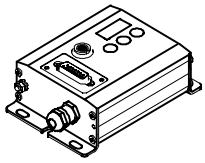
SPC11 Soft Stop

FESTO

Electronics/ pneumatics manual

System manual
Soft Stop
type SPC11-...-...



Manual
196 724
en 0012NH
[647 458]

Author ..... S. Breuer

Editors ..... H.-J. Drung, M. Holder

Original ..... de

Translation ..... transline Deutschland

Layout ..... Festo AG & Co., Dept. KG-GD

Type setting ..... KI-TD

Edition ..... en 0012NH

Title ..... MANUAL-EN

Designation P.BE-SPC11-SYS-EN

Order no. 196 724

Trade marks

Temposonics® is a registered trade mark of MTS Sensortechnologie GmbH & Co

Contents

Intended use

The SPC11 has been designed for fitting into a machine or an automation device. In conjunction with permitted drives and measuring systems and a proportional directional control valve type MPYE-5-..., the SPC11 enables:

- fast movement into the mechanical end positions and one or two selectable mid-positions
- manual movement between the end positions.

Depending on the drive used, fixed stops are in some cases required for protecting the drive. The end positions can be set with fixed stops. The end position cushioning, movement into the intermediate positions and manual movement are controlled electronically. The SPC11 must only be used as follows:

- as intended
- in original condition
- without any modifications
- in faultless technical condition
- only in conjunction with permitted drives/measuring system combinations.

If used in conjunction with additional commercially-available components, such as sensors and actuators, the specific maximum values for pressures, temperatures, electrical data, torques, etc. must be observed. Please observe also national and local laws and regulations.

Service

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

Target group

This manual is intended exclusively for personnel trained in control and automation technology.

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 sensible 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.

Product-specific terms and abbreviations

The following product-specific abbreviations are used in this manual:

Term/ abbreviation	Meaning
0-signal	Input or output supplies 0 V
1-signal	Input or output supplies 24 V
Drive	In this manual the term ”Drive” represents the terms ”linear unit” (DGP(I)(L)-...), ”cylinder” (DNC-...) or ”rotary drive” (DSMI).
O	Digital output
Cushioning stage	The positioning behaviour is determined by the amplification and cushioning stages. The cushioning stage serves for optimizing the starting behaviour when movement is made towards the end positions.
I	Digital input
PLC, IPC	Programmable logic controller/industrial PC
System parameter	Characteristic value which describes both the system structure as well as the features and components of the drive used.
Parameter	Parameters which must be set for operating the system. This includes the cushioning stage, the amplification stage and the system parameters.
Teach procedure	In the Teach procedure, the SPC11 checks the set parameters, learns the position of the mechanical fixed stops as well as various characteristic system values and saves these in the integrated EEPROM.
Amplification stage	The amplification stage influences e.g. the acceleration behaviour of the drive. The amplification stage should usually be set in accordance with the specifications in the manual “Drive-specific supplement”. If it is necessary to optimize the positioning behaviour, only the cushioning stage should be modified.

Notes on the use of this manual

This system manual contains general, basic information on the method of operation, on fitting, installing and commissioning the SPC11.

Special information on installing and commissioning the SPC11 in conjunction with the drive used can be found in the manual “Drive-specific supplement”.

Manual	Title	Contents
System manual SPC11 Soft Stop electronics/pneumatics (this manual)	P.BE-SPC11-SYS...	General instructions on installation and commissioning
Drive-specific supplement for operating the SPC11 with a certain drive, e.g. the DSMI-...	P.BE-SPC11-..-...	Special instructions on installation and commissioning as well as parameter settings for the relevant drive [1)]

1) These manuals contain the permitted drive-valve combinations, cylinder diameters/lengths and mass loads as well as the parameter settings of the SPC11 which are valid in these cases.

Please note
For installation and commissioning you will require the System manual as well as the manual “Drive-specific supplement” for the drive used.

Summary of components

Chapter 1

Contents

1.1 Structure

In conjunction with permitted drives and measuring systems and a proportional directional control valve type MPYE-5-..., the SPC11 enables:

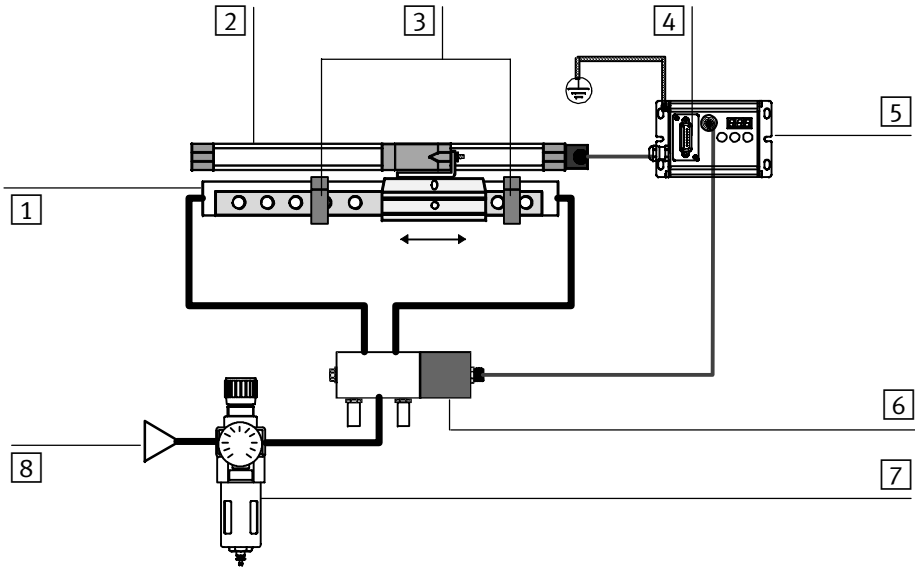
– fast movement into the mechanical end positions and one or two selectable mid-positions

– manual movement between the end positions.

The end position cushioning, movement into the intermediate positions and manual movement are controlled electronically. A distinction is made between the following types of SPC11:

Type	Manual
SPC11-POT-TLF	Enables connection of linear potentiometer type MLO-POT-...-TLF.
SPC11-POT-LWG	Enables connection of connecting-rod potentiometer type MLO-POT-...-LWG and swivel drive with integrated measuring system type DSMI-... .
SPC11-MTS-AIF	Enables connection of the linear drive with integrated measuring system type DGPI(L)-...-...-...-AIF or digital measuring system type MME-MTS-...-AIF.

The following diagram shows the basic structure of a drive with the SPC11, using as an example a linear module with a linear potentiometer.



1 Drive (linear module)

2 Measuring system (external linear potentiometer)

3 Fixed stops

4 Power connection and I/O coupling (e.g. with PLC)

5 SPC11 Soft Stop

6 Proportional directional control valve type MPYE-5-...-...

7 Maintenance unit (without lubricator, with 5 µm filter)

8 Compressed air supply source (5...7 bar)

Fig. 1/1: Structure of a drive with SPC11 (example of linear drive)

When the SPC11 is used, positioning is closed-loop controlled. During commissioning, the end positions (cylinder end positions or position of the fixed stops) as well as the desired mid-positions are “learnt” by the SPC11.

During operation, the SPC11 ensures that the moveable mass moves closed-loop controlled into the saved end positions and mid-positions at the highest possible speed. Shortly before the learnt end position or mid-position is reached, the moveable mass is braked so that it comes to a stand.

To ensure that the moveable mass remains in the learnt end position, it is pushed against the end position, at maximum with the same force as the operating pressure.

Advantages

Compared with pneumatic-stop drives with double-solenoid valve control, this control process permits higher positioning speeds. The following measures, which would be necessary for controlling a drive with a double-solenoid valve, are no longer required:

- the use of restrictors
- the use of limit switches
- the use of mechanical end positioning cushioning (shock absorbers)
- the maintenance of fixed stops.

Compared with pneumatic stop drives with double-solenoid valve control, the SPC11 permits:

- more frequent machine cycle intervals
- less vibration in the system
- less maintenance cost.

Components

In order to implement fast positioning with electronically-controlled closed-loop end position cushioning, you will require the following components:

- the SPC11 Soft Stop
- a proportional directional control valve type MPYE-5-...-...
- a maintenance unit with 5 µm filter, without lubricator
- a permitted measuring system (external or incorporated in the drive)
- a drive, if possible, with mechanical guide
- if required, two fixed stops (depending on drive used)
- 24 V DC power supply
- if required, components for a pneumatic emergency stop circuit.

1.2 Method of operation

Tasks of the SPC11

The SPC11 takes control of the following:

- It ascertains characterisitc system values of the connected components.
- It saves the desired end positions and the mid-positions.
- It specifies the two end positions and mid-positions.
- It compares the nominal and actual positions and moves to the desired position by appropriate control of the proportional directional control valve (status control).

Method of operation

The SPC11, valve, drive and measuring system are connected with each other to form a closed-loop control circuit. In this control circuit, the position of the moveable mass represents the control variable. This type of control is therefore also called closed-loop positional control.

The term “moveable mass” also refers below to the terms piston, slide and flange shaft.

The following diagram shows the basic structure of a closed-loop positional control circuit with the SPC11.

1 Measuring system

2 Actual position value

3 SPC11

4 Valve control (nominal value)

5 Proportional directional control valve

6 Drive, e.g. linear drive

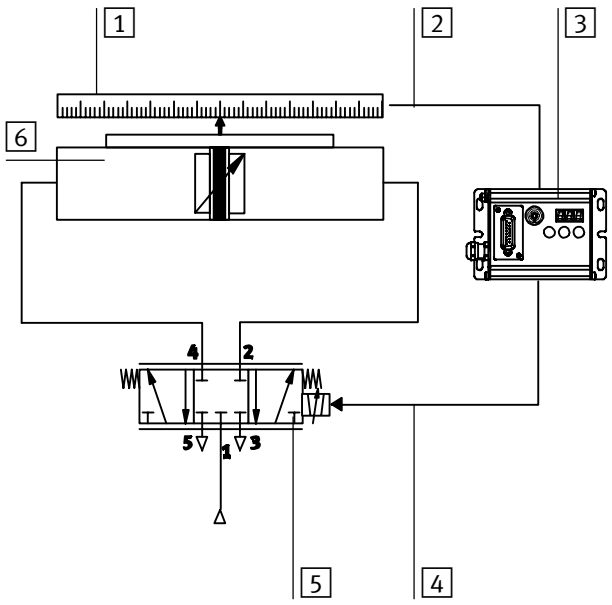


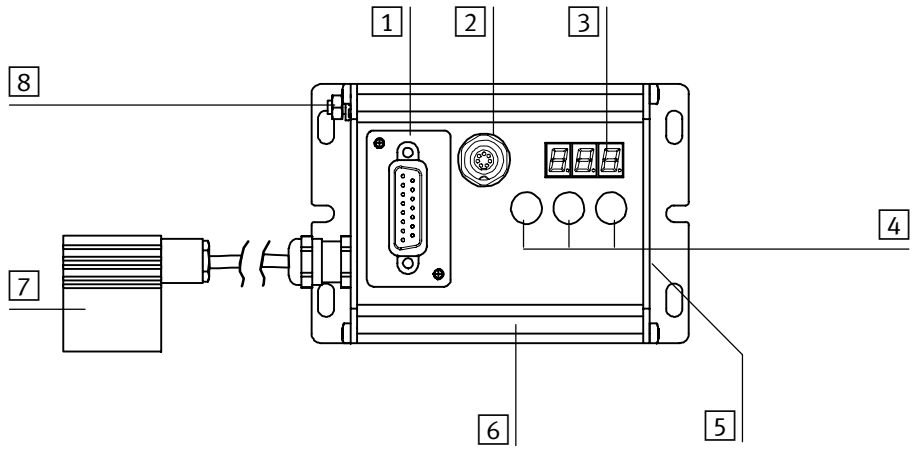
Fig. 1/2: Positional control circuit with pneumatic components

The measuring system constantly registers the position of the moveable mass and passes this on as an electrical signal to the SPC11. The SPC11 compares the actual position with the target position (the taught end positions 1 and 2 or the mid-positions 3 and 4) and calculates from these the positioning signal for the proportional directional control valve.

The proportional directional control valve controls the drive by pressurizing one chamber and exhausting the other. The flow is blocked in the valve slide mid-position.

1.3 Display and connecting elements on the SPC11

The following diagram shows the display and connecting elements on the SPC11.



1 Control: Operating voltage connnection and I/O coupling

2 Valve: Valve connection

3 Display

4 Operating keys

5 Type plate see side

6 Groove for identification signs (type IBS 6x10)

7 Measuring system connection

8 Earth connection

Fig. 1/3: Display and connecting elements on the SPC11

Fitting

Chapter 2

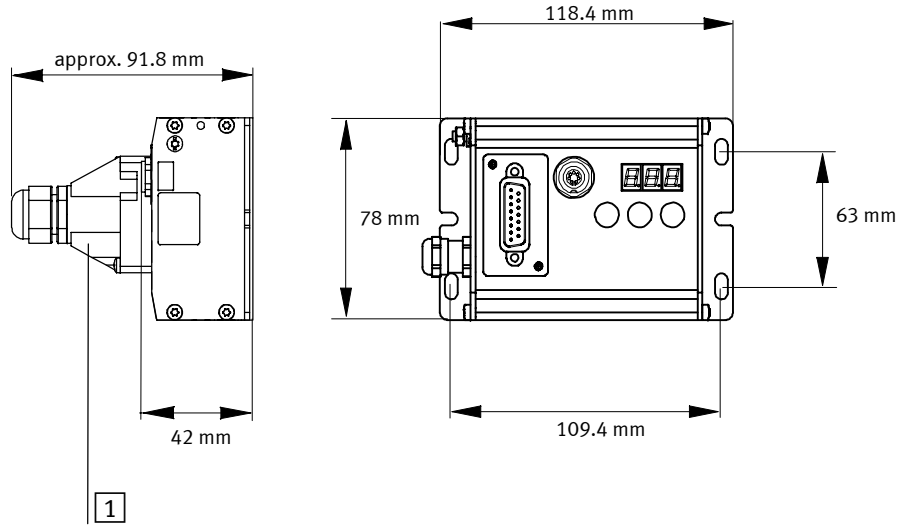
Contents

Please note
When fitting the pneumatic components please observe the fitting instructions in the accompanying operating instructions and the installation instructions in chapter 3.

2.1 Fitting the SPC11

The SPC11 can be fastened onto a flat surface with the aid of the support brackets.

The following diagram shows the mounting surface required, as well as the dimensions for the four threaded holes of M4 screw size. Fasten the SPC11 with at least three screws.



1 Plug fitted

Fig. 2/1: Fitting dimensions for the SPC11

Installation

Chapter 3

Contents

3.1 General instructions on installation

Warning
Undesired movements of the connected actuators and uncontrolled movements of loose tubing can cause injury to human beings and damage to property.

Before carrying out installation and/or maintenance work, switch off the power supply and the compressed air supply simultaneously or in the following sequence:

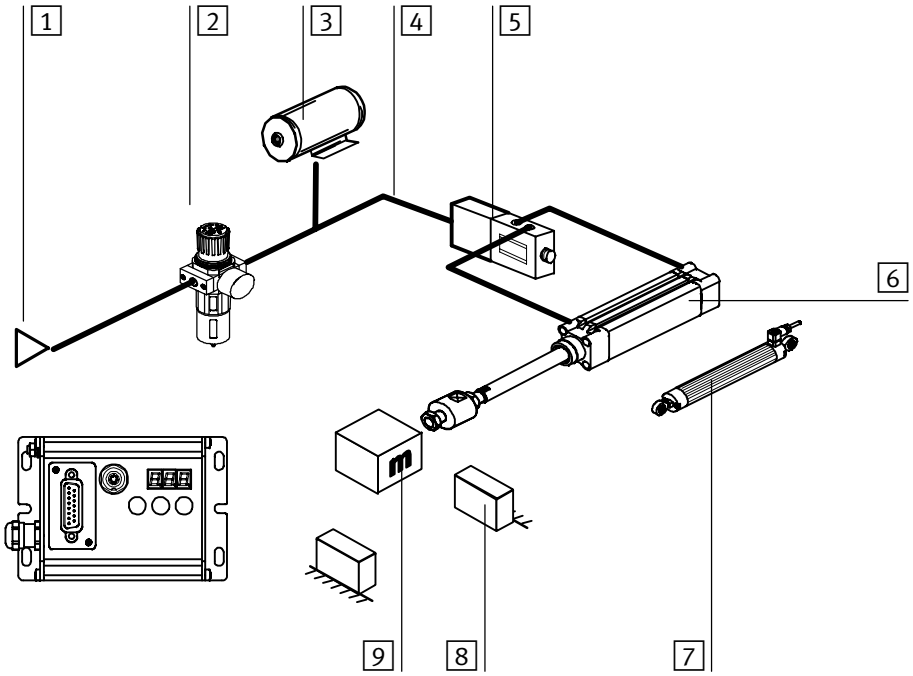
1. The compressed air supply
2. The power supply

Caution
The use of components, which are not approved of for use with the SPC11, can cause incorrect functioning.

Use only the matching components from Festo for setting up and wiring the system.

3.2 Notes on installing the pneumatic components

Please note
Observe the following instructions on installing the pneumatic components. Only then can faultless operation be guaranteed.



1 ... 9 Notes on installation see following pages

Fig. 3/1: Summary of pneumatic installation

Compressed air supply (1)

- Use only dry, non-lubricated, 5 µm filtered compressed air from 5 to 7 bar.

To prevent damage to the proportional directional control valve, you must install a service unit with a 5 µm filter.

Service unit (2)

- Use a service unit
  - without lubricator
  - with a 5 µm filter
  - with sufficiently large standard flow appropriate to the air requirement of the connected drive when it carries out a positioning movement. Guideline: twice the standard flow of the valve (type MPYE-5-...), e.g.:

Valve type	**Service unit**
MPYE-5-1/8-LF-010B	LFR-M1-G1/8-C10RG or LFR-1/8-D-5M-MINI
MPYE-5-1/8-HF-010B	LFR-M1-G1/4-C10RG or LFR-1/4-D-5M-MINI
MPYE-5-1/4-010B	LFR-M1-G1/4-C10RG or LFR-3/8-D-5M-MINI
MPYE-5-3/8-010B	LFR-M2-G3/8-C10RG or LFR-3/4-D-5M-MAXI

- Use a micro filter if slight oil mist from the compressed air supply cannot be avoided.

Compressed air reservoir (3)

If the positioning behaviour does not meet with your expectations and if you ascertain fluctuations in presssure of over 1 bar at the pressure-measuring point during operation:

- Install a compressed air reservoir between the service unit and the proportional directional control valve (e.g. type VZS-...-B).

In this way you can reduce the fluctuations in pressure during operation. You can compensate for slight excessses in the permitted pressure fluctuation by using a supply line with a larger diameter.

Reservoir volume:

The reservoir volume should be at least four times the volume of the drive used.

$V_P = 4 * V_Z$

V_P = Buffer volume;
V_Z = Cylinder volume (linear drives: $V_Z = r^2 * \pi * L_Z$)
L_Z = Cylinder stroke length

Compressed air tubing and screw connectors (4)

- Use only straight screw connectors. If angled screw connectors cannot be avoided, use screw connectors from the Quick Star series.
- Cut the compressed air tubing and hose connectors to the dimensions specified in the manual for the drive used.
- Lay the tubing between the valve (MPYE-5-...) and the drive symmetrically.
- Use only clean compressed air tubing and screw connectors. Specifications on the permitted temperature and pressure ranges of tubing and screw connectors can be found in the product catalogue.
- Do not use restrictors in the supply air lines.
- Lay the tubing so that it does not project into the positioning range.

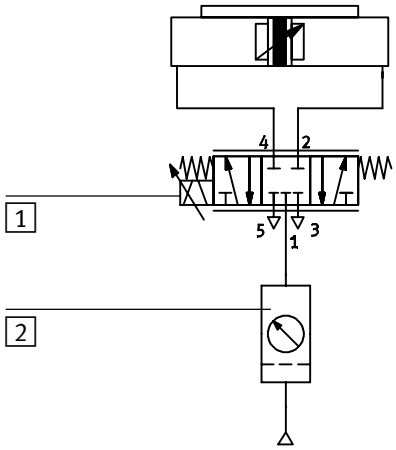
For good positioning, fluctuations in pressure up to max. 1 bar are permitted in front of the proportional directional control valve during positioning. In order to check the stability of the supply pressure, you can provide a pressure-measuring point directly in front of the proportional directional control valve, if necessary.

Proportional directional control valve (5)

Lay the tubing between the valve (MPYE-5-...) and the drive symmetrically.

Recommendation for linear drives and drives with piston rod: Tubing length = cylinder length.

The following diagram shows as an example the tubing circuitry of a cylinder with an MPYE-5-..., when an SPC11 is used without an emergency stop circuit.



1 Proportional directional control valve type MPYE-5-...-...

2 Service unit with 5 µm filter, without lubricator

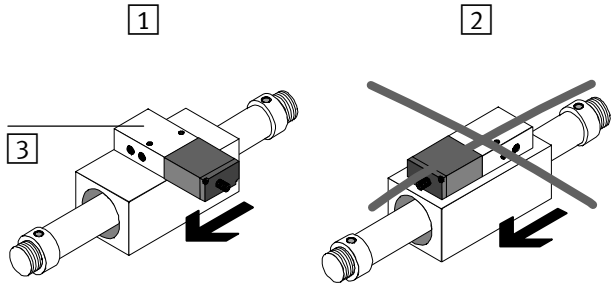
Fig. 3/2: Pneumatic circuit diagram

Fit the valve in accordance with the operating instructions for the valve.

- If the environment is subjected to heavy electrical interference, fit the proportional directional control valve electrically isolated on the mounting surface.

When fitting onto moving parts:

- Fit the proportional directional control valve diagonally to the direction of movement. In this way, acceleration forces cannot affect the position of the valve slide.



1 Fitting diagonally to the direction of movement

2 Not permitted

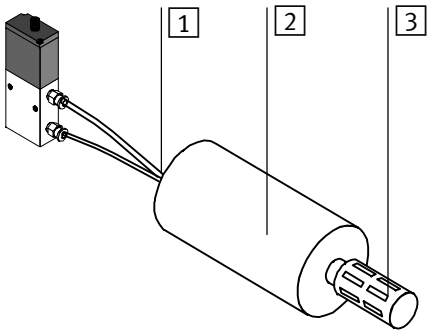
3 Proportional directional control valve type MPYE-5-...-...

Fig. 3/3: When fitting onto moving parts

Use silencers with large flow rate UC-M5, U-1/8, U-1/4 or U-3/8.

For reducing high exhaust noises.

- With the aid of tubing fit larger silencers or
- Pass the exhaust ducted into a small compressed air reservoir and exhaust this with a large silencer. Make sure that the screw connectors and tubing provide sufficient flow (with PUN-8 tubing length max. 1 m).



1 Ducted exhaust

2 Compressed air reservoir

3 Silencers

Fig. 3/4: Ducted exhaust

Drive (6)

Use only permitted combinations of drives and measuring systems for the SPC11 approved of by Festo.

Permitted combinations of drives and valves, cylinder diameter and length, as well as mass loads for the drive used can be found in the manual “Drive-specific supplement...”.

Connect the drive, guide, potentiometer and load in the direction of movement free of play and flush with each other.

If required, select a sufficiently large energy supply chain, in order to minimize the effects of bending forces on the positioning behaviour.

Please observe the maintenance intervals specified in the operating instructions for the drive (see operating instructions for the cylinder/drive or the guide).

Measuring system (7)

See also “Drive-specific supplement”.

- Fit the measuring system and the drive symmetrically, so that the centre of the usable measuring system stroke coincides with the centre of the complete cylinder stroke.

With type MLO-POT-...-TLF:

The remaining path of the measuring system slide must be identical in the cylinder end positions on both sides.

1 Remaining slide path

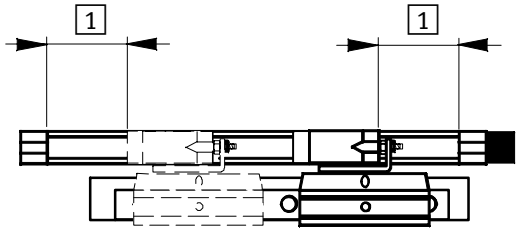


Fig. 3/5: Symmetrically mounted measuring system (with type MLO-POT-...-TLF)

With type MLO-POT-...-LWG:

The remaining path of the measuring system slide must be identical in the cylinder end positions on both sides and can be calculated as follows:

Calculation formula	**User manual**	
$\frac{(L_M - L_Z)}{2} = L_R$	L_M L_Z L_R	Measuring system length Cylinder length Remaining slide path

With type MME-MTS-...-AIF:

Please note
The mechanical path (possible slide path) of measuring system type MME-MTS-...-AIF is longer than the electrical path (usable stroke length).

Fit measuring system type MME-MTS-...-AIF so that the electrical path (see type designation MME-MTS-...-AIF) of the measuring system is symmetrical to the complete cylinder stroke.

1 Remaining slide path

2 Electrical path (usable stroke length)

3 Mechanical path (possible slide path)

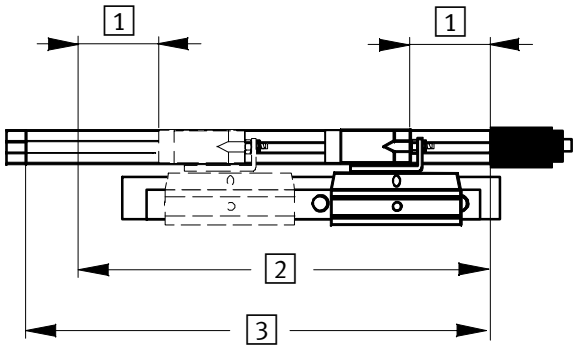


Fig. 3/6: Usable stroke length with type MME-MTS-...-AIF

Fixed stops (8)

Fixed stops may be necessary, depending on the drive used.
See also “Drive-specific supplement”.

Mass load (9)

Fit the mass load free of play.

Possible moveable mass loads see “Drive-specific supplement”.

3.2.1 Pneumatic emergency stop circuit

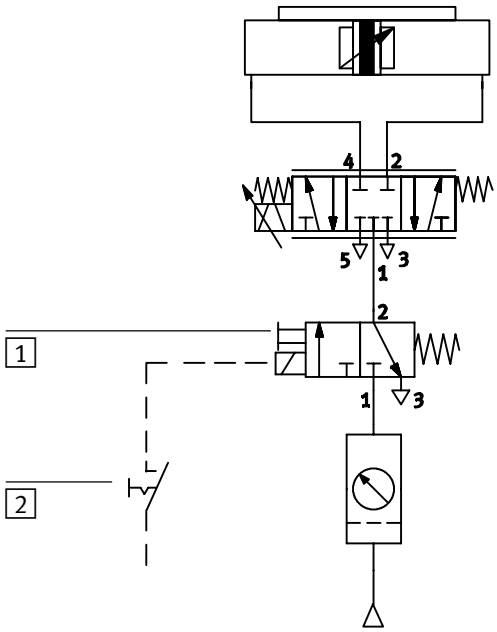
In order to place the system in a defined status in the event of faults, you will require a pneumatic emergency stop circuit. Select one of the following depending on the design and operating characteristics of your system:

- drive with emergency stop pressureless
- moveable mass clamped during emergency stop
- moveable mass moves restricted into the left or right-hand end position during emergency stop.

When the power supply to the SPC11 is switched off, the MPYE-... moves to the mechanical mid-position.

Emergency stop circuit with switching valve

In order to switch off the operating pressure, you can fit a switching valve between the service unit and the proportional directional control valve. The emergency stop situation is represented.



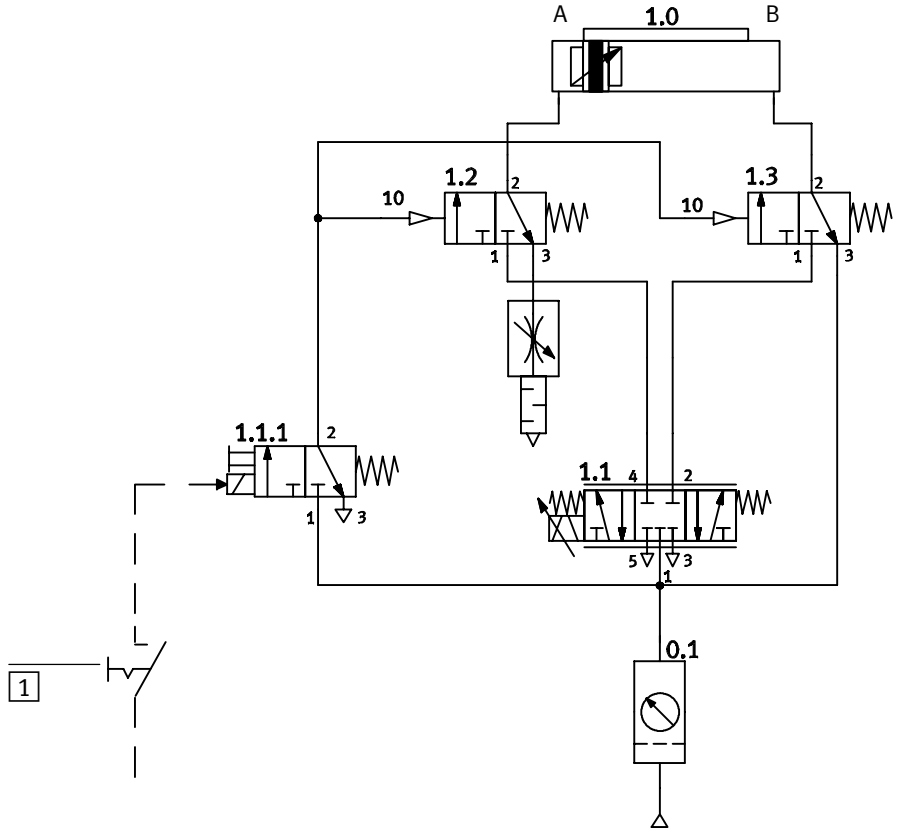
1 Switching valve for emergency stop

2 Emergency stop actuated

Fig. 3/7: Switching off the operating pressure

Universal emergency stop circuit

The diagram below shows a variant of the universal emergency stop circuit with a linear drive. With the variant shown, the slide moves restricted into end position A when emergency stop is triggered. The emergency stop situation is represented here.



1 Emergency stop actuated

Fig. 3/8: Example of a universal emergency stop circuit with a linear drive

The emergency stop circuit shown in the previous diagram permits different methods of switching off the power supply in an emergency. The reaction of the drive depends on whether you seal connection 3 of switching valves 1.2 and 1.3 or connect either the compressed air or a flow-control valve with a silencer.

Reaction of the drive	**Connection 3 of valve 1.2**	**Connection 3 of valve 1.3**
Drive pressureless	Connect a flow-control valve with a silencer [1)]	Connect a flow-control valve with a silencer [1)]
Moveable mass clamped	Seal with a blanking plug	Seal with a blanking plug
Right-hand end position	Connect the compressed air	Connect a flow-control valve with a silencer
Left-hand end position	Connect a flow-control valve with a silencer	Connect the compressed air

[1)] Flow-control valves reduce the impact forces caused by the incorrect functioning of an emergency stop valve.

3.3 Fitting the electronic components

Caution
Cables with high noise levels can cause electromagnetic interference.

Do not place the following cables in the vicinity of such lines:

– the measuring system cable
– the proportional directional control valve cable

Caution
Incorrect pin assignments can cause damage to the SPC11.

Use only the original cables. Make sure that the pin assignments are correct with the measuring system cable and the valve cable.

Caution
Incorrect or missing earthing can cause faults.

With the DGP(L):
Connect cylinder type (DGP(I)(L)-... with low impedance (short cable with large diameter) to the earth potential, if the cylinder is not mounted on an earthed machine stand.

3.3.1 Connecting elements on the SPC11

The following diagram shows the connecting elements on the SPC11, using the SPC11-POT-TLF as an example.

1 Measuring system connection (with type MLO-POT-...-TLF)

2 Earth connection

3 Valve connection

4 Power supply connection as well as inputs and outputs

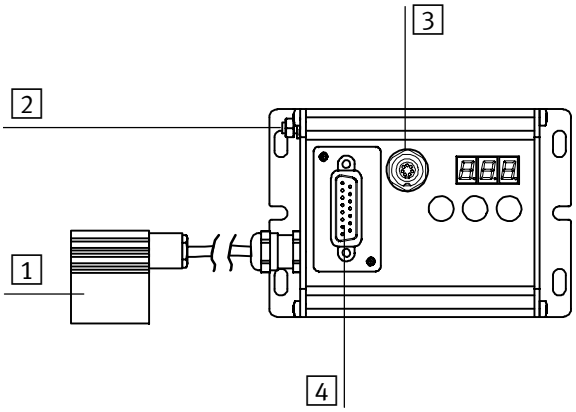


Fig. 3/9: Connecting elements on the SPC11

3.3.2 Connecting the power supply and the I/Os

Warning
Use only power units which guarantee reliable electrical isolation of the voltage supplies in accordance with IEC 742/EN 60742/VDE 0551 with at least 4 kV isolation resistance (Protected Extra-Low Voltage, PELV). Switch power packs are permitted providing they guarantee reliable isolation in accordance with EN 60950/VDE 0805.

By using PELV power units, you can ensure protection with the SPC11 against electric shock (protection against direct and indirect contact) in accordance with EN 60204-1/IEC 204. For supplying power to PELV networks, you should use safety transformers with the symbol shown here. The SPC11 must be earthed in order to guarantee the operation of certain functions (e.g. EMC).

Caution
In order to avoid faults caused by electromagnetic influences:

- Connect the earth connection on the left-hand side of the housing to the earth potential with low impedance (short cable with large cross-sectional area).
- Use only the following original cables for connecting the power supply and the inputs/outputs:

Original cables for connecting the power supply and the inputs/outputs:

Type designation	Cable length
KMPV-SUB-D-15-5	5 m
KMPV-SUB-D-15-10	10 m

The power is supplied via the 15-pin plug marked with “Control” together with the input/output circuit (see Fig. 3/8):

Pin 15 (white-yellow): +24 V DC
Pin 14 (brown-green): 0 V
Tolerance -10 % to + 25 %

Connect an earth conductor with sufficient cable diameter to the drive, if the drive is not mounted on an earthed machine stand.

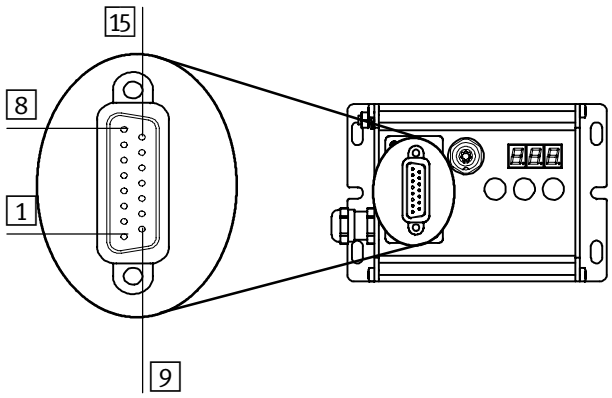
The following diagram shows the pin assignment of the “Control” connection, as well as the core colours for the original cable type KMPV-SUB-D-15-... .

1 Pin 1

8 Pin 8

9 Pin 9

15 Pin 15



Pin	Pin assignment and core colours		Pin	Pin assignment and core colours
1	I8: Remote (white)		9	O5: Error (black)
2	I7: Remote, key ←/- (brown)		10	O4: P.04 (violet)
3	I6: Remote key Enter/Teach/Esc (green)		11	O3: P.03 (grey-pink)
4	I5: Remote Key +/→ (yellow)		12	O2: P.02 (red-blue)
5	I4: P.04 (grey)		13	O1: P.01 (white-green)
6	I3: P.03 (pink)		14	0 V (brown-green)
7	I2: P.02 (blue)		15	24 V supply (white-yellow)
8	I1: P.01 (red)			
I = Input, O = Output				

Fig. 3/10: “Control” connection, pin assignment and core colours

Brief description of the I/O signals at the Control connection

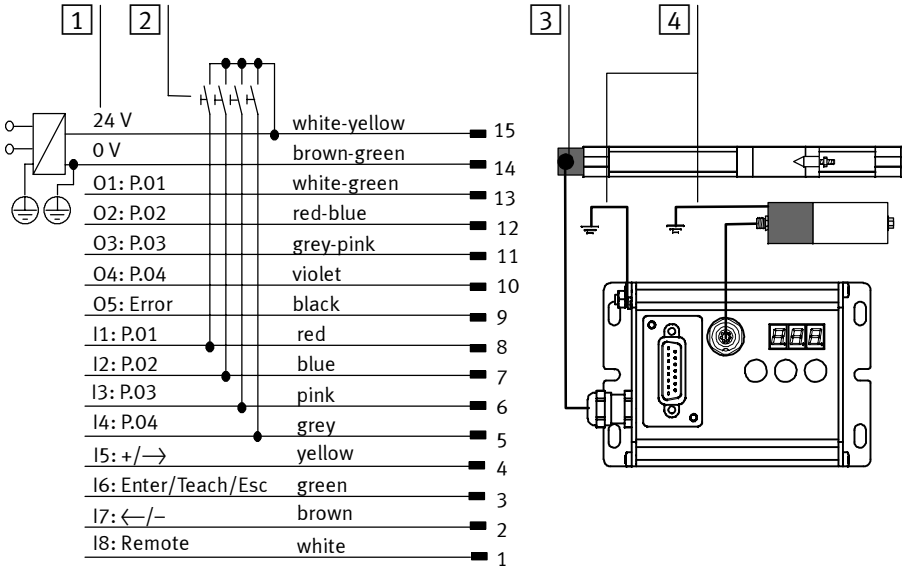
A detailed description of the I/O signals can be found in section 4.4.

Output	Pin	Manual
O1: P.01	13	Supplies a 1-signal when the drive is in the appropriate position. Supplies a 1-signal for 50 ms when the drive overruns the relevant position.
O2: P.02	12	
O3: P.03	11	
O4: P.04	10	
O5: Error	9	Supplies a 1-signal when there is an error.

Input	Pin	Manual
I1: P.01	8	1-signal (min. 20 ms) sends command to move to the relevant position when there is a 0-signal at the other inputs P.0...
I2: P.02	7	
I3: P.03	6	
I4: P.04	5	
I7: +/⟶	4	Controls the drive when there is a 1-signal at the Remote input (see Appendix A).
I6: Enter/Teach/Esc	3	
I5: {/–	2	
I8: Remote	1	A 1-signal deactivates the operating keys and activates the relevant Remote inputs (pins 2...4).

Connection example type SPC11-...-...

Please note
With measuring system type MLO-POT-...-LWG):
In order to earth, connect the earthing strip on the flat plug of the measuring system with the earth connection on the SPC11.



1 Pin assignment for Control connection with core colours for cable KMPV-SUB-D-15-...; O..: Output, I..: Input

2 Push button for movement to the positions

3 With linear drives, end position P.01 lies on the side with the electrical connection of the measuring system

4 Earthing

Fig. 3/11: Connection example type SPC11-...-...

3.3.3 Connecting the proportional directional control valve and the measuring system

Connecting the measuring system

Use only permitted combinations of drives and measuring systems for the SPC11 approved of by Festo. The connecting cable for the measuring system is firmly connected to the SPC11.

Please note
Short cables will help to reduce interference caused by electromagnetic influences. Use only the original cables.

Please observe also the notes in the instructions supplied with the measuring system.

Fasten the plug with the aid of the integrated screw, in order to prevent unintentional loosening, e.g. due to shock.

Connecting the proportional directional control valve

The valve connection provides the power supply for the valve, as well as the voltage for controlling the position of the valve slide.

Use only the original cable for connecting the valve.

Type designation	Cable length
KMPYE-AIF-1-GS-GD-2	2 m
KMPYE-AIF-1-GS-GD-0.3	0.3 m

1 Pin 1

4 Pin 4

7 Pin 7

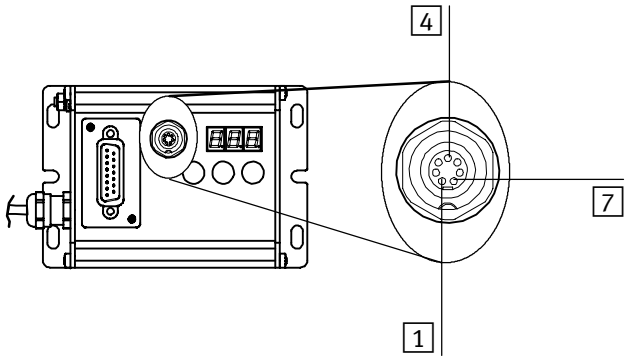


Fig. 3/12: Valve connection, pin assignment and core colours

Pin	Pin assignment and core colours of the cable type KMPYE-...	Pin no. on the valve plug
1	24 V load supply for valve (blue)	1
2	0 V (brown)	2
3	0 V (green)	2
4	Vs (positioning signal 0 ... 10 V) (yellow)	3
5	Signal GND (grey)	4
6	n.c.; not connected (pink)	
7	24 V supply for valve (white)	1

Fasten the plug with the aid of the union nut, in order to prevent unintentional loosening, e.g. due to shock.

Commissioning

Chapter 4

Contents

4.1 General instructions on commissioning

This chapter describes the parametrizing and commissioning with the aid of the three keys on the SPC11. The keys of the SPC11 can be blocked by means of a 1-signal at the remote input (I8). Key functions can then be accessed via the digital inputs (I5...I7). Detailed information on this can be found in Appendix A.

Warning
During both commissioning and operation, the moveable mass will be moved at the highest possible acceleration and speed. Make sure that:

- It is not possible to place one's hand in the postioning range of the moveable mass when compressed air is applied to the system.
- The complete positioning range is unobstructed.

Warning
Incorrectly set parameters can cause damage to the fixed stops and to the drive.

Take the utmost care when setting the parameters.

4.1.1 Basic principles of configuring and operating the SPC11

Parameters

Certain conditions of use must be made known to the SPC11. These conditions of use are described by the three following parameters:

Parameters	**Manual**
Amplification stage (Amplification stage)	Influences the acceleration behaviour of the drive
Cushioning stage (Cushioning stage)	Influences the starting behaviour when moving to the end stops and intermediate positions
System parameter (System parameter)	Characteristic value for the structure of the drive

The parameters can be entered:

– before commissioning (pre-parametrizing without drive in the office)

– during commissioning.

Key functions

The keys of the SPC11 are only active when there is a 0-signal at the remote input (I8).

Key	Manual
←/-	Reduce the input value or position value [1] (drive moves in direction of measuring system zero point)
Enter/Teach (> 2 s)	Press the key down for longer than 2 seconds, in order to confirm the parameter value or to start the Teach procedure
Esc (< 1 s)	Press the key briefly in order to discontinue the procedure
+/→	Increase the input value or position value [1] (drive moves away from measuring system zero point)
1) Press the key briefly in order to modify the value by 1. Hold the key pressed down in order to modify the value continuously.	

The keys of the SPC11 can be blocked by means of a 1-signal at the remote input (I8). Key functions can then be accessed via the digital inputs. Detailed information on this can be found in Appendix A.

Display on the SPC11

The display on the SPC11 shows:

– parameters or

– status information.

The first character in the display shows the identifier letter for parameters or for status information. The last two positions show the relevant value, the stage or number.

1 Identifier letter for parameters (A, C, S) or status type

2 Value, stage or status information

3 Point for separation

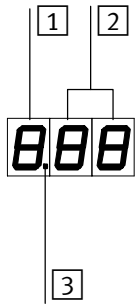
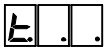
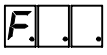
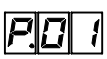


Fig. 4/1: Composition of display on the SPC11

The parameters

Display	Manual
	Amplification stage (**A**mplification stage) influences the acceleration behaviour of the drive
	Cushioning stage (**C**ushioning stage) influences the starting behaviour when moving to the end stops and intermediate positions
	System parameters (**S**ystem parameters) characteristic value for the structure of the drive

Possible status information

Display	Manual
	When letter (t) flashes: the SPC11 waits for a teach task. When the dots (...) flash: the teach movement is being carried out.
	The SPC11 checks whether the measuring system is connected (find measuring system).
	When the device is switched on: The moveable mass stands uncontrolled and is not in a taught position (P.01...P.04). Outputs O1...O4 therefore supply a 0-signal. During operation (e.g. manual positioning): The moveable mass stands controlled, but is not in a taught position (P.01...P.04). Outputs O1...O4 therefore supply a 0-signal.
	The moveable mass stands in end position P.01 (end position when measuring system is connected).
	The moveable mass stands in end position P.02 (opposite end position).
	The moveable mass stands in mid-position P.03 (taught mid-position).
	The moveable mass stands in mid-position P.04 (taught mid-position).
	Error number (**E**rror; value range: 01...14); see chapter 5.

4.2 Pre-parametrizing without the drive in the office

The permitted values of the parameters for the drive which you have selected can be found in the relevant axis-specific supplement.

All parameters are deleted at the factory (status when supplied). When the power supply is switched on, the SPC11 expects in this case the parameters to be entered. As a preliminary step for commissioning, you can set the parameters without setting up the drive “in the office”. This will simplify the commissioning of large-scale series in the Production Department.

You can set the parameters without the drive as follows (in the office).

The values and stages specified here are only examples. Enter instead the values and stages valid for your drive structure (see axis-specific supplement).

1. Switch on the power supply for the SPC11.
   The SPC11 will then show briefly the version number of the internal firmware.
   The SPC11 then waits for the amplification stage to be entered. The display shows the letters A (**A**mplification stage). The figures indicate the stage (here 0).

   
   (A.00)

2. Use the keys +/- to set the desired amplification stage (see axis-specific supplement), e.g. 02.

   
   (A.02)

3. Hold the Enter key pressed down for longer than 2 seconds (> 2 s). The value will then be transferred to the SPC11 and the cushioning stage will be displayed (here 0). This shows the letter C (**C**ushioning stage).


(C.00)

4. Use the keys +/- to set the cushioning stage (see axis-specific supplement), e.g. 04.


(C.04)

5. Hold the Enter key pressed down for longer than 2 seconds (> 2 s). The value will then be transferred to the SPC11 and the system parameter will be displayed (here 0).


(S.00)

6. Use the keys +/- to set the system parameter valid for your drive (see axis-specific supplement), e.g. 01.


(S.01)

7. Hold the Enter key pressed down for longer than 2 seconds (> 2 s). The value will then be transferred to the SPC11 and the readiness to carry out the teach procedure will be displayed by a flashing “t”. The three parameters are then saved and pre-parametrizing is then completed (in the office).


The t flashes

When all requirements for carrying out the teach procedure have been fulfilled (see sections 4.3.1), the teach procedure can now be started (see sections 4.3.2).

8. If you wish to end the pre-commissioning, switch of the power supply.

Switching-on behaviour after successful pre-commissioning (in the office)

When the power supply is switched on again, the SPC11 shows briefly the firmware version number and then the values of the three set parameters one after the other. The SPC11 then signals its readiness to carry out the teach procedure (t ...). The t flashes (see Fig. 4/2).

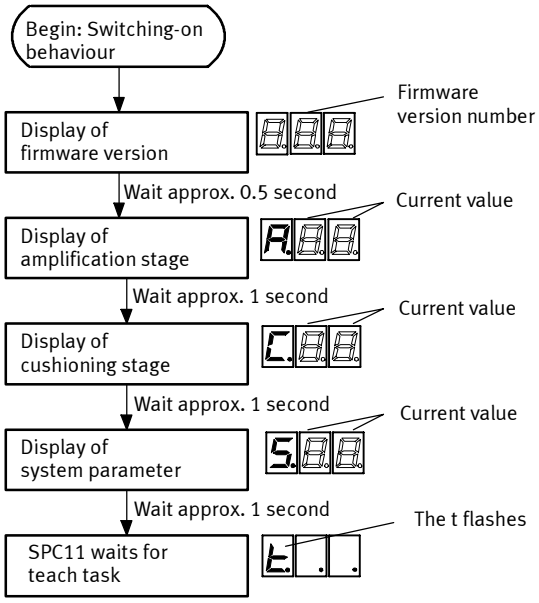


Fig. 4/2: Switching-on behaviour of the SPC11 after pre-commissioning (in the office)

The teach procedure can be started (see section 4.3.1).

4.2.1 Modify parameter

If necessary, you can modify the set parameters again, e.g. in order to correct incorrect entries or to optimize positioning behaviour. You can do this in one of the following ways:

Possibilities	Manual
Activate modify mode	In this mode the set parameter values are retained and can be modified or transferred. Taught mid-positions are retained.
Restore to status as at delivery	All parameter values will then be set to 0. Taught mid-positions will be deleted.

Activate the modify mode

Prerequirements

The measuring system must be connected. There must be an 0-signal at input Remote (I8). The drive must be standing still.

Caution
When the modify mode is activated, the valve slide moves to the mechanical mid-position. During positioning, the mass can therefore move uncushioned into one of the end positions.

Make sure that the drive is standing still before you activate the modify mode.

You can activate the modify mode with the help of the keys.

1. Make sure that the drive is standing still.
2. Press all three keys on the SPC11 simultaneously.

   The display shows the letter A (**A**mplification stage) and the set stage (here 02).

(A.02)

If you have activated the modify mode unintentionally, you can discontinue the procedure by switching off the power supply. If you have already carried out the teach procedure, you can thereby avoid having to carry this out again.

With the keys +/- you can modify the parameter shown and transfer it with Enter (see section 4.2). When the last parameter has been transferred, the SPC11 signals again its readiness to carry out the teach procedure (t flashes).

Restore to status as at delivery

Prerequirements

The measuring system must **not** be connected. There must be an 0-signal at input Remote (I8). The compressed air supply must be switched off.

You can restore the status as at delivery with the help of the keys.

1. Switch off the compressed air supply and the power supply.
2. Disconnect the measuring system cable from the measuring system.
3. Switch on the power supply.
   The SPC11 will then display error E01 (measuring system not connected).

(E.01)

4. Press all three keys simultaneously (> 2 s).

The display shows the letter A (**A**mplification stage). The value is reset to 0.

(A.00)

With the keys +/- you can now set the value again and transfer it with Enter. In the same way, the cushioning stage and the system parameter can be set again and transferred (see section 4.2).

4.3 Proceed as follows when commissioning

Warning
Faults in the system structure as well as incorrectly set parameters can cause the drive to move uncushioned into one of the end positions. This may cause damage to the fixed stop or to the drive. Please observe the following instructions in order to prevent such collisions.

- The end positions (cylinder end positions or position of the fixed stops) are “learnt” by the SPC11 during the teach procedure. The teach procedure must always be carried out during the first commissioning and when the fixed stops are adjusted as well as when components and tubing are replaced.
- During the teach procedure, the SPC11 can recognize incorrect tubing in the drive or incorrectly set parameters. The teach procedure must therefore be carried out again when the tubing is disconnected, then reconnected, or when the settings are modified again.
- Make sure that the maximum permitted mass load is observed during operation.

Recommendation: Place appropriate warning signs on your system.

4.3.1 Preparations for the teach procedure

Teach procedure

During the teach procedure, movement is made first cyclically and slowly to the end positions. The SPC11 then learns the position of the mechanical end stops and some characteristic system values, such as friction and hysteresis. The SPC11 saves these values in the integrated EEPROM.

In order that the set parameters can be checked for plausibility, the moveable mass is then moved dynamically into the centre of the positioning stroke used and then just in front of end position A. The teach procedure is completed when the moveable mass is pressed against end position A and when output O1 supplies a 1-signal.

The pneumatic drive must be ready to operate before commissioning can be carried out. The teach procedure should be carried out with the maximum mass load. During the teach procedure there must be an 0-signal at inputs P.01 to P.04.

In order to prepare the teach procedure, proceed as follows:

1. Check the complete system structure, especially the tubing of the drive (see chapter 3). Special specifications concerning your drive can be found in the “Drive-specific supplement”.
2. Check the electric circuitry.
3. If fixed stops are used:
   set the fixed stops exactly in the desired end positions. Please refer to the “Drive-specific supplement” for the permitted positioning strokes for the drive used.
4. Check whether the parameters (amplification stage, cushioning stage and system parameter) have already been set correctly during previous pre-commissioning in accordance with the components used and the mass load to be moved.

The permitted values of the parameters for the drive which you have selected can be found in the relevant axis-specific supplement. The values currently set will be shown briefly when the power supply is switched on (see also Fig. 4/2).

If the SPC11 is in the status as at delivery:

The SPC11 will wait for the amplification stage (A) to be entered when the power supply is switched on.

- In this case set the parameters as described in section 4.2.

If the parameters have already been set:

The SPC11 will display the set parameters briefly one after the other when the power supply is switched on, so that they can be checked. The SPC11 then signals its readiness to carry out the teach procedure (t flashes).

 (t flashes)

The teach procedure can now be started (see sections 4.3.2).

4.3.2 Start the teach procedure

Prerequirements

There must be an 0-signal at inputs I1...I4. The parameters must be set correctly. The maximum mass load and, if applicable, the fixed stops must be fitted correctly. In order to start the teach procedure with the keys, there must be an 0-signal at input Remote (I8).

Warning
In order to prevent damage due to uncushioned movement into the end positions:

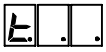
- during the first commissioning
- after adjusting the fixed stops
- after modifying the parameters
- or after replacing components or tubing, always proceed as follows:

1. Make sure that:
   - the compressed air supply and the electric power supply to the SPC11 are switched off
   - the above-mentioned conditions are fulfilled.
2. Switch on the power supply for the SPC11. The SPC11 will then display briefly the firmware version. The set parameters will then be shown, so that they can be checked (see section 4.3.1).
3. Now switch on the compressed air supply (5 to 7 bar). As the valve slide moves to the electrical mid-position, the moveable mass can move slowly into one of the end positions due to the asymmetrical voltage-pressure curve of the proportional directional control valve.

Caution
During the teach procedure, the moveable mass moves at first slowly, then at the highest possible acceleration and speed. Make sure that:

– It is not possible to place one's hand in the positioning range of the moveable mass when compressed air is applied to the system.
– The complete positioning range is unobstructed.

4. If the teach procedure has not yet been carried out, the SPC11 signals its readiness to carry out the teach procedure (t flashes).

 (t flashes)

Then proceed as described under 5.

If the teach procedure has already been carried out, the moveable mass will stand controlled in a taught position (P.01...P.04) or in any position (P...). Proceed as follows:

- Hold the Enter/Teach key pressed down for at least 2 seconds. The SPC11 then signals its readiness to carry out the teach procedure (t flashes).

5. Hold the Teach key pressed down for at least 2 seconds in order to start the teach procedure.
The SPC11 then carries out the teach procedure. The moveable mass moves at first slowly, then dynamically. The display shows the following:

 The dots flash at the same rate.

The teach procedure can take several minutes, depending on the drive used. The teach procedure is completed when the drive stands in end position P.01. The display shows the following:

Output O1 supplies a 1-signal. The drive is now ready to operate.

When the teach procedure is completed, the SPC11 knows the positions of the mechanical end positions (P.01...P.02). You can now teach the mid-positions manually (P.03...P.04) or trigger a positioning task into the end positions (P.01...P.02).

4.3.3 Teaching mid-positions

The SPC11 enables fast movement to up to two selectable mid-positions. The desired mid-positions are “learnt” by means of manual movement or by pushing the moveable mass and then saving this value. Movement can be made to the “learnt” mid-positions during operation.

The mid-positions can also be used as sensor positions, as the relevant output (O3...O4) supplies a 1-signal for 50 ms when the mid-positions are overrun (see section 4.4.4.).

Prerequirements

The drive must be ready to operate. There must be an 0-signal at inputs I1...I4. There must be an 0-signal at input I8 (Remote) when positioning is made with the help of the keys on the SPC11. The procedure should be carried out with the maximum mass load. Depending on the variant, the supply pressure must be switched on or off.

Variants	**Proceed as follows:**
The supply pressure is switched off	During the teach procedure, the moveable mass can be moved by hand very precisely into the desired position.
The supply pressure is switched on	The mass can be moved manually. Under certain circumstances, very precise movement is difficult and/or time-consuming.

The following section explains how to teach the mid-positions when the supply pressure is switched on. If you wish to teach the mid-positions when the supply pressure is switched off, you must adopt the same procedure. However, the mass will not start to move automatically when key ⟵ or ⟶ is pressed, but must be pushed by hand into the desired mid-position. It is nevertheless necessary to press key ⟵ or ⟶ at the relevant point.

In order to teach a mid-position when the supply pressure is switched on, proceed as follows:

1. Press briefly key ⟵ or ⟶. The teachable position number (e.g. 3) will then flash.

The position number flashes.

2. If you do not wish to teach the mid-position, press briefly the Esc key. The procedure will then be discontinued. Then repeat step 1. The next teachable position number then flashes.

Please note
The drive is started with the following function: Make sure that:

- it is not possible to place one's hand in the positioning range of the moveable mass when compressed air is applied to the system.
- the complete positioning range is unobstructed.

3. If you wish to teach the mid-position displayed, hold the key ⟵ or ⟶ pressed down while the mass moves. The mass will then move in the appropriate direction.

4. Release the key when the moveable mass is to stop. The mass now stands controlled in the current position.

5. Repeat steps 3 and 4 until the moveable mass has reached the desired position.

The position number flashes.

6. When the moveable mass has reached the desired position, confirm with Enter (> 2 s), in order to save the position. The current position will then be saved as the mid-position. The relevant output (O3 or O4) supplies a 1-signal.

No flashing

7. If you wish to teach the next mid-position, repeat the steps listed as from step 1.

Repetition accuracy

The repetition accuracy when approaching the mid-position depends on the drive type.

Detailed specifications on the repetition accuracy with the drive you are using can be found in the drive-specific supplement.

Please note
Observe the following instructions in order to achieve good positioning behaviour and the specified repetition accuracy.

– The distance between the mid-position and the end position of the drive must be at least 10 % of the total cylinder stroke length or complete swivel angle, in order to provide a siufficient compressed air cushion.

– Positioning paths between taught positions should not be less than 3 % of the total cylinder stroke length or complete angle.
With linear drives and cylinders the positioning paths should be at least 20 mm long.

– If mid-positions P.03 and P.04 lie at the same point and if movement is made to one of the mid-positions (e.g. to P.03), only the output for the relevant order will be set when the mid-position is reached (e.g. O3). The output of the other mid-position will be set for 50 ms only if it is overrun (overswing) (sensor function).

Summary of the commissioning procedure on the SPC11

Set the parameters and start the automatic teach procedure (SPC11 as supplied from factory)

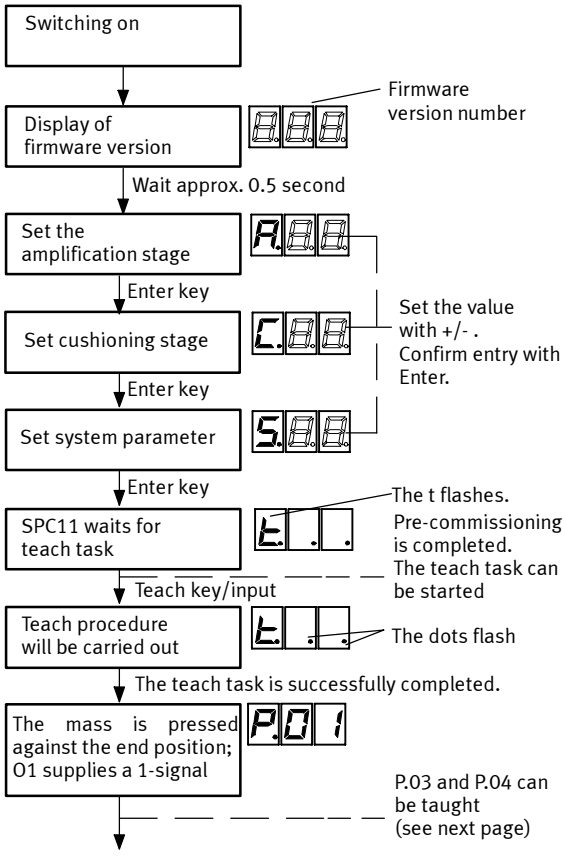


Fig. 4/3: Setting parameters and starting the teach procedure

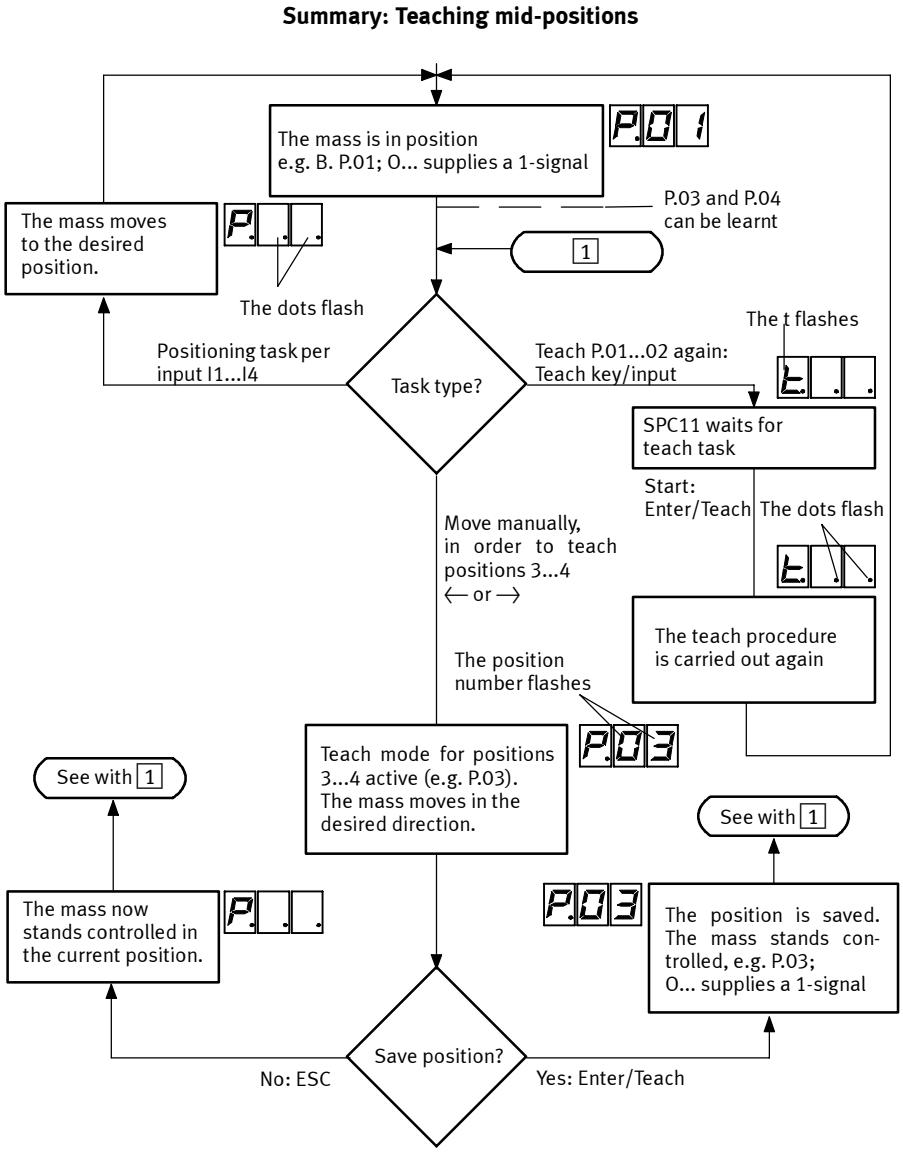


Fig. 4/4: Teaching the mid-positions (P.03 and P.04)

4.3.4 Conclude teach procedure

Adaption

The positioning behaviour is constantly monitored during operation. Internal characteristic values are then adapted to the actual status of the drive (adapted), e.g. in order to compensate for system wear, or similar, during the period in service.

After commissioning, the positioning behaviour improves automatically by adaption after approx. 20 to 30 strokes. Always allow therefore 20 to 30 positioning cycles to be carried out after teaching the end positions and mid-positions.

4.3.5 Carry out the teach procedure again

When the SPC11 is ready to operate, the teach procedure can be started again, e.g. with the Teach key. The SPC11 then signals its readiness to carry out the teach procedure (t flashes). You can discontinue this procedure by switching off the power supply. You can start the teach procedure by pressing the Teach key again (for at least 2 seconds) (see section 4.3.2).

When the end positions are taught again, the adaption values will be deleted. Taught mid-positions are retained.

Please note
If, when the end positions have been taught again, the previously taught mid-positions (P.03 and P.04) now lie outside the positioning range, positioning commands for moves to the mid-positions will be quitted with error E14. As soon as the mid-positions lie once again in the permitted positioning range by adjustment and re-teaching of the end positions, the commands for moves to the mid-positions will be carried out.

4.4 Notes on operation

Warning
Damage may be caused if permitted limits, such as mass loads, mass moments of inertia, swivel frequencies etc. are exceeded. Make sure that the specified limits for the drive used are observed (see operating instructions for the relevant drive).

Warning
In order to prevent damage due to uncushioned movement into the end positions:

- Always carry out the teach procedure again if the fixed stops have been adjusted or if components and tubing have been replaced.
- Do not exceed the permitted mass load.

Warning
In order to avoid undesired movements of the actuators, always proceed as follows:

Switching on

- Always switch on first the power supply, then the compressed air supply.

Switching off

- Switch off the power supply and the compressed air supply simultaneously or in the following sequence:
  1. the compressed air supply
  2. the power supply.

A positioning task is retained permanently when the power supply is switched on. When the power supply is switched on again, the positioning task (P.01...P.04) at inputs I1...I4 will be carried out.

If there is no positioning task when the power supply is switched on, and the moveable mass is not in an end position, the valve slide will remain in the electrical mid-position. The moveable mass can move slowly into an end position, due to the asymmetrical voltage-pressure curve of the proportional directional control valve.

4.4.1 Switching-on behaviour after successful commissioning

If commissioning has already been carried out, the SPC11 will be ready for operation after a few seconds.

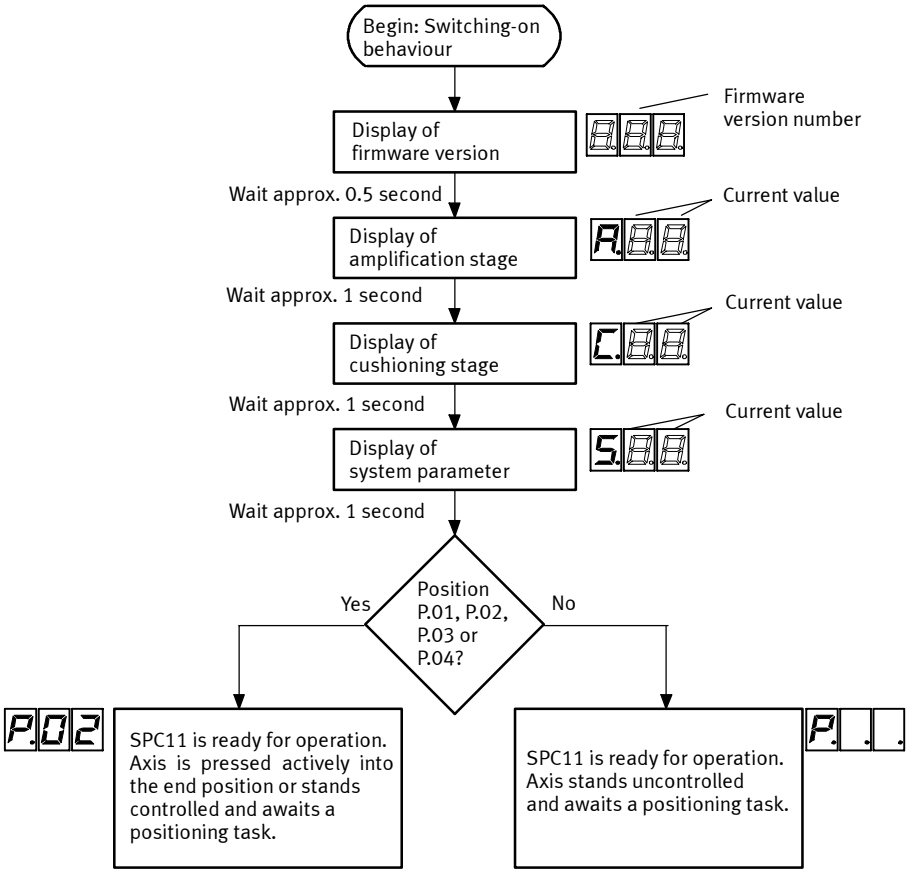


Fig. 4/5: Switching-on behaviour of the SPC11 after commissioning

Position of the moveable mass	Switching-on behaviour
In end position P.01...P.02	A positioning task for movement to the appropriate end position is generated, whereby the moveable mass is pressed against the end position. The relevant output (O1 or O2) supplies a 1-signal.
In taught mid-position P.03...P.04	The moveable mass remains uncontrolled in the taught position (P.03...P.04). The relevant output (O3 or O4) supplies a 0-signal. The SPC11 waits for the next positioning task.
Outside positions P...	The moveable mass remains uncontrolled in the current position (P...). The SPC11 waits for the first positioning task.

4.4.2 The first positioning task

With the first positioning task, the SPC11 checks whether the mass moves in the desired direction. If the mass moves in the wrong direction, the SPC11 will diagnose an incorrectly connnected system and will display error E12 (incorrect direction of movement...). The SPC11 then reacts as follows:

– The valve slide of the proportional directional control valve will be brought into the electrical mid-position (flow blocked).

– The output ERROR supplies a 1-signal.

– No more positioning tasks will be accepted.

In order to delete the error:

• Switch off the power supply, then switch it on again.

This safety function helps to avoid damage due to incorrect tubing connections in systems.

If the moveable mass is already in an end position when the power supply is switched on, a positioning task for movement into this end position will be generated and the mass will be pressed against the end position. If the drive moves out of the end position instead of holding this end position, the SPC11 will also diagnose incorrectly connected tubing in the system and will display an error. This may also be due to one of the following causes:

– The compressed air supply is still switched off. The drive has been moved manually or by external forces out of the end position or it moves itself (e.g. in the vertical mounting position).

– As a result of the system being pressurized too quickly, the drive moves briefly out of the end position (asymmetrical pressure build-up in the cylinder chambers).

In order to avoid such causes, proceed as follows:

- Pressurize the complete system slowly (e.g. with a safety start-up valve type HEL-... or HEM-...). Actuator movements will then be controlled.
- Make sure that the moveable mass can neither be moved by hand nor manually out of the end position when the power supply is switched on, e.g. by using a clamping unit.

4.4.3 Controlling the SPC11

With the command inputs P.01...P.04 you can move the moveable mass into the saved end positions or mid-positions. When an end position is reached, the moveable mass will be pressed against the stop with a pressure at maximum equal to the operating pressure. When a mid-position is reached, the moveable mass stands controlled in position.

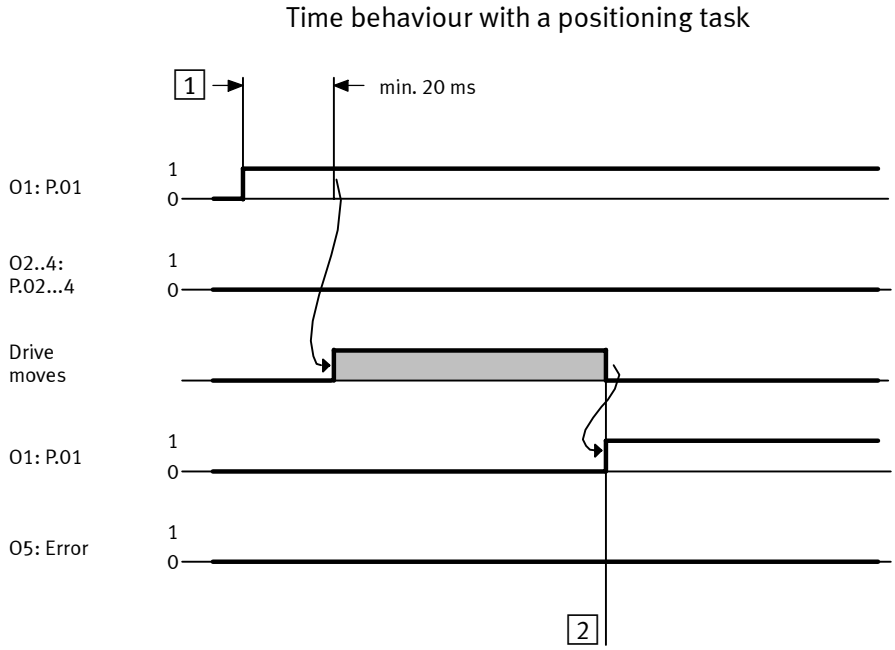
A 1-signal at the Remote input deactivates the operating keys and activates the relevant remote inputs (pins 2...4). Manual positioning, e.g. via external operating keys or a higher-order PLC is therefore possible.

Inputs on the 15-pin plug "Control" (I = Input)

Pin	Inputs/outputs	Manual
1	I8: Remote	A 1-signal deactivates the operating keys and activates the relevant inputs (pins 2...4)
2	I7: Remote +/⟶	If there is a 0-signal at the Remote input, these inputs have no function. If there is a 1-signal at the Remote input, the functions of the operating keys can be accessed via these inputs (see Appendix A).
3	I6: Remote Enter/Teach/Esc	
4	I5: Remote +/⟵/–	
5	I4: P.04	If inputs P.01, P.02 and P.03 supply a 0-signal (0 V), the positioning task for movement to taught mid-position P.04 is issued by a 1-signal at this input (min. switch-on duration 20 ms). 1)
6	I3: P.03	If inputs P.01, P.02 and P.04 supply a 0-signal (0 V), the positioning task for movement to taught mid-position P.03 is issued by a 1-signal at this input (min. switch-on duration 20 ms). 1)
7	I2: P.02	If inputs P.01, P.03 and P.04 supply a 0-signal (0 V), the positioning task for movement to end position P.02 is issued by a 1-signal at this input (min. switch-on duration 20 ms). 1)
8	I1: P.01	If inputs P.02, P.03 and P.04 supply a 0-signal (0 V), the positioning task for movement to end position P.01 is issued by a 1-signal at this input (min. switch-on duration 20 ms). 1)

1) Change of direction is possible at any time.

Outputs on the 15-pin plug “Control” (O = Output)		
Pin	**Inputs/outputs**	**Manual**
9	O5: Error	Supplies a 1-signal, when an error occurs (see chapter 5). Supplies a 0-signal in normal operating status.
10	O4: P.04	This output supplies a 1-signal when the moveable mass is in the taught mid-position P.04. The output supplies a 1-signal for 50 ms if mid-position P.04 is overrun.
11	O3: P.03	This output supplies a 1-signal when the moveable mass is in the taught mid-position P.03. The output supplies a 1-signal for 50 ms if mid-position P.03 is overrun.
12	O2: P.02	This output supplies a 1-signal when the moveable mass is in the end position P.02.
13	O1: P.01	This output supplies a 1-signal, if the moveable mass is in end position P.01 (on the side with the electrical connection to the potentiometer).



1 Switch-on duration at least 20 ms

2 End position (P.01) reached

Fig. 4/6: Time behaviour at the start of a positioning task (example position 1)

Manual positioning

Prerequirements

The drive must be ready to operate. There must be an 0-signal at inputs I1...I4. There must be a 0-signal at input I8 (Remote) when positioning is made with the help of the keys.

With the keys ← or → the moveable mass can be positioned manually.

Key	Manual
←/-	Reduce position value (mass moves slowly in direction of measuring system zero point)
+/→	Increase position value (mass moves slowly away from measuring system zero point)

In order to position the moveable mass manually:

- Hold the relevant key (← or →) pressed down for as long as the mass is to move.
- Release the key in order to stop.

The flashing of the position number indicates that the current position can be saved as mid-position when the Enter key is pressed (see section 4.3.3).

4.4.4 Using the taught mid-position as a sensor position

The mid-positions can also be used as sensor positions, as the relevant output (O3...O4) supplies a 1-signal for 50 ms when the mid-positions are overrun.

Example 1: Change of direction

Please note
If the SPC11 is to be controlled directly via the “sensor signal”, please note that:

– The distance between the taught mid-position and the mechanical end position must be correspondingly long, as the braking procedure is not started until the signal has been recognized.

A premature change of direction can be implemented with the aid of a taught mid-position (P.03...4). The relevant output (O3...O4) of the SPC11 supplies a 1-signal for 50 ms when the moveable mass has travelled the corresponding stretch. The moveable mass will then be brought back to the end position by means of an input signal.

Example: Target position = Pos2

1 Drive (here linear drive type DGP...-...)

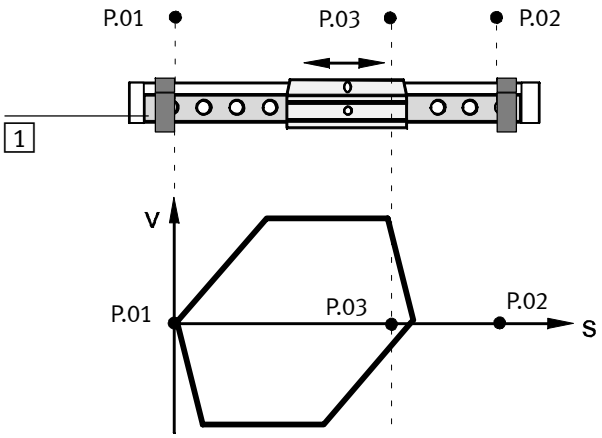
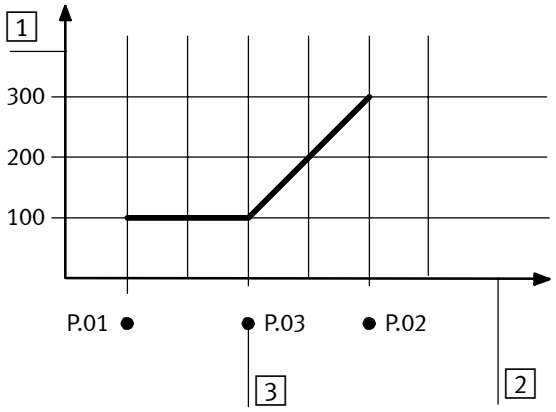


Fig. 4/7: Premature change of direction (example with linear drive)

The output which signalizes that the mid-position has been reached (here O3), can be wired, if necessary, directly with the corresponding input (here I1, for P.01).

Example 2: Preselect position for time-optimized by-passing

The taught mid-positions (P.03...4) can also be used for starting a second drive in advance, e.g. in order to by-pass obstacles time-optimized.



1 Positioning path for the second, external drive

2 Positioning path for the SPC11

3 Preselect position P.03

Fig. 4/8: Time-optimized by-passing

The second drive begins moving to position 300, as soon as the drive controlled by the SPC11 overruns the taught mid-position P.03 and has not yet completed the positioning task.

Diagnosis and error treatment

Chapter 5

Contents

5.1 Error messages on the SPC11

If an error occurs, the output ERROR will supply a 1-signal.
The SPC11 displays an error number and reacts as follows:

– The valve slide of the proportional directional control valve will be brought into the electrical mid-position (flow blocked).

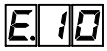
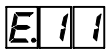
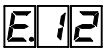
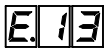
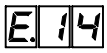
– The output ERROR supplies a 1-signal.

– No more positioning tasks will be accepted.

In order to delete the error:

• Switch off the power supply, then switch it on again.

Error number	Operating status	Eliminating faults
	Measuring system not connected or measuring system cable fracture	• Connect the measuring system or check the cable
	Incorrect direction of movement ascertained; tubing is not connected correctly	• Correct the incorrect tubing connections to the proportional directional control valve
	Offset error - static identification: Proportional directional control valve is faulty or there is an external varying force on the slide during identification travel	• Replace the proportional directional control valve or use a constant external force during the identification travel
	No movement during static identification	• Check the compressed air supply and the tubing
	Overswing error during dynamic identification due to incorrect amplification stage, cushioning stage or system parameter	• Check and correct the amplification stage, cushioning stage and system parameter
	Amplification stage, cushioning stage or system parameter set incorrectly	• Correct parameters

Error number	Operating status	Eliminating faults
	Measuring system contains no valid length code (non-permitted measuring system length or length code does not exist)	Servicing required
	SPC11 damaged (EEPROM-ACK error)	• Replace SPC11
	Measuring system type is not supported (invalid measuring system ID read)	• Replace measuring system
	Communication with Temposonics faulty (non-plausible data received)	• Check measuring system length or replace measuring system
	Communication with Temposonics faulty (non-plausible data received)	• Check measuring system length or replace measuring system
	Incorrect direction of movement ascertained during first positioning stroke; tubing is not connected correctly	• Correct the incorrect tubing connections to the proportional directional control valve
	Time out, Position cannot be reached quickly enough (positioning time out approx. 10 s)	• Eliminate obstacle in positioning range or check compressed air supply
	Mid-position does not exist or is outside the permitted positioning range	• Extend the positioning range and teach the end positions again, in order that the mid-positions once again lie within the permitted positioning range, or • Teach the mid-positions again.

5.2 Faults during operation

1) The mass does not move

Cause	Remedy	Remark
No supply pressure	Check	5...7 bar required
Valve cable is not connected correctly	Check	See section 3.3.3
Proportional directional control valve is defective	Check and, if necessary, replace	Look through the viewing window to see if the valve slide jams [1)]
There are several positioning tasks simultaneously	Check input signals I1...I4	Only one positioning task is permitted
1) See operating instructions for valve MPYE-5-...		

2) Bad positioning behaviour during movement to end position

Cause	Remedy	Remark
System is not mounted correctly	Check fitting and mechanical parts	Check measuring system and drive for parallelism, mechanical play and sluggishness
System is not earthed correctly	Check	See chapter 3
Parameters are not set optimally	Check parameters	See in the manual “Drive-specific supplement”
High fluctuations in the supply pressure (> 0.5 bar)	Check supply pressure	If necessary, fit a compressed air reservoir
Non-permitted mass load	Check mass load and parameters	If necessary, apply a basic load, in order that the permitted value range can be maintained when positioning is made with different masses.

Cause	Remedy	Remark
With too fast/hard movement to the end positions	Increase the cushioning stage (parameter C)	See section 5.3
with too fast/hard movement to the end positions	Increase the cushioning stage (parameter C)	See section 5.3

3) Mass moves without command against the end position

Cause	Remedy	Remark
Proportional directional control valve is defective	Check and, if necessary, replace the proportional directional control valve	Look through the viewing window to see if the valve slide jams [1)]
1) See operating instructions for valve MPYE-5-...		

5.3 Optimizing the positioning behaviour

After the teach procedure the positioning behaviour is optimized automatically by internal adaption in the first 20 to 30 strokes. If the quality of the positioning behaviour still does not fulfil requirements, proceed as follows:

– Check the set parameters (see “Drive-specific supplement” for the drive used).

– Check whether the pneumatic installation fulfils the requirements listed in section 3.2. Pay attention here in particular to the stability of the supply pressure and correct tubing lengths, tubing diameter and screw connectors.

If the mass moves too hard into the end position or brakes too hard before reaching the end position, you can optimize the positioning behaviour by increasing or reducing the cushioning and/or amplification stages.

Control parameter stage	**Display on the SPC11**
Amplification stage (**A**mplification stage)	A
Cushioning stage (**C**ushioning stage)	C

Warning
Incorrectly set parameters can cause damage to the fixed stops and to the drive.

Take the utmost care when setting the parameters.

When the parameters are modified, the saved end positions and adaption values will be deleted for security purposes. The teach procedure must therefore be carried out again. Taught mid-positions are retained.

All parameters are set to 0 at the factory. Further information on the parameters see “Drive-specific supplement” for the drive used.

Cushioning stage (Cushioning stage)

The cushioning stage serves for optimizing the starting behaviour when movement is made towards the end positions (lower stage = less cushioning).

Setting	User manual
Too high	The positioning move is heavily cushioned. The positioning time increases.
Too low	Leads to heavy overswing and, as a result, to hard knocking againt the end positions.
Optimal	The braking phase (counter-directional pressurization) is started sufficiently early. Slight shocks when movement is made to the end positions.

Amplification stage (Amplification stage)

The amplification stage should not usually be modified (lower stage = less amplification).

Procedure for optimizing

Please note
If, when the end positions have been taught again, the previously taught mid-positions (P.03 and P.04) now lie outside the positioning range, positioning commands for moves to the mid-positions will be ignored. As soon as the mid-positions lie once again in the permitted positioning range by adjustment and re-teaching of the end positions, the commands for moves to the mid-positions will be carried out.

Prerequirements

There must be an 0-signal at inputs I1...I4. The maximum mass load and, if applicable, the fixed stops must be fitted correctly

1. Ascertain first the cushioning stage which is recommended for the components you are using (see “Drive-specific supplement”.
2. Make sure that the drive is standing still.

Caution
When the modify mode is activated, the valve slide moves to the mechanical mid-position. During positioning, the mass can therefore move uncushioned into one of the end positions.

Make sure that the drive is standing still before you activate the modify mode.

3. In order to activate the modify mode, press all three keys on the SPC11 simultaneously. Ther modify mode will then be activated. The SPC11 displays the amplification stage set, e.g.:

(A.02)

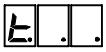
4. With the keys +/- you can increase or reduce the value by one stage, according to the positioning characteristics of the drive (see Axis-specific supplement).
   Hold the Enter key pressed down for longer than 2 seconds (> 2 s) in order to transfer the value. The cushioning stage will then be displayed.

   
   (C.04)

5. With the keys +/- you can increase or reduce the value by one stage, according to the positioning characteristics of the drive (see Axis-specific supplement).
   Hold the Enter key pressed down for longer than 2 seconds (> 2 s) in order to transfer the value. The system parameter will then be displayed.

   
   (S.01)

6. Check and, if necessary, correct the current setting. Hold the Enter key pressed down for longer than 2 seconds (> 2 s) in order to transfer the value. The SPC11 then signals its readiness to carry out the teach procedure (t flashes).

   
   The t flashes

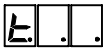
Please note
During the teach procedure, the moveable mass moves at first slowly, then at the highest possible acceleration and speed. Make sure that:

- It is not possible to place one's hand in the positioning range of the moveable mass when compressed air is applied to the system.
- The complete positioning range is unobstructed.

7. When there is a 0-signal at the Remote input:
   hold the Enter/Teach key pressed down for at least 2 seconds.

When there is a 1-signal at the Remote input:
apply a 1-signal to the teach input for at least 2 seconds.

The SPC11 then carries out the teach procedure. The moveable mass moves at first slowly, then dynamically. The display shows the following:



The dots flash at the same rate.

The teach procedure can take several minutes, depending on the drive used. The teach procedure is completed when the drive stands in end position P.01. The display shows the following:

(P.01)

Output O1 supplies a 1-signal. The drive is now ready to operate. The mid-positions P.03 and P.04 can be taught.

8. Check the positioning behaviour. Repeat steps 2 to 8 if the positioning behaviour still does not meet with your requirements.

In order to influence the positioning times:

- Increase or reduce the supply pressure within the permitted range.
- Install exhaust air restrictors in the exhaust lines of the proportional directional control valve.

With fluctuations in pressure of over 1 bar in front of the proportional directional control valve, fit a compressed air reservoir (see chapter 3). Please observe general installation instructions.

Commissioning via digital inputs/outputs

Appendix A

Contents

A.1 The remote inputs of the SPC11

A 1-signal at the Remote input deactivates the keys of the SPC11. The key functions can then be accessed via the digital inputs (I5...I7). This permits commissioning with external operating keys or via a higher-order PLC/IC.

Input	Function	Manual
I5:	←/-	With change of position: A 1-signal (min. 20 ms) at this input reduces the position value continuously as long as there is a 1-signal (drive moves in the direction of the measuring system zero point) With change of parameter: A 1-signal (min. 20 ms) at this input reduces the parameter value by one [1)]
I6:	Enter/Teach (> 2 s) Esc (< 1 s)	A 1-signal at this input (longer than 2 seconds) confirms the parameter value or starts the teach procedure. A short 1-signal (< 1 s) interrupts the procedure.
I7:	+/→	With change of position: A 1-signal (min. 20 ms) at this input increases the position value continuously as long as there is a 1-signal (drive moves away from the measuring system zero point) With change of parameter: A 1-signal (min. 20 ms) at this input increases the parameter value by one [1)]
1) Continuous modification of parameter values is only possible with the keys on the SPC11.		

A.2 Instructions on commissioning via digital inputs/outputs

Please note
With commissioning via digital inputs, the same conditions must be fulfilled as for commissioning with the keys on the SPC11 (see chapter 4).

Setting the parameters by PLC/IPC

The parameters of the SPC11 can be set with the digital I/Os, e.g. with external operating keys or by PLC/IPC.

Commissioning via digital I/Os does not differ from commissioning with the keys on the SPC11. Continuous modification of parameter values is however only possible with the keys on the SPC11 (see chapter 4).

Please note
When parameters are modified, the current parameter values are shown in the display on the SPC11. There is no reply message to the PLC/IPC.

The following diagram (see Fig. A/1) and the time diagrams in the sections which follow show how the parameters can be set by PLC/IPC.

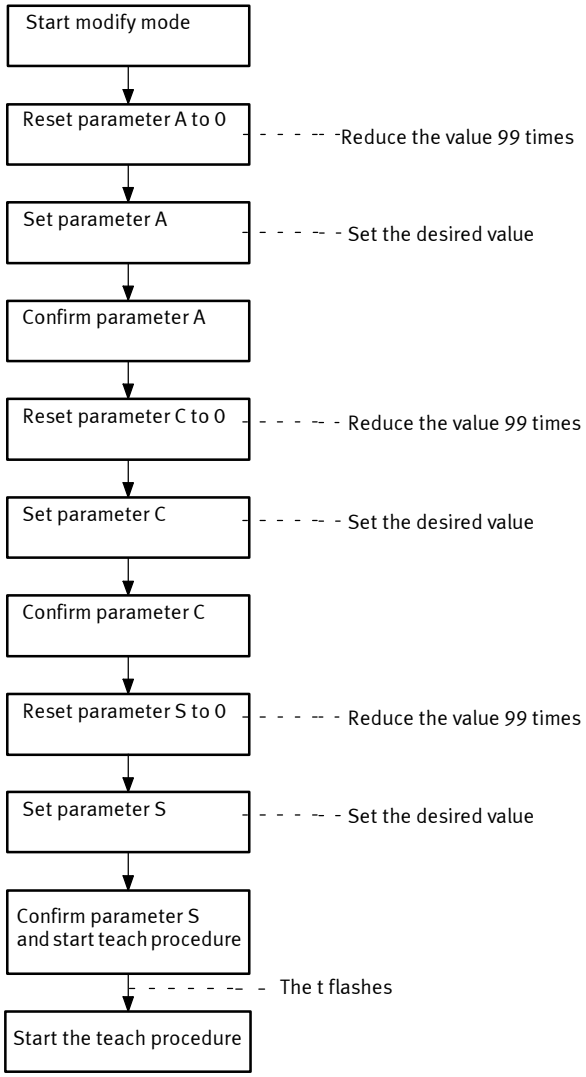
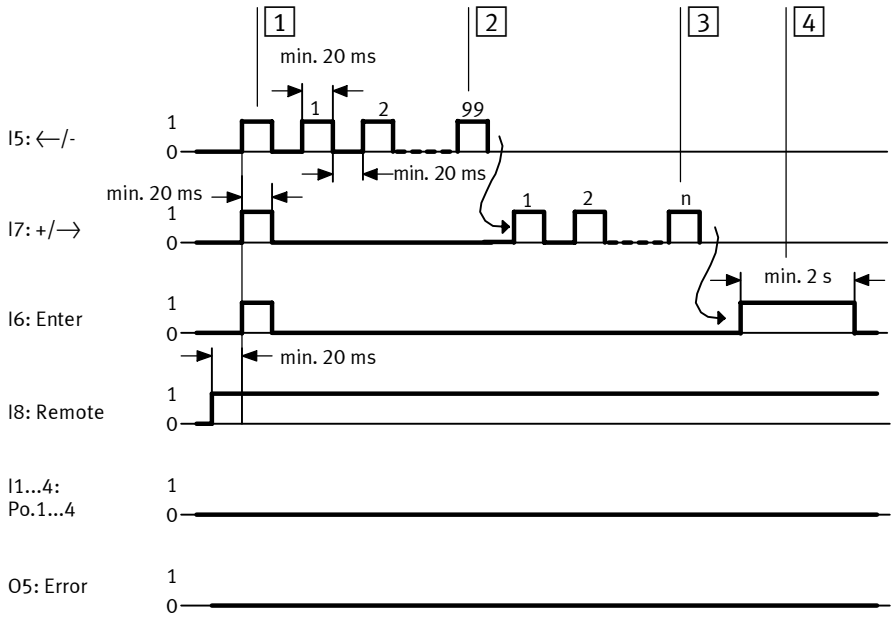


Fig. A/1: Set parameters and start the teach procedure

A.2.1 Set time diagram for parameters



1 Activate the modify mode

2 Reset parameter A to 0

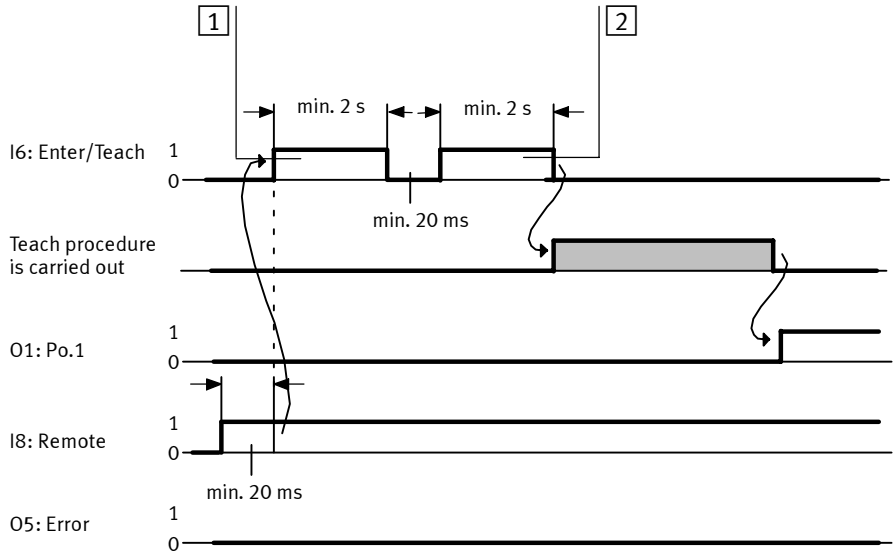
3 Set parameter value A

4 Confirm parameter value A (switch-on duration min. 2 s)

Fig. A/2: Time diagram Set parameter A

When parameter value A has been confirmed, parameter C and then parameter S can be set (see Fig. A/1). When parameter S is confirmed, the teach procedure is introduced at the same time and can then be started (see Fig. A/3).

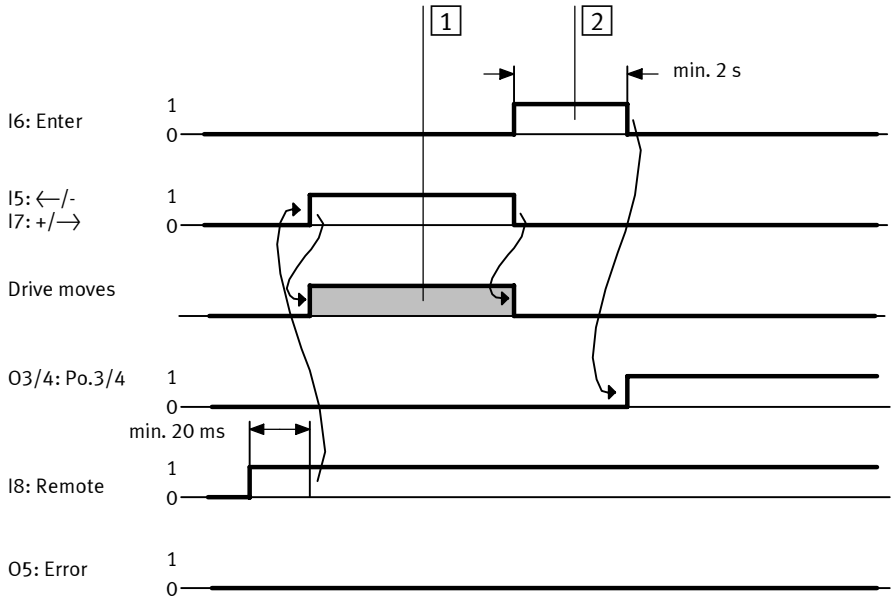
A.2.2 Introduce and start the time diagram for the teach procedure



1 Introduce the teach procedure 2 Start the teach procedure

Fig. A/3: Time diagram Introduce and start the teach procedure

A.2.3 Time diagram Teach mid-position



[1] Drive moves as long as there is an appropriate signal (I5 or I7)

[2] Save current position as mid-position (switch-on duration min. 2 s)

Fig. A/4: Time diagram Teach mid-position

Technical appendix

Appendix B

Contents

B.1 Technical specifications

Technical specifications		Type SPC11-...-...
Dimensions (plug exit upwards; without cable incl. fastening bracket)	– Height – Width – Depth	Approx. 43 mm Approx. 118.4 mm Approx. 80 mm
Weight		Approx. 400 g
Temperature range	– Operation – Storage/transport	0...+50 °C -20...+70 °C
Relative humidity		95 % non condensing
Protection class as per EN 60529; plug connector inserted or fitted with protective cap		IP65
Protection against electric shock as per EN 60204-1 / IEC 204	Protection against direct and indirect contact	By connection to a PELV power unit (Protected Extra-Low Voltage)
Supply	– Voltage – Permitted voltage fluctuations – Residual ripple – Current consumption incl. valve type SPC11-POT--... type SPC11-AIF-MTS – Current consumption without valve type SPC11-POT--... type SPC11-AIF-MTS	24 V DC -10 %...+25 % max. 6 % 1.2 A 1.3 A Approx. 70 mA Approx. 170 mA
Digital inputs	– Input voltage – Input current – Minimum switch-on period – Signal voltage	24 V DC 4 mA/input with 24 V 20 ms For logical 0: 0...5 V for logical 1: 15...30 V
Digital outputs	 – Output voltage (min.) – Output current – Sum of output currents	Short-circuit resistant V_b to V_b -3 V at 0.1 A Max. 0.1 A Max. 0.5 A

Technical specifications		**Type SPC11-...-...**
Measuring system input type SPC11-POT-... type SPC11-MTS-AIF	Potentiometer – Power supply – Input voltage MTS Temposonics – Power supply – Communication	 +10 V 0...+10 V 24 V CAN field bus
Valve output	– Supply – Output voltage	24 V DC 0...+10 V
Electromagnetic compatibility	– Interference emission – Immunity to interference	Tested as per EN 55011 Limit value class B Tested as per EN 61000-6-2
Vibration and shock	– Vibration – Shock	Tested as per EN 60068 part 2-6; severity class 1 Tested as per EN 60068 part 2-27; severity class 2

B.2 Index

E

F

I

K

M

O

P

R

S

T