3	Outputting faults	10-4
10.4	Error list	10-5
10.5	Warning: old firmware	10-7

10. Diagnosis and error treatment

10.1 Status display

The following states are displayed by means of status messages:



Status	Description
	Controller enable
	Revolving outer segments – display of relative motor direction – display of relative motor speed

Fig. 10/1 Status list

10.2 General information

Extensive monitoring functions ensure very reliable operation of the servo controller. The micro controller and an additional external hardware logic register error signals from the motor, evaluate the shaft encoder and final output stage and can switch off the final output stage extremely quickly.

In addition to hardware faults, the servo controller can also recognize faults in the control circuit. This includes, e.g. faults in communication or in the positioning procedure.

10. Diagnosis and error treatment

10.3 Outputting faults

The user is informed of faults occurring in the servo controller in the following ways:

- by the display of a 2-figure error code number on the 7-segment display on the housing. First the tens figure of the error code number are shown, followed by the units figure. For example, error 08 will be indicated first by the display 0, then by the display 8 and finally a blank.
- If a PC with a parametrizing program is connected, the fault together with its error number will be shown in the error window and in the status bar. See also the chapter 'Extended functions of the parametrizing program', section "Error window".

10. Diagnosis and error treatment

10.4 Error list

Below is a table with error numbers, cause of fault and methods of rectifying the fault.

Error no.	Description	Remedy
02	Undervoltage in intermediate circuit	Check the 230 V AC power supply. See also chapter 'Extended functions of the parametrizing program', section 'Parameters/Device parameters/Intermediate circuit voltage'
03	Excessive temperature in motor	Check plug connection X6 and the connecting cable from the servo controller and the motor. If the motor does not have a temperature sensor, the relevant input on plug X6 must be short-circuited.
04	Excessive temperature in final stage	Check the fitting conditions of the servo controller. If necessary, a ventilator must be used.
05	Partial failure of low voltage supply	You cannot rectify this fault. Contact your Festo service.
06	Overcurrent/short circuit in final stage	Check the connecting cable to the motor. If you are using very long cables, this fault may be triggered by leakage currents. In this case, you must observe very closely the EMC safety instructions for the servo controller. The overcurrent fault may be caused by an incorrect current controller parametrization.
07	Overvoltage in the intermediate circuit	Check the 230 V AC power supply. See also chapter 'Extended functions of the parametrizing program', section 'Parameters/Device parameters/Intermediate circuit voltage'.
08	Angle sensor fault	Check plug X2 and the angle sensor cable from the servo controller and motor.
09	Path overrun when positioning	This fault occurs when the positioning range is overrun.
11	Fault in reference travel	This fault occurs when the maximum search path is exceeded. Either you must define a larger search path or the limit switch could not be found for other reasons. This fault also occurs when both limit switches are actuated at the same time.
14	Fault in angle sensor identification	Possible causes of fault: no intermediate circuit voltage, motor shaft cannot turn freely, rated current set too low

10. Diagnosis and error treatment

Error no.	Description	Remedy
16	Initialization fault	You cannot rectify this fault. Contact your Festo service.
17	Position deviation too large	This fault is shown when the value, which is set in the monitoring function as a drag fault, is exceeded. See chapter 'Extended functions of the parametrizing program', section 'Positioning module'.
18	Fault in positioning pre-calculation	You cannot rectify this fault. Contact your Festo service.
20	Incremental sensor input fault	Angle sensor wired incorrectly
21	Offset current measurement too large	Fault in current measurement. You cannot rectify this fault. Contact your Festo service.
25	Unknown device type	You cannot rectify this fault. Contact your Festo service.
26	Flash memory: no user parameter set	This fault only occurs if you switch off the servo controller within 3 seconds of issuing the command [Save parameter]/[parameter set] or if you press the reset button during this period. The data could not be written completely into the flash memory. You can rectify this fault by loading the parameter set again from the hard disc into the controller. See chapter "Basic settings", section "Loading preset parameter sets".
27	Flash memory: check sum fault	You cannot rectify this fault. Contact your Festo service.
28	Flash memory: write fault	You cannot rectify this fault. Contact your Festo service.
31	I ² t fault	

Fig. 10/2

10. Diagnosis and error treatment

10.5 Warning: old firmware

The parametrizing program possesses options which function at best with a firmware version as from 07e. If firmware of version V6 or older is found, the following warning will appear on the screen:

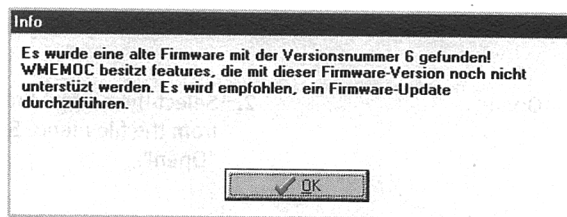


Fig. 10/3

Helps/About

You can find out the version of the current firmware by selecting [Helps]/[About] in the menu bar. You will then see the following menu:

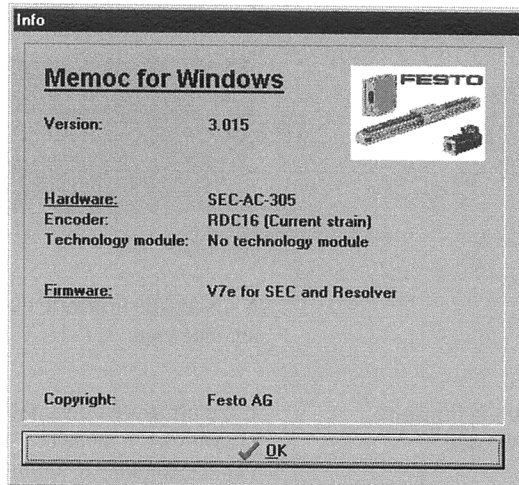


Fig. 10/4

10. Diagnosis and error treatment



(Firmware version V7d is loaded in this example.)
If the correct firmware is already loaded in the controller, you can omit this chapter.

Loading firmware into the servo controller

- | | |
|------------------------|---|
| File/Firmware download | 1. Select the command [File]/[Firmware download] in the menu bar. |
| Open | 2. Select the correct firmware for your servo controller from the file menu. See the table above. Then click "Open". |
| 57600 baud | 3. You will be asked for the baud rate for the firmware download. Enter 57600 baud for the first attempt. This will guarantee a fast download. If there are problems with the download, select a lower speed and confirm with "OK". |
| | 4. Follow further instructions. |

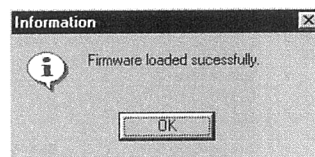


Fig. 10/5

A successful firmware download will be shown by the following message:

Fault in firmware download

If the firmware download is not successful, this will be shown by the message "Fault in firmware download". The cause is usually a communication fault in transferring the data to the servo controller. Repeat the procedure described above with a lower baud rate.

List of the RS232 commands

Chapter 11

11. List of the RS232 commands

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11. List of the RS232 commands

11.1 RS232 test possibilities



Caution

Due to direct operation of the SEC-AC via RS232 commands, there is full access to the internal variables of the servo controller. Incorrect operation can lead to unexpected reactions of the controller and the motor can start uncontrolled. Operation via the RS232 commands should therefore be undertaken only by experienced users.

The RS232 commands listed can be transmitted to the SEC-AC with any commercially-available terminal program. A simple terminal window has been included in the Wmemoc software for test purposes. The following window appears when you access the function under [File]/[Transfer]:

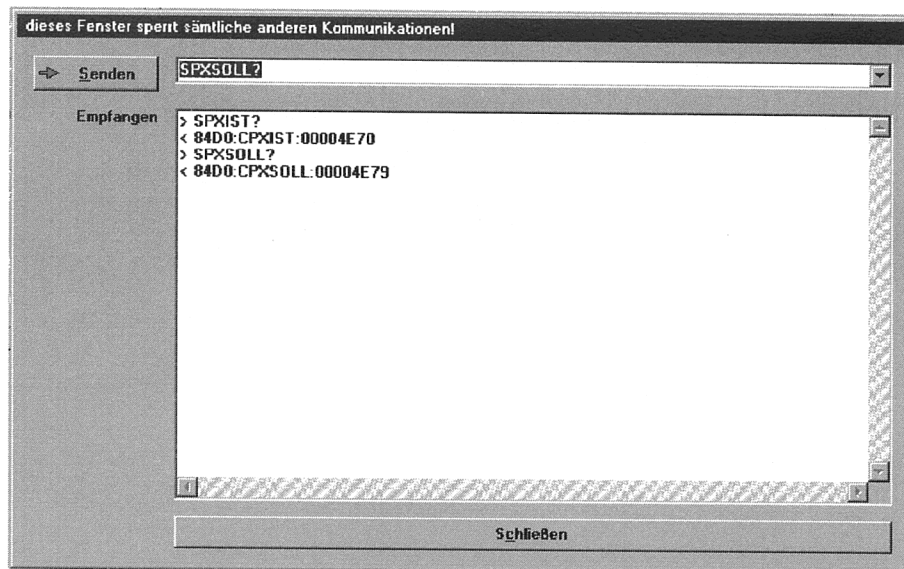


Fig. 11/1

11. List of the RS232 commands

Enter the command code in the upper line and confirm the transfer with the “Send” button.

The transferred command and the reply from the SEC-AC appear in the lower window.



Please note

When the “Transfer” window (Terminal window) is activated, all other communication protocols will be deactivated. The controller can then only be operated via this window until the “Transfer” window is deactivated.

The commands listed are implemented in the controllers as from firmware version 5c. Please contact Festo if you require an update.

11. List of the RS232 commands

11.2 General commands/messages

Command	Syntax	Reply
Controller enable on/off functions only when controller enable logic is set to Din5 and RS232	SRF+ / SRF-	xxxx:CRF+ / CRF-
Switches off the final stage	SES-	xxxx:CES-
Quits fault	SQT+ / SQT-	xxxx:CQT+ / CQT-
Re-initializes controller	RESET!	
Saves the parameters of the internal RAM in the external flash IC	SAVE!	DONE Programming_error! Verify_error!
Sets the baud rate for serial communication	BAUD9600 BAUD19200 BAUD38400 BAUD57600	xxxx:ok
Reads controller type	TYP?	
Command unknown		xxxx:ERR!
Buffer overrun		xxxx:OVL!

Fig. 11/1

11. List of the RS232 commands

11.3 Selecting the operating mode

Command	Syntax	Reply
Torque control mode on/off	SIN+ / SIN-	xxxx:CIN+ / CIN-
Switches positioning module on/off	SLA+ / SLA-	xxxx:CLA+ / CLA-
Position control on/off	SPO+ / SPO-	xxxx:CPO+ / CPO-
Switches synchronous run on/off	SYNC+ / SYNC-	xxxx:CSYNC+ / CSYNC-
Nominal value integrator on/off	SHL+ / SHL-	xxxx:CHL+ / CHL-

Fig. 11/2

11.4 Specifying the speed

For specifying the speed via the RS232, one of the nominal value selectors (A or B) must first be set to RS232 in the menu "Nominal values" with the parametrizing program.

Command	Syntax	Reply
Speed specification in rpm	SN4:HHHH	Xxxx:CN4:HHHH

Fig. 11/3

11. List of the RS232 commands

11.5 Reference travel/Position control

The following abbreviations apply to the positioning commands:

- PP: Positioning record (hexadecimal form)
- 00: CAN
- 01: Serial interface
- 02: Reference (not permitted)
- 03: POS 0
-
- 09: POS 6
- 0A: POS 7
- 12: POS 15
- TTTT: Time in ms (hexadecimal form)
- VVVV: Speed in rpm (hexadecimal form)
- XXXXXXXX: Path in increments (hexadecimal form)
(65536 increments are 1 revolution)
- MMMM: Each functionality corresponds to 1 bit.
The individual expressions must be
OR-linked to form the total functionality.

11. List of the RS232 commands

Behaviour when start is made with current positioning

- 0000 Start is ignored with current positioning
- 0001 Current positioning interrupted (start)
- 0020 Wait for end of current positioning

Reference point for positioning:

- 0000 Current nominal position (relative positioning)
- 0002 Zero position (absolute positioning)
- 0010 Last (or not reached) destination

Synchronization:

- 0000 Synchronization off
- 0008 Synchronization on (for flying saw)

SS: Status after SPSTART/after SPSELPOS

- 00 Positioning started or controller ready for pos.
- 01 Positioning control is off
- 02 Final output stage is off
- 04 Reference travel active
- 08 Current positioning cannot be aborted

11. List of the RS232 commands

Command	Syntax	Reply
Starts reference travel	REFGO!	Xxxx:CREFGO
Set destination position	SPX:PP:XXXXXXXX	Xxxx:CPX:PP:XXXXXXXX
Set acceleration time	SPT1:PP:TTTT	Xxxx:CPT1:PP:TTTT
Set smooth part	SPT1R:PP:TTTT	Xxxx:CPT1R:PP:TTTT
Set braking time	SPT2:PP:TTTT	Xxxx:CPT2:PP:TTTT
Set smooth part	SPT2R:PP:TTTT	Xxxx:CPT2R:PP:TTTT
Set max. speed	SPVMAX:PP:VVVV	Xxxx:CPVMAX:PP:VVVV
Set final speed	SPVEND:PP:VVVV	Xxxx:CPVEND:PP:VVVV
Set rest path trigger	SPTTRG:PP:TTTT	Xxxx:CPTTRG:PP:TTTT
Set rest time trigger	SPXTRG:PP:XXXXXXXX	Xxxx:CPXTRG:PP:XXXXXXXX
Start positioning	SPSTART:PP	Xxxx:CPSTART:SS
Set time selector for ext. start	SPSELPOS:PP	Xxxx:CPSELPOS:SS
Set positioning type	SPMODE:PP:MMMM	Xxxx:CPMODE:PP:MMMM
Set actual position at existing value	SPSETX:XXXXXXXX	Xxxx:CPSETX:XXXXXXXX
Interrogate actual position	SPXIST?	Xxxx:CPXIST:XXXXXXXX
Interrogate nominal position	SPXSOLL?	Xxxx:CPXSOLL:XXXXXXXX

Fig. 11/4

11. List of the RS232 commands

11.6 Synchronization unit

The functionality of the synchronization unit cannot yet be controlled completely by RS232. If necessary, contact your dealer.

Command	Syntax	Reply
Reads status of synchronization unit aa: zpr_x_sel bb: zpr_n_sel cc: zpr_x_sel_ref dd: zpr_n_sel_ref	GETSYNC!	Xxxx:GETSYNC:aabbccdd
Sets status of synchronization unit	SETSYNC:aabbccdd	Xxxx:DONE

Fig. 11/5

11.7 Parking brake

Command	Syntax	Reply
Automatic brake on/off	SABR+ / SABR-	Xxxx:CABR+/CABR-
Switches the parking brake on (pull immediately, until next SBR-, no positioning possible)	SBR+	Xxxx:CBR+
Switches the parking brake off (release immediately, but automatic brake is active again after next positioning)	SBR-	Xxxx:CBR-

Fig. 11/6

11. List of the RS232 commands

11.8 Commissioning/Calibrating

These commands are used by the parametrizing software and made available to the user in an easy-to-use form. The user should trigger these commands only via the parametrizing software.

Command	Syntax	Reply
Load default parameter block (for motor EK87-120) Automatically carries out SAVE and RESET (Access only with controller enable switched off)	DSP!	Xxxx:CDP
Start motor identification	MOTID!	Xxxx:DONE
Decrement/increment offset analogue input 1	GND1-/GND1+	Xxxx:OK!
Decrement/increment offset analogue input 2	GND2-/GND2+	Xxxx:OK!

Fig. 11/7

11.9 Parameter commands

Before modifying individual parameters with these commands, you should contact your dealer. These commands permit direct uncontrolled access to almost all internal variables of the controller.

Command	Syntax	Reply
Read parameter	RIP:ooo	Xxxx:CIP:aaaa:HHHH
Read LONG parameter	RIPL:ooo	Xxxx:CIPL:aaaa:HHHHHHHH
Write parameter	SIP:ooo:HHHH	Xxxx:CIP:aaaa:HHHH?
Write LONG parameter	SIPL:ooo:HHHHHHHH	Xxxx:CIPL:aaaa:HHHHHHHH?
Write confirmation for commands SIP and SIPL	OK!	Xxxx:DONE

Fig. 11/8

11. List of the RS232 commands

11.10 Example of parametrizing

Set operating mode: position transducer and positioning control

Command	Syntax	Reply
Serial nominal speed value to 0	SN4:0000	xxxx:CN4:0000
Torque regulator off	SIN-	xxxx:CIN-
Positioning control on	SLA+	xxxx:CLA+
Switches synchronous mode on	SPO+	xxxx:CPO+
Position transducer on	SYNC+/SYNC-	xxxx:CSYNC+/CSYNC-
Nominal value integrator on/off	SHL-	xxxx:CHL-
Quit error	SQT+ SQT-	xxxx:CQT+ xxxx:CQT-
Controller enable on: Functions only when controller enable logic is set to Din5 and RS232	SRF- SRF+	xxxx:CRF- xxxx:CRF+

Fig. 11/9

11. List of the RS232 commands

Set position block 3 (this position block can be selected via the digital inputs as position 0):

Command	Syntax	Reply
Acceleration time 100ms	SPT1:03:0064	xxxx:CPT1:03:TTTT
30ms thereof smooth	SPT1R:03:001E	xxxx:CPT1R:03:TTTT
Braking time 200ms	SPT2:03:00C8	xxxx:CPT2:03:TTTT
200ms thereof smooth	SPT2R:03:00C8	xxxx:CPT2R:03:TTTT
Positioning type: relative related to last destination, current positioning is interrupted	SPMODE:03:0011	xxxx:CPMODE:03:MMMM
max. speed 1500 rpm	SPVMAX:03:05DC	xxxx:CPVMAX:03:05DC
Final stage speed 0 rpm	SPVEND:03:0000	xxxx:CPVEND:03:0000
Rest time trigger off	SPTTRG:03:0000	xxxx:CPTTRG:03:0000
Rest path trigger off	SPXTRG:03:00000000	xxxx:CPXTRG:03:00000000
Positioning path 1.5 rev.	SPX:03:00018000	xxxx:CPX:03:00018000
Start positioning	SPSTART:03	xxxx:CPSTART:00
Positioning path -2.2 rev.	SPX:03:FFFDCCCD	xxxx:CPX:03:FFFDCCCD
Start positioning	SPSTART:03	xxxx:CPST

Fig. 11/10

11. List of the RS232 commands

Set current position to 1.5 rev.

Command	Syntax	Reply
Current position 1.5 rev.	SPSETX:00018000	xxxx:CPSETX:XXXXXXXX
Interrogate actual position	SPXIST?	xxxx:CPXIST:00018000
Interrogate nominal position	SPXSOLL?	xxxx:CPXSOLL:00018000

Fig. 11/11

Technical Appendix

Appendix A

A. Technical Appendix

A. Technical Appendix

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