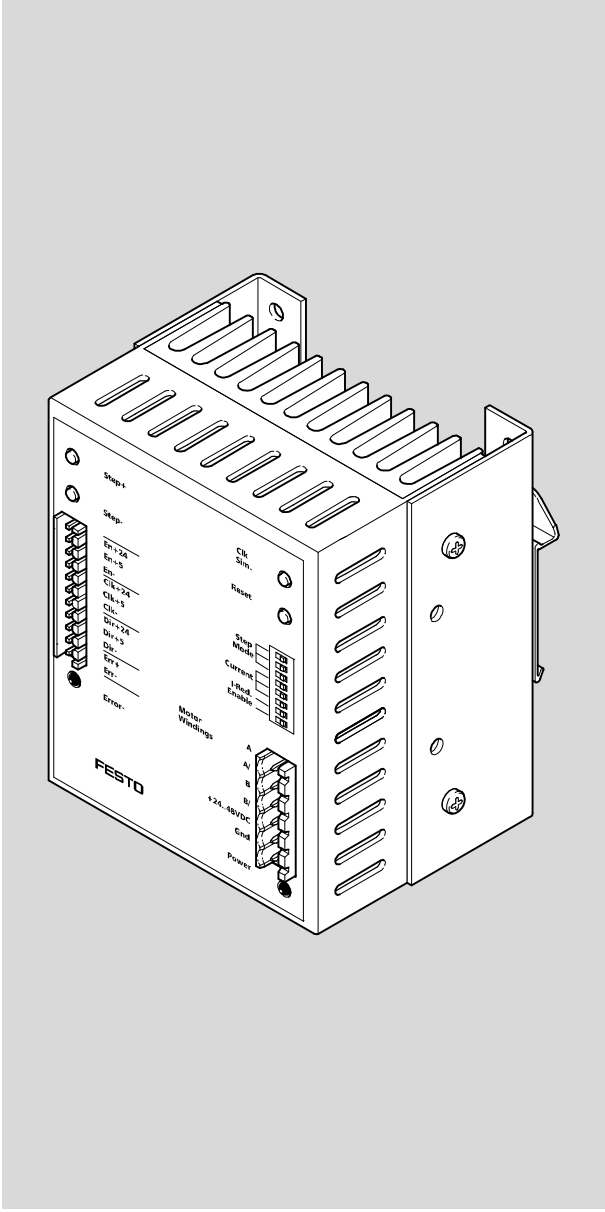
Motor controller

SEC-ST-48-6-P01



FESTO

Description

8046712
en 1507d
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Designation SEC-ST-48-6-P01-EN

Edition ..... en 1507d

Original ..... de

Part no. ..... [8046714]

Contents

Designated use

The SEC-ST-48-6-P01, referred to here as the SEC-ST, **S**mart **E**lectromotor **C**ontroller **St**epper motor, has been designed for use in control cabinets for controlling stepper motors in 2-string technology.

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

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

The SEC-ST may only be operated in a stationary industrial or commercial system. The electromagnetic resistance to interference of the power electronics is not designed for operation in mobile systems, in households or in firms which are connected directly to the low voltage network.

Install the SEC-ST screened and earthed in a control cabinet. Otherwise, the electromagnetic compatibility (EMC) of the power electronics cannot be guaranteed.

The SEC-ST may only be used as follows:

– in accordance with designated use

– in its original state

– without any modifications by the user

– in faultless technical condition.

If additional commercially-available components such as sensors and actuators are connected, the specifiedlimits for pressures, temperatures, electrical data, torques, etc. must not be exceeded.

Please observe the standards specified in the relevant chapters and comply with technical regulations, as well as with national and local regulations.

Target group

This manual is directed exclusively at technicians trained in control and automation technology,

- who are dealing for the first time with stepper motor controllers
- or who already have experience of stepper motors.

Service

Please consult your local Festo service centre if you have any technical problems.

Notes on the use of this manual

This manual will help you in successfully commissioning your SEC-ST for the first time.

This manual contains important information and provides you with the basic knowledge which you will require for operating the SEC-ST correctly.

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

- the description:
  Here you can learn important instructions and the aim of each work step.
- the instructions:
  Here you learn how to carry out the work steps.

General information on stepping motor systems

Description

Stepping motors are a special type of synchronous motor triggered through electrical pulses from a required control unit. Here, a pulse always corresponds to the same rotational angle. This permits positioning without acknowledgement. Due to their ”digital” rotation, stepping motors are used as switch mechanisms and in positioning technology. It should be noted that the control system does not receive any kind of acknowledgement that the motor has, in fact, performed its step.

Accuracy and resolution

The step angle depends on the structural form; for the two-phase Festo stepping motors type MTR-ST, the angle is 1.8° (+/-5%) in full step. A single step takes place when the two coils receive full alternating current. Here, the stepping motor performs a step of 1.8° each time the current to the coils alternates.
But it is also possible to supply the two coils simultaneously with different current shares. The result is a 1/2, 1/4, 1/5, 1/8, 1/10 or 1/32 of a step, depending on the current share. This allows considerable refinement in the maximum resolution of positions to which a stepping motor can run.

The smallest incremental path (resolution) on a positioning axis is determined by the motor’s step angle (number of steps per revolution) and the feed constant of the positioning axis (determined by the diameter of the input pinion or the slope of the spindle).

This can be calculated as follows:

$$\text{Number of steps per revolution} = \frac{360°}{\text{Motor step .angle}}$$

$$\text{Resolution} = \frac{\text{Feed constant of the axis} \cdot \text{Gear multiplication}}{\text{Steps/Revolution}}$$

Example

Motor step angle: 0.9° (+/- 5%) at half-step
Feed constant of the positioning axis: 120mm/revolution
Gear multiplication: 1/4 (gear reduction i = 4)

The above example results in a resolution of 0.075 mm per step.

All positions that this motor-gear-axis combination can run to are divisible by 0.075.
In contrast, if the motor runs in quarter step, the resolution is 0.0375 mm; in one-tenth step, even a resolution of 0.00375 mm per step would be possible. Axis play, circumferential backlash of any gears and the tolerance of the stepping motor itself have to be calculated in. The stepping motor's tolerance must always be taken into account as the absolute value of the full step.
This must be considered when very precise positioning assignments are to be executed.

Basic information

Despite the simplicity of the stepping motors, it should be mentioned that it is not a controller. The control system does not receive any kind of acknowledgement whether the motor has, in fact, performed its step.
And so it is extremely important to dimension the motor using its speed-torque characteristic curve. This ensures that the applied load can, in fact, be moved by the motor with the specified acceleration and speed.
If the motor loses a step, that is, if the applied load is greater than the force the motor can produce, the part to be positioned is no longer in the desired position. Errors that must be monitored in the overall system, such as through limit switches, can thus occur.

Start-stop frequency

Another important variable in the use of stepping motors is the so-called start-stop frequency. It is the frequency or speed at which the stepping motor can safely, that is, without loss of step, start and also stop again under the torque to be provided.

Losses of step can occur when decelerating (stopping) just as much as when accelerating!

Resonance frequencies

Impressing of a fixed current for the maximum holding torque of a stepping motor can cause the motor to tend to oscillate. Since the stepping motor is a synchronous motor, it follows the set field within very narrow limits. If no load is applied, the rotor oscillates beyond the targeted step due to the very low inertia. If excitation of the next step takes place at an unfavourable time, the system resonates.

The following possibilities exist to reduce the incidence of this resonance.

– In practice, one tries to put the start-stop frequency into a higher area (ca. 200 Hz and higher), since stepping motors in the lower frequency areas have more resonance frequencies.

– One can combat it by increasing the start-stop frequency or through lower phase current.

– Conversion from full-step to half-step or quarter-step operation can also provide help.

– It is helpful to always operate the motor with its nominal load. If that is not possible, the phase current should be reduced.

Phase current

Phase current is the current that flows through strand of a winding. At the maximum phase current, the stepping motor has its maximum holding torque. The phase current should be adjusted to the load. That is, it does not always make sense to set the motor's maximum phase current. If the motor is run without load or with a torque lower than its nominal torque, it can also carry out steps too far or begin to resonate (see above), which is equivalent to a loss of step.
The set phase current flows at all times through the active coils of the motor, even when the motor is standing still. An advantage of this is that the motor has a certain resting torque and can be loaded with its holding torque during standstill. Also, the motor is warmed even at standstill. If this holding torque is not needed in standstill, it makes sense to reduce the phase current when the motor is at standstill. The Festo stepping motor controller SEC-ST-48-6-P01 offers this option.

With these attributes of the stepping motor considered, it provides an economical positioning variant with adequate precision.

Procedure for correctly adjusting the stepping motor

Determining the possible speed with known load

If the torque of the load on the drive is known, the possible speed can be determined from the speed-torque characteristic curve.
The highest usable speed is the one where the resulting torque is about 80% of the maximum torque. Beyond that, the motor's loss of torque is so great that the danger of losing steps increases.

Resonance

Increased incidence of resonance can be expected in full-step operation. Since this always depends on the system, it cannot always be precisely determined where resonance will occur. Here it is necessary to test.
In general, it is advantageous to run at half-step to reduce resonance. Current should be reduced when the motor is run without load. Current that is set too high can also cause resonance and thus a loss of step.

Example

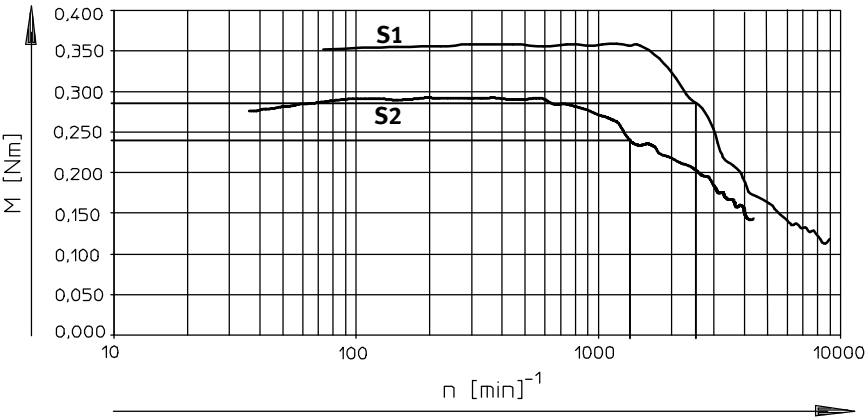


Fig. 0/1: Upper graph S1 - full step / lower graph S2 - half step
M = Torque, n = Speed

The characteristic curve shows the maximum speed that can be run at full or half step, depending on the set torque (in the example around 1100 RPM at half step).

Determining the start-stop frequency

It is advantageous to set the start-stop frequency as high as possible since resonance leading to losses of step can occur especially in the lower frequency areas.
The start-stop frequency is increased until the drive loses steps when starting. Then the start-stop frequency is reduced again by a good 20% to ensure that no steps are lost during acceleration. A starting value of 400 Hz for small drives and around 200 Hz for large drives can be assumed.

How can incidences of resonance be suppressed? Tips and tricks!

- Half step instead of full step.
  Half step here is better than full step. The two-phase stepping motor shows generally good run characteristics at half step.

- Set phase current lower (to the value actually required).
  While this reduces the system's stiffness, it also reduces its tendency to oscillate.

- Operating frequencies not equal to resonance frequencies.
  The operating frequency is often near the resonance frequency or is a multiple of it. Small deviations from the "critical" step frequency usually show good results.

- Make the acceleration ramps steeper.
  The stepping motor is "pulled" through the critical areas quickly and so does not tend so quickly to oscillate.

- Increase the friction (emergency solution)
  Friction dampens the entire system, but useful torque is lost.

Important user instructions

Danger categories

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

Warning
This means that failure to observe this instruction may result in serious personal injury or damage to property.

Caution
This means that failure to observe this instruction may result in personal injury or damage to property.

Please note
This means that failure to observe this instruction may result in damage to property.

The following pictogram marks passages in the text which describe activities with electrostatically sensitive components.

Electrostatically sensitive components may be damaged if they are not handled correctly.

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 environment-friendly use of Festo products.

Text markings

- The bullet indicates activities which may be carried out in any order.

1. Figures denote activities which must be carried out in the numerical order specified.

– Hyphens indicate general activities.

Trademarks

All product names in this documentation are registered trademarks. All trademarks in this documentation are only used for identifying the relevant product.

Safety instructions

Please note
The relevant safety instructions and accident-prevention regulations valid for each specific application must be observed during installation, commissioning and maintenance.

The following precautionary measures also apply without claim to completeness:

- Regulations for setting up high-voltage systems up to 1000 volts.
- Electrical equipment for machines.
- Equipping high-voltage systems with electronic operating media.

System summary

Chapter 1

Contents

1.1 Overview

The SEC-ST stepper motor controller is used for simple commissioning of stepper motors in 2-string technology.

By means of digital inputs, control can be carried out in respect of the number of steps and the direction.

1.2 Performance characteristics

- Bipolar chopper driver
- Input voltage 24 V DC to 48 V DC
- Phase current can be set up to 6 A in 8 steps
- Automatic current reduction to 30 % of the set phase current can be switched on
- 1/1, 1/2, 1/4, 1/5, 1/8, 1/10 and 1/32 of a step possible
- Step frequency max. 40 kHz
- Manual movement with push buttons possible
- Protective function against excess temperature and short circuit
- Error output

1.3 Controller part

1.3.1 Brief description

Communication with higher-order controllers, e.g. programmable logic controllers (PLC) takes place via inputs and outputs.

The inputs are completely electrically isolated from each other. This inputs can be actuated with either 5 V or 24 V. (See section 1.6 User interfaces)

By means of push buttons, an individual step or travel can be carried out in both directions of rotation.

1.4 Final output stage

1.4.1 Brief description

The integrated final output stage can control up to 6 A string current. The string current can be set with the dip switch. (see 1.7.2).

1.4.2 Internal monitoring

The end stage possesses an excess temperature cut-out, as well as monitoring in the event of short circuit of the motor strings between each other or against GND. (edition see 1.6. User interfaces)

1.5 Displays

1.5.1 Ready-to-operate display

The blue ready-to-operate LED (Power) on the front of the SEC-ST indicates the readiness to operate.

1.5.2 Fault display

A fault is shown by a red LED “Error”.

1.6 User interfaces

1.6.1 Enable input

The controller is enabled via the Enable input.

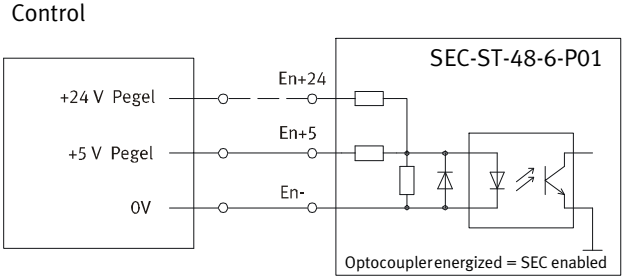


Fig. 1/1:

Please note
An incorrect connection may cause damage to the SEC-ST or to the higher-order control.

- Please note the output levels of your higher-order control.

+24 V **or** +5 V can be used as signal level.

1.6.2 Direction input

The direction of rotation of the motor is determined via the Direction input.

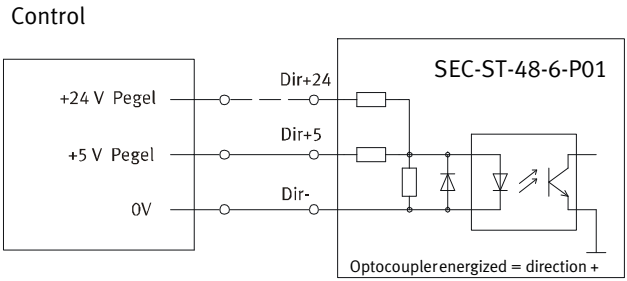


Fig. 1/2:

Please note
An incorrect connection may cause damage to the SEC-ST or to the higher-order control.

- Please note the output levels of your higher-order control.

+24 V **or** +5 V can be used as signal level.

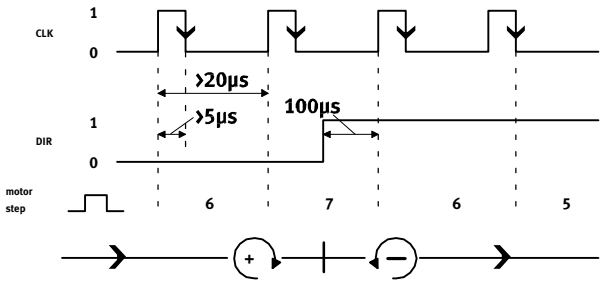


Fig. 1/3:

1.6.3 Clock input

The motor performs a step via the Clock input.

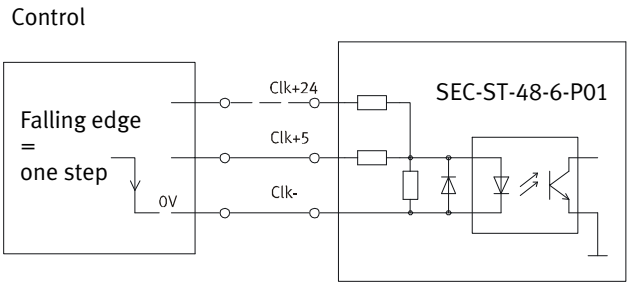


Fig. 1/4:

Please note
An incorrect connection may cause damage to the SEC-ST or to the higher-order control.

- Please note the output levels of your higher-order control.

+24 V **or** +5 V can be used as signal level.

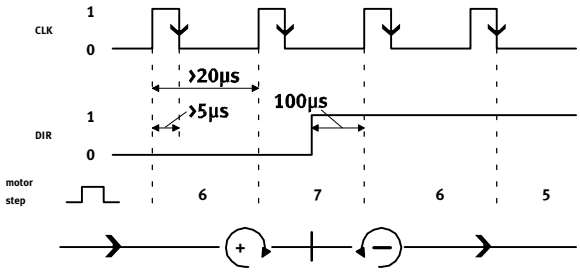


Fig. 1/5:

1.6.4 Fault output

The temperature of the controller is monitored. A fault is also shown here in the event of a short circuit (red LED).

There is a fault output for logical scanning.

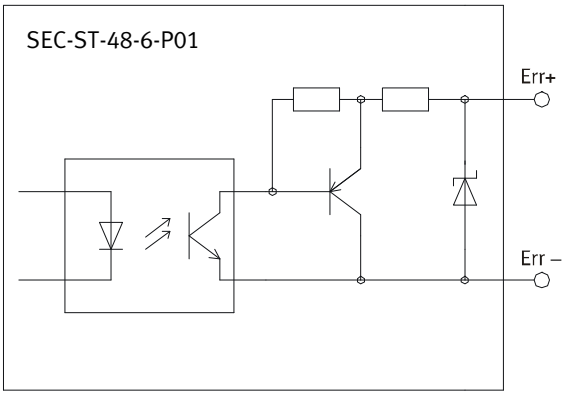


Fig. 1/6:

Caution
Note the maximum permitted voltage of + 30 V DC and the maximum permitted current of 30 mA at the fault output Err+.

Connecting example

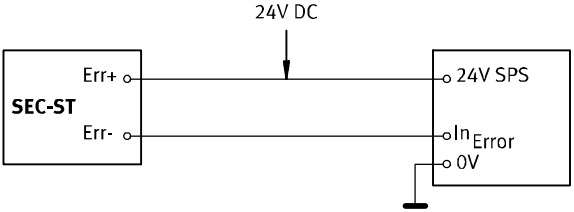


Fig. 1/7:

1.7 Settings

1.7.1 The step mode

The step mode can be set by the user by means of dip switches 1, 2 and 3. The default value (as at factory) is set as half step.

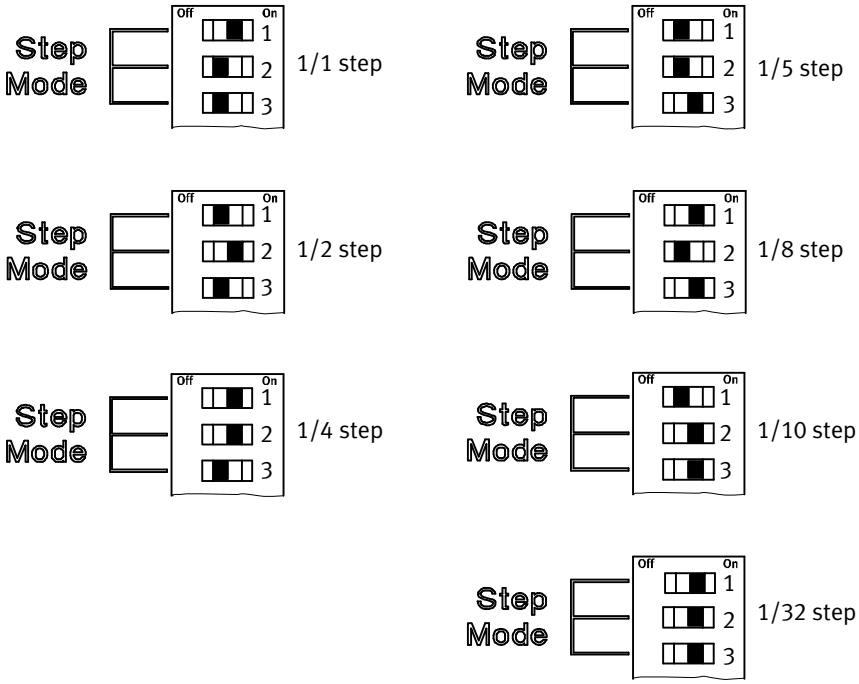


Fig. 1/8:

Step designation	Number of steps per revolution
1/1 step	200
1/2 step	400
1/4 step	800
1/5 step	1000
1/8 step	1600
1/10 step	2000
1/32 step	6400

1.7.2 The current setting

The 8 adjustable current values apply to the stepper motors from Festo.

The setting is made with the dip switches 4, 5 and 6.

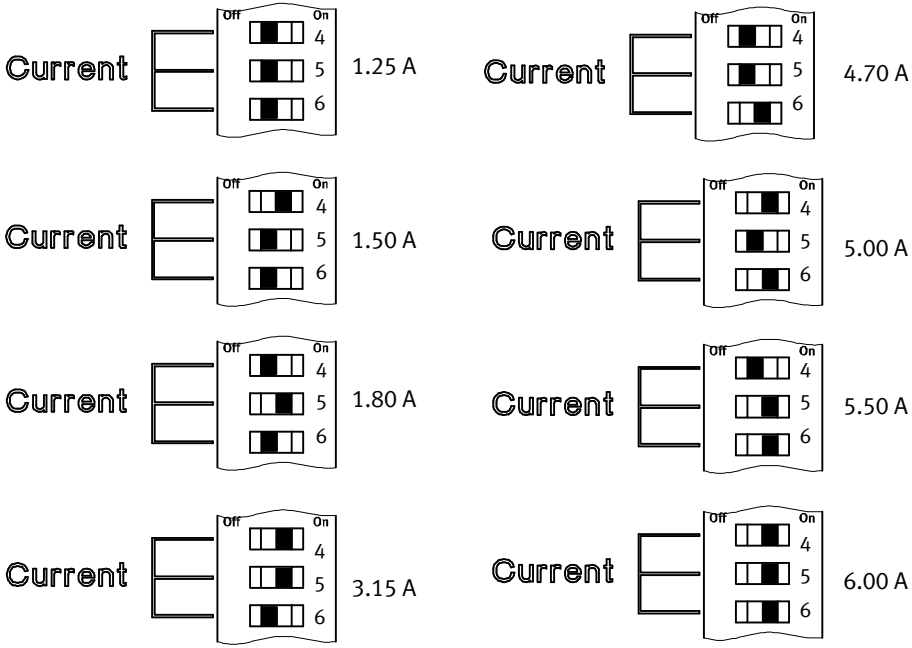


Fig. 1/9:

Caution
Observe the maximum permitted holding current of your stepping motor. Please refer to the data sheet of the relevant motor for the current settings.

1.7.3 The current reduction I-red

The automatic current reduction can be activated with dip switch 7. If there is no step signal for at least 80 ms, the string current will be reduced to 30 % of the set current.

Switch 7 on = current reduction active (default value)

Fig. 1/10:

Caution
With active current reduction, the holding torque of the motor is reduced.
Note in particular with vertical applications.

1.7.4 Enable switch

The motor current can be switched off with dip switch 8. When the motor current is switched on again, the motor windings will be energized with the current which was applied immediately before it was switched off.

Switch 8 off = motor current off (Default value)

Fig. 1/11:

1.7.5 The buttons

Buttons Step+ and Step–	With these buttons you can test the stepper motor. When the Step+ button is pressed, the stepper motor starts to turn. The direction depends on the wiring of the motor phases; with the stepper motors from Festo: in a clockwise direction (view of motor shaft). It thereby increases its rotational speed step by step. When the Step- button is pressed, the stepper motor turns in the opposite direction.
Button Clock Sim	With this button you can simulate the Input “Clock”. Each time you push it, a step will be carried out. The button is not debounced.
Button Reset	Pressing this button, you can reset the SEC-ST. All the inputs, outputs, displays and buttons are then without function. The motor current is switched off. After releasing the button, the SEC-ST is reinitialized and the motor is energized again.

Please note
The settings which you make on the SEC-ST do not become active until you press the Reset button (or switching the SEC-ST off and on again).

Fitting

Chapter 2

Contents

2.1 Dimensions

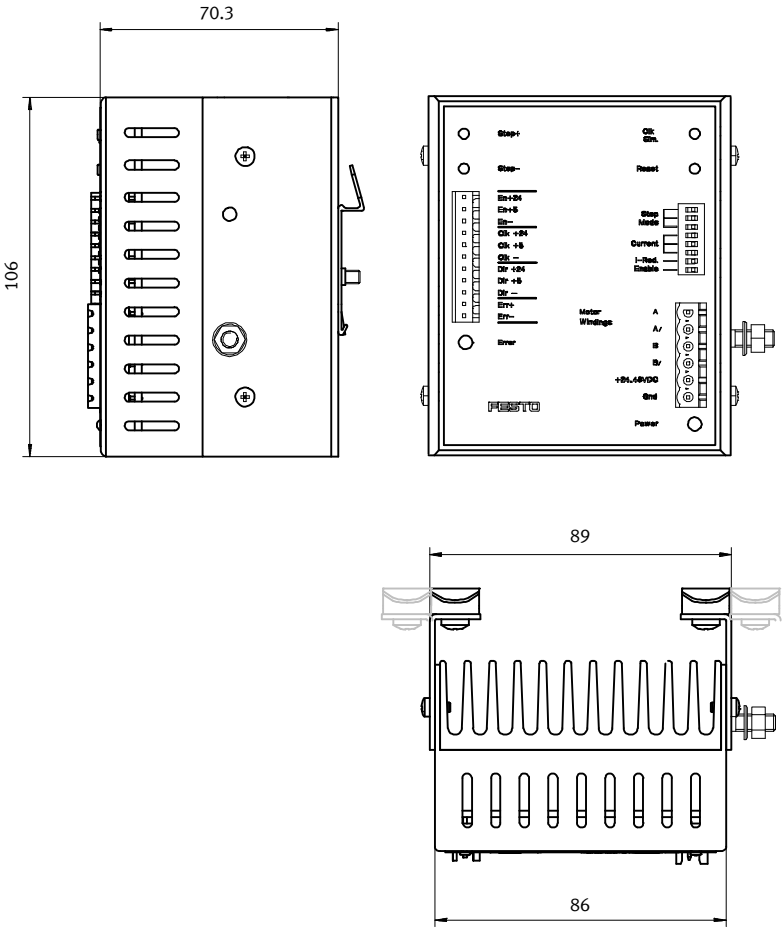
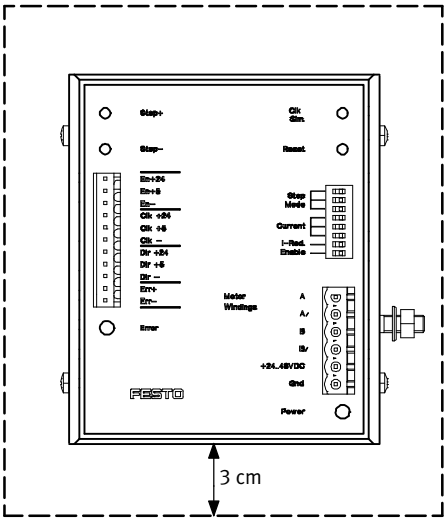


Fig. 2/1: Dimensions of the SEC-ST

Please note
Screening can be attached to the M4 earthing screws intended for this purpose.

Fastening screws must not be used as earthing screws.

The devices in this series are intended as compact units for fitting into a control cabinet or onto a wall. The loss of power which occurs in operation and the subsequent heating of the unit depends on the output. The SEC-ST is being cooled by convection. There must be a gap of at least 3 cm on all sides for sufficient cooling.



2.2 Current supply

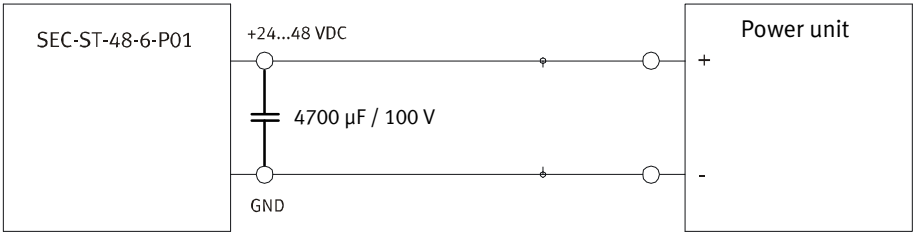


Fig. 2/2:

Warning

- Use only PELV **circuits** as per IEC/DIN EN 60204-1 (Protective Extra-Low Voltage, PELV) for the electrical supply. Consider also the general requirements for PELV circuits in accordance with IEC/DIN EN 60204-1.
- Use power **supplies** which guarantee reliable electrical isolation of the operating voltage as per IEC/DIN EN 60204-1.

By the use of PELV circuits, protection against electric shock (protection against direct and indirect contact) is guaranteed in accordance with IEC/EN 60204-1 (Electrical equipment for machines, General requirements).

Caution

Serious damage to the device !

- Make sure the polarity is correct.
- Do **not** disconnect any cables before the power supply to the system is switched off.

For rated output in the designated application range a power unit with 48 V DC is required. The SEC-ST can also be operated with 24 V DC. Losses in the dynamics of the stepper motors must be taken into account here (see data sheet for the stepper motors).

With motors with rated current ≥ 4,5 A and at the same time high braking energies (recommendation) :

- Connect a **capacitor** of at least 4700 µF / 100 V at the power supply connection, in order to prevent exceeding the permitted voltage (e.g. when braking).

2.3 Electromechanics: front view

1 Button Step+
2 Button Step–
3 Plug X1
4 LED Error
5 Button Clock Sim
6 Button Reset
7 Switches 1...8
8 Plug X2
9 Plug X3
10 LED Power

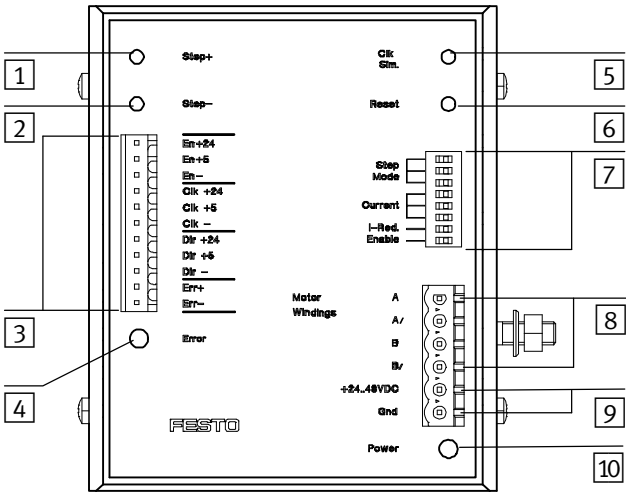


Fig. 2/3: Front view of the SEC-ST

Warning
Note the pin assignment on plug connector X3. The unit may become seriously damaged if the connection terminals are swapped.

Installation

Chapter 3

Contents

3.1 Material

3.1.1 Manufacturer

Caution
Incorrectly prepared cables may damage the electronics and trigger off unexpected movements of the motor.

- Test every cable in accordance with the instructions in the section “Connecting the cables” (see 3.3). Make sure that the cables are correctly connected and that the plugs are provided with strain-relief.

Caution
Long lines reduce immunity to interference (EMC).

- Do not exceed the maximum permitted cable lengths:
  – Control cable: 30 m
  – Power supply cable: 10 m
  – Motor cable: 10 m

For cabling the electric components of the system, use only the cables from the Festo accessories ➔ www.festo.com/catalogue

Assemble a cable for connecting the cable screening to the earth terminal of the controller with the following characteristics:

– Cable Ø1.5 mm² Length 60±10 mm

– Cable with push-in sleeve: flat plug 6.35x0.81

– Earth terminal at the motor controller:
  cable lug M4

3.1.2 Plug X1 for control cable

1 plug connector, 11-pin from Weidmüller, BLZ 3.5/11 SN SW, order no. 161572, included in delivery.

3.1.3 Plug X2 for stepper motor connection

1 plug connector, 4-pin from Weidmüller, BLZ 5.00/4 SN SW, order no. 159608, included in delivery.

3.1.4 Plug X3 for power supply

1 plug connector, 2-pin from Weidmüller, BLZ 5.00/2 SN SW, order no. 162516, included in delivery.

3.1.5 PE connection of the SEC-ST

The PE connection of the SEC-ST (mains and motor side) is made via an M4 threaded bolt.

3.2 Plug connectors and their pin assignments

3.2.1 X1 plug for control cable KSPC-SECST-1.5

* Plug connector: Weidmüller, BLZ 3.5/11 SN SW

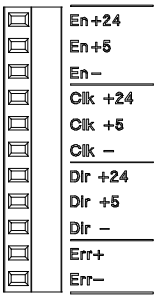


Fig. 3/1:

Pin	Brief description	Meaning/remark
1	EN+24	Enable input + 24 V (7 mA)
2	En+5	Enable input + 5 V (10 mA)
3	En–	Enable input –
4	Clk +24V	Clock input + 24 V (7 mA)
5	Clk +5V	Clock input + 5 V (10 mA)
6	Clk–	Clock input –
7	Dir +24V	Direction input + 24 V (7 mA)
8	Dir +5V	Direction input + 5 V (10 mA)
9	Dir–	Direction input –
10	Err+	Fault output + (max. 30 mA)
11	Err–	Fault output –

Fig. 3/2: Assignment of plug connector X1

3.2.2 Motor cable and current supply for the SEC-ST

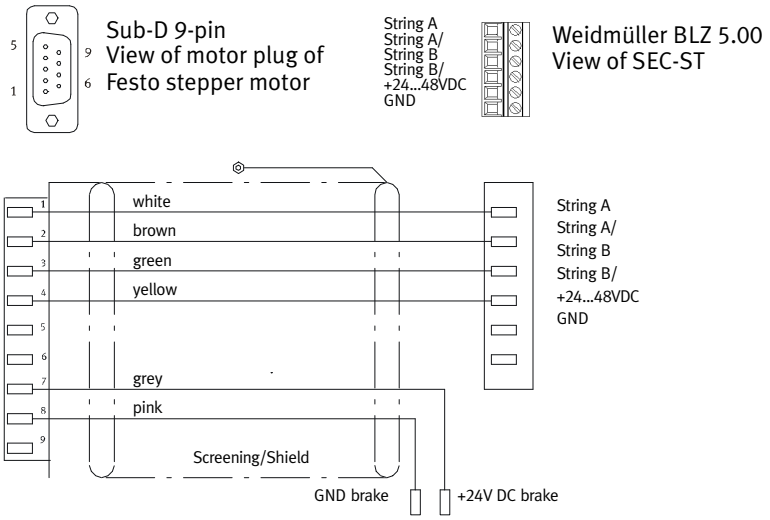


Fig. 3/3: Pin assignment of motor cable

Pin	Brief description	Meaning/remark
1	String A	Motor connection winding A start
2	String A/	Motor connection winding A end
3	String B	Motor connection winding B start
4	String B/	Motor connection winding B end

Fig. 3/4: Assignment of plug connector X2 (motor connection)

Pin	Brief description	Meaning/remark
1	+ 24...48 V DC	Current supply + 24...+48 V DC
2	GND	GND current supply

Fig. 3/5: Assignment of plug connector X3 (current supply)

3.3 Connecting the cables

Please note
Connection to the main power supply and the fitting of mains switches, transformers, fuses and mains filters may only be carried out by a qualified electronics engineer.

Caution
- Do not connect any cables to the electronics and do not disconnect any cables before the power supply to the system is switched off. The electronics of the power controller and the motor may otherwise be damaged.
- Check all cables once again before installation, as incorrect connection assignments can cause serious functional impairment.
- Make sure that the SEC-ST is connected to the protective earth (PE) of the power supply unit.
- Make sure that the screening cables of the motor are connected to the earth connection of the SEC-ST before you commission the motor.

Caution
- Place the motor cables and the signal cables at a distance from each other where possible, e.g. in cable channels with intermediate walls. Use only screened cables for the connection to the motor and cables twisted in pairs for signal lines.

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

Please note
- Make sure that the cables are provided with strain relief. In the case of boom arm and multi-axis operation, cables which are subject to mechanical stress must be laid in a drag chain.

3.3.1 Overview of connections

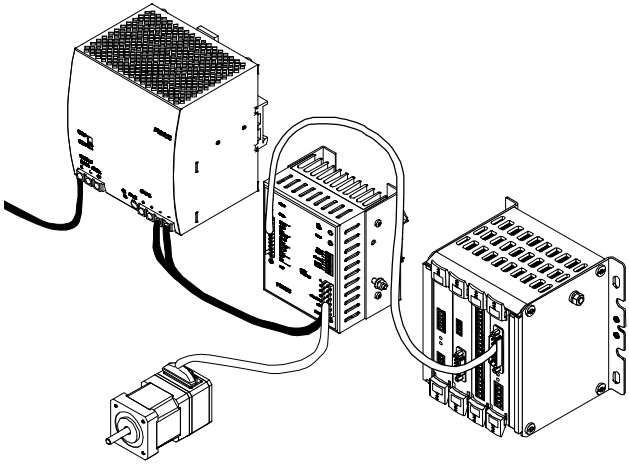


Fig. 3/6: Complete structure of SEC-ST with motor and controller

3.3.2 SEC-ST complete system

A complete SEC-ST system is shown in Fig. 3/6 on the previous page. The following components are required for operating the SEC-ST:

- Power unit 24...48 V DC / PELV voltage source
- SEC-ST-48-6-P01
- Motor
- Cable for controller
- Motor cable
- Controller

3.3.3 Connecting the motor to the SEC-ST

1. Insert the 9-pin sub-D plug for the power cable into the appropriate socket on the motor.
2. Connect the motor cables to the screw terminal of the plug.
3. Connect the cable screening to the earth terminal PE.
4. If applicable, connect the brake cables to the controller.
5. Check all plug connectors once again.

3.3.4 Connecting the SEC-ST to the power supply

1. Make sure that the power supply is switched off.
2. Insert the plug into socket X3 of the SEC-ST.
3. Connect the PE cable of the mains supply to the earth terminal PE.

3.3.5 Connecting the SEC-ST to the controller

1. Make sure that the power supply is switched off.
2. Insert plug X1 into the socket on the SEC-ST.
3. Connect the cable screening to the earth terminal PE.
4. Insert the 15-pin sub-D plug connector into the stepper motor control card socket.

3.4 PE protective conductor and screening connections

3.4.1 Connection instructions

The screening of the motor cable is connected to the central PE connection point of the SEC-ST.

The mains PE connector is also connected at this star point.

With greater lengths, special EMC protective measures must be observed.

Warning
All PE cables must be connected before commissioning for reasons of safety.

The mains PE connection is connected to the central PE connection point of the SEC-ST.

Make sure that the earth connections between devices and the mounting plate are of sufficiently large dimensions in order to be able to discharge HF interference.

3.4.2 Electrical isolation

In the design of the SEC-ST, great importance has been placed on high resistance to interference. For this reason individual function blocks are electrically isolated from each other. Signal transmission within the SEC-ST is carried out by an opto coupler.

3.5 Measures for complying with EMC guidelines

Caution
Long lines reduce immunity to interference (EMC).

- Do not exceed the maximum permitted cable lengths:
  – Control cable: 30 m
  – Power supply cable: 10 m
  – Motor cable: 10 m

If correctly fitted and if Festo cables are used for all the connections, the devices of the SEC-ST product family will comply with the relevant regulations (see Declaration of Conformity).

Interference emission and resistance to interference of a device always depend on the complete design of the drive, which consists of the following components:

– the power supply

– the SEC-ST

– the motor

– the electromechanics

– the design and type of wiring

– the higher-order controller.

Commissioning

Chapter 4

Contents

4.1 Commissioning the SEC-ST

- Set the string current in accordance with chapter 1.7.2 “Setting the current.”
- Make sure that the current set is adapted to the stepper motor.

Caution
If the current is set too high, the motor may become overheated.

- Set the desired step angle in accordance with chapter 1.7.1 “The stepper mode.”
- Check that the step angle set is taken into consideration by your position controller.

When all connections have been made, the power supply can be switched on. The connected motor may perform a step at this stage. For this reason we recommend that the motor be disconnected from the load in order that a test run can be carried out.

When the power supply is switched on, the blue power LED lights up. If the red fault LED lights up, you must switch the unit off immediately and check the connections (see chapter 5 “Diagnosis and error treatment”).

Buttons Step+ and Step–

With these buttons you can test the stepper motor.
When the Step+ button is pressed, the stepper motor starts to turn. The direction depends on the wiring of the motor phases; with the stepper motors from Festo: in a clockwise direction (view of motor shaft). It thereby increases its rotational speed step by step.
When the Step- button is pressed, the stepper motor turns in the opposite direction.

Button Clock Sim

With this button you can simulate the Input “Clock”.
Each time you push it, a step will be carried out. The button is not debounced.

Button Reset

Pressing this button, you can reset the SEC-ST. All the inputs, outputs, displays and buttons are then without function. The motor current is switched off. After releasing the button, the SEC-ST is reinitialized and the motor is energized again.

Please note
The settings which you make on the SEC-ST do not become active until you press the Reset button (or switching the SEC-ST off and on again).

Diagnosis and error treatment

Chapter 5

Contents

5.1 Fault messages of the SEC-ST

The SEC-ST possesses a red LED which indicates a fault.

LED Error lights up red when:

– there is excess temperature:
  The final stage is overheated and is switched off.

– there is a short circuit:
  There is a short circuit between the motor strings or against GND.

5.2 Fault functions of the SEC-ST

Fault	Cause	Possibilities
Power LED does not light up	No supply voltage	– Check supply cable – Check power unit
Fault LED lights up red	Short circuit at motor output	– Check motor – Check motor cable
	Final stage overheated	– Winding resistor of motor too small – Motor defective, check – Check fitting of controller
Motor does not move, power LED lights up blue, red fault LED is out	Dip switch 8 off	– Dip switch 8 on
	Motor cable defective	– Check motor cable
	Brake not activated	– Open brake by applying 24 V DC
Motor loses steps	Frequency too high	– Check characteristic curve of motor, check which torque can be given
	Motor cannot give torque required	– Reduce frequency (controller)

Fig. 5/1:

Technical appendix

Appendix A

Contents

A.1 Technical specifications

A.1.1 SEC-ST-48-6-P01

Feature	Value
Rated current I_n	1.25 A ~ 6 A adjustable
Rated voltage V_n	24...48 V DC
Operating mode	Bipolar chopper driver
Operating mode	1/1 step = 200 steps per revolution 1/2 step = 400 steps per revolution 1/4 step = 800 steps per revolution 1/5 step = 1000 steps per revolution 1/8 step = 1600 steps per revolution 1/10 step = 2000 steps per revolution 1/32 step = 6400 steps per revolution
Setting the step	With the dip switch
Step frequency	Max. 40 kHz
Current reduction	0 or 70 % can be selected with dip switch
Manual movement	With buttons Step+ and Step–
LED	Blue (power), red (fault)
Button	RESET, Step+, Step–, CLK Sim.
Type of connection	Screw plug terminals
Method of fastening	TS 35 DIN hat rail
Ambient temperature	0 ... + 40 °C (... + 50° at I ‹ 4.7 A)
Storage temperature	–10 ... +60 °C
Relative humidity 95 % (non condensing)	Protect from humidity, no moisture condensation
Protection class	IP20
Certification	CE symbol

Fig. A/1:

A.1.2 Maximum ratings

Inputs

Plugs	Pin	V_{in} [V DC]	V_{in} max. [V DC]	I_{in}	I_{in} max.
X1	En +24	20...26 V	28 V	5.4...17.2 mA	22 mA
	En +5	4...6 V	7.5 V	4.8...8 mA	8.4 mA
	En -	0 V	---	---	---
	Clk +24	20...26 V	28 V	5.4...17.2 mA	22 mA
	Clk +5	4...6 V	7.5 V	4.8...8 mA	8.4 mA
	Clk -	0 V	---	---	---
	Dir +24	20...26 V	28 V	5.4...17.2 mA	22 mA
	Dir +5	4...6 V	7.5 V	4.8...8 mA	8.4 mA
	Dir -	0 V	---	---	---
X3	+ 24...48	21...50 V	51 V	0...6.5 A	7 A
	GND	0 V	---	---	---

Outputs

Plugs	PIN	V_{out} [V DC]	V_{out} max. [V DC]	I_{out}	I_{out} max.
X1	Err+	4...26 V	30 V	5...20 mA	30 mA
	Err-	---	0 V	---	---
X2	String A	24...48 V	51 V	0...6.5 A	7 A
	String A/	24...48 V	51 V	0...6.5 A	7 A
	String B	24...48 V	51 V	0...6.5 A	7 A
	String B/	24...48 V	51 V	0...6.5 A	7 A