SISTO

A KSB Company

SISTO-SK-i.310/.320
Intelligent Position Feedback Unit

Operating Manual

Legal information/Copyright

Operating Manual

Original operating manual

Contents

Glossary

24 V

Communications system with discrete digital inputs and digital outputs

AS-i

AS interface (abbreviation for Actuator Sensor interface) – standard interface for field bus communication for connecting actuators and sensors in accordance with IEC 62026-2.

AZ actuator

OPEN/CLOSE = double-acting piston actuator (air-to-open / air-to-close)

DI

Digital input, binary input

DO

Digital output, binary output

IO-Link

Communications system for connecting intelligent sensors and actuators to an automation system in accordance with the IEC 61131-9 standard.

K

Piston diameter

LAP

Pneumatic piston actuator, available in versions AZ, OF and SF

MD

Diaphragm diameter, numeric designation of the diaphragm size

MV

Solenoid valve

OF actuator

Opening spring = pneumatic piston actuator, fail-open (spring-to-open / air-to-close)

PLC

Programmable logic controller

SF actuator

Closing spring = pneumatic piston actuator, fail-close (air-to-open / spring-to-close)

1 General

1.1 Principles

This operating manual is valid for the type series and variant indicated on the front cover.

The operating manual describes the proper and safe use of this equipment in all phases of operation.

In the event of damage, immediately contact SISTO Armaturen to maintain the right to claim under warranty.

1.2 Contact data

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1.3 Target group

This operating manual is aimed at the target group of trained and qualified specialist technical personnel.

1.4 Other applicable documents

Table 1: Overview of other applicable documents

Document	Contents
Type series booklet 8676.5	Description of SISTO-SK-i.310/.320
Operating manual 0570.822	Operating manual of SISTO-C diaphragm valves
SISTO catalogue 8652.10	Sterile Processes catalogue

1.5 Symbols

Table 2: Symbols used in this manual

Symbol	Description
✓	Conditions which need to be fulfilled before proceeding with the step-by-step instructions
▷	Safety instructions
⇨	Result of an action
⇨	Cross-references
1. 2.	Step-by-step instructions
	Note Recommendations and important information on how to handle the product

1.6 Key to safety symbols/markings

Table 3: Definition of safety symbols/markings

Symbol	Description
DANGER	**DANGER** This signal word indicates a high-risk hazard which, if not avoided, will result in death or serious injury.
WARNING	**WARNING** This signal word indicates a medium-risk hazard which, if not avoided, could result in death or serious injury.
CAUTION	**CAUTION** This signal word indicates a hazard which, if not avoided, could result in damage to the machine and its functions.
	**General hazard** In conjunction with one of the signal words this symbol indicates a hazard which will or could result in death or serious injury.
	**Electrical hazard** In conjunction with one of the signal words this symbol indicates a hazard involving electrical voltage and identifies information about protection against electrical voltage.
	**Machine damage** In conjunction with the signal word CAUTION this symbol indicates a hazard for the machine and its functions.
	**Warning: Strong magnetic field** In conjunction with one of the signal words this symbol indicates a hazard involving magnetic fields and identifies information about protection against magnetic fields.
	**Warning for persons with pacemaker** In conjunction with one of the signal words this symbol indicates a hazard involving magnetic fields and identifies special information for persons with a pacemaker.

2 Safety

DANGER

All the information contained in this section refers to hazardous situations.

In addition to the present general safety information the action-related safety information given in the other sections must be observed.

2.1 General

- This operating manual contains general installation, operating and maintenance instructions that must be observed to ensure safe operation of the system and prevent personal injury and damage to property.
- Comply with all the safety instructions given in the individual sections of this operating manual.
- The operating manual must be read and understood by the responsible specialist personnel/operators prior to installation and commissioning.
- The contents of this operating manual must be available to the specialist personnel at the site at all times.
- Instructions and information attached to the position feedback unit, the respective valve and the accessories must always be complied with and kept in a perfectly legible condition at all times.
- The operator is responsible for any eventualities or incidents which may occur during installation performed by the customer, operation and maintenance.
- The operator is responsible for ensuring compliance with all local regulations not taken into account.

2.2 Intended use

- The SISTO-SK-i.310/.320 position feedback unit signals and controls (optional) the position of pneumatic valve actuators.
- Only operate position feedback units which are in perfect technical condition.
- The position feedback unit must only be operated within the operating limits described in the other applicable documents.
- Consult the manufacturer about any other modes of operation not described in the product literature.
- The position feedback unit's cover must not be removed.

2.2.1 Prevention of foreseeable misuse

- Never exceed the permissible application and operating limits specified in the product literature regarding pressure, temperature, etc.
- Observe all safety information and instructions in this manual.
- Do not supply the following fluids to the position feedback unit's air supply connections:
  - Liquids
  - Solids-laden fluids
  - Aggressive fluids
  - Combustible fluids
- Never use the position feedback unit in potentially explosive atmospheres.
- Prevent any moisture ingress into the position feedback unit's housing.
- The position feedback unit's housing must not be subjected to mechanical loads.
- When laying the power cables and the existing pneumatic lines, ensure that forces are not transmitted to the position feedback unit.

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- Protect the position feedback unit from sources of radiation (e.g. sun).
- Protect the position feedback unit against vibrations.
- Regularly check that the electrical and pneumatic connections and the connection to the pneumatic valve actuator are properly fitted.

2.3 Personnel qualification and training

- All personnel involved must be fully qualified to install, operate, maintain and inspect the product this manual refers to.
- The responsibilities, competence and supervision of all personnel involved in transport, installation, operation, maintenance and inspection must be clearly defined by the operator.
- Deficits in knowledge must be rectified by means of training and instruction provided by sufficiently trained specialist personnel. If required, the operator can commission the manufacturer/supplier to train the personnel.
- Training on the product must always be supervised by specialist technical personnel.

2.4 Consequences and risks caused by non-compliance with this manual

- Non-compliance with this operating manual will lead to forfeiture of warranty cover and of any and all rights to claims for damages.
- Non-compliance can, for example, have the following consequences:
  - Hazard to persons by thermal and mechanical effects
  - Failure of important product functions
  - Failure of prescribed maintenance and servicing practices

2.5 Safety awareness

In addition to the safety information contained in this operating manual and the intended use, the following safety regulations shall be complied with:

- Accident prevention, health regulations and safety regulations
- Explosion protection regulations
- Safety regulations for handling hazardous substances
- Applicable standards, directives and laws

2.6 Safety information for the operator/user

The position feedback unit including valve is intended for use in areas which cannot be accessed by unauthorised persons. Operation of the valve in areas accessible to unauthorised persons is only permitted if appropriate protective devices are fitted at the site. This must be ensured by the operator.

- Fit protective equipment (e.g. contact guards) supplied by the operator for hot, cold or moving parts, and check that the equipment functions properly.
- Do not remove any protective equipment (e.g. contact guards) during operation.
- Ensure that the system and system section are in a safe state that allows safe operation of the valve.
- Eliminate all electrical hazards. (In this respect refer to the applicable national safety regulations and/or regulations issued by the local energy supply companies.)

2.7 Safety information for maintenance, inspection and installation

- Modifications or alterations of the position feedback unit and the valve require the manufacturer's prior consent.
- Use only original spare parts or parts/components authorised by the manufacturer. The use of other parts/components can invalidate any liability of the manufacturer for resulting damage.
- The operator ensures that maintenance, inspection and installation are performed by authorised, qualified specialist personnel who are thoroughly familiar with the manual.
- Shut down the systems before performing work on the position feedback unit and the valve.
- Ensure that the recognised safety regulations and technical rules are complied with when planning assignments and operating the equipment.
- When taking the position feedback unit out of service always adhere to the procedure described in the operating manual.
- As soon as the work has been completed, re-install and re-activate any safety-relevant devices and protective devices. Before returning the product to service, observe all instructions on commissioning. (⇨ Section 7, Page 32)

2.8 Unauthorised modes of operation

- The position feedback unit is operated outside the limits stated in the operating manual.
- The position feedback unit is not operated in accordance with the intended use.

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3 Transport/Storage/Disposal

3.1 Checking the condition upon delivery

1. On transfer of goods, check each packaging unit for damage.
2. In the event of in-transit damage, assess the exact damage, document it and notify the supplying dealer and the insurer about the damage in writing immediately.

If the position feedback unit has been ordered as a unit together with a pneumatic valve actuator, the position feedback unit will be supplied mounted to the pneumatic valve actuator.

3.2 Transport

Take suitable precautions to prevent damage during transport.

Dispose of the transport packaging in accordance with the respective disposal regulations/environmental protection regulations.

3.3 Storage/preservation

If commissioning is to take place some time after delivery, the following measures are recommended for storage:

- Storage and/or temporary storage of the position feedback unit must ensure that, even after a prolonged period of storage, its function is not impaired.
- For this reason, the position feedback unit must be stored in its original packaging in a dry, dark and dust-free location.
- The storage room temperature must be between +10 °C and +30 °C.

3.4 Disposal

1. Dismantle the position feedback unit.
2. Separate and sort the materials, e.g. by:
   - Metals
   - Plastics
   - Electronic waste
3. Dispose of materials in accordance with local regulations or in another controlled manner.

4 Description

4.1 SISTO-SK-i.310/.320

4.2 Operating data

Table 4: Operating properties

Characteristic	Value
Stroke [mm]	2 - 60
Min. permissible temperature [°C]	≥ -20
Max. permissible temperature [°C]	≤ +60

4.3 Design details

- Compact position feedback unit for mounting on linear valves
- Electrical connection via M12 plug
- Continuous valve travel recording via non-contact, wear-free measurement system
- Open/closed position feedback and fault status via digital output
- Status indication and position indication via high-visibility LEDs
- Pneumatic actuator control via integrated solenoid valve (optional)

4.4 Variants

Process interfaces

- 24 V
- IO-Link
- AS interface

Housing materials

- Plastic
- Stainless steel

Control

- Position feedback unit
- Position feedback unit with integrated 3/2-way solenoid valve for decentralised process automation
  - SF or OF actuator: 1 solenoid valve
  - AZ actuator: 2 solenoid valves

4.5 Materials

Table 5: Overview of available materials

Description	Material
Lower housing section SK-i.310	Polyamide, black
Lower housing section SK-i.320	Stainless steel A4
Housing cover	Polyamide, transparent
Electrical connection	Stainless steel A4

4.6 Function

Fig. 1: Indicator and operating elements of SISTO-SK-i.310/.320

1	High-visibility LED	2	Magnetic sensor for in-situ initialisation

Table 6: Colour code of high-visibility LED

Colour code of high-visibility LED	Operating status	Colour index
Orange	Valve position, open	4
Green	Valve position, closed	2
Yellow	Warning	5
Red	Fault	1
White	Initialising	7
Blue	Not initialised	3
Violet	Localisation	6
Turquoise	Free function	8

The position feedback unit SISTO-SK-i.310/.320 signals the valve position (open or closed) by means of coloured high-visibility LEDs and electrically via digital outputs.

The optional integrated solenoid valve can be used to control the process valve via the position feedback unit's electric interface.

User-friendly setting of limit positions and fast commissioning by automatic initialisation in situ or via a process control system.

The position feedback unit analyses the valve position via an integrated microcontroller. The valve position is recorded digitally via a non-contact displacement/position measurement system (Hall effect sensor).

4.7 Auxiliary energy supply failure

A valve fitted with an SK-i with integrated solenoid valve and position feedback adopts the actuator's fail-safe position in the event of a control air supply failure or power failure.

- SF actuator = Closed
- OF actuator = Open
- AZ actuator = Undefined

The limit positions saved during initialisation are retained even in the event of a power failure. Once the power supply and control air supply are re-established, the actuator/ valve assembly adopts the operating status currently requested via the process interface.

4.8 Design

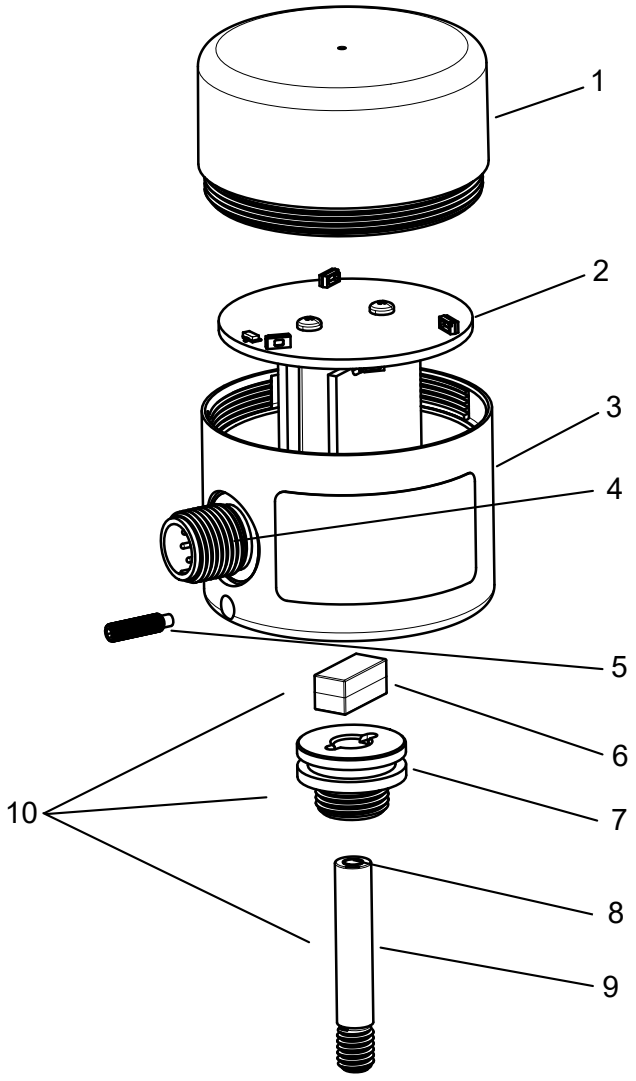


Fig. 2: SISTO-SK-i.310/.320 design

Number	Description	Material
1	Housing cover	PA transparent
2	Electronic unit	-
3	Lower housing section	PA black (SK-i.310) A4 (SK-i.320)
4	Electrical connection	A2
5	M3 grub screw	A2
6	"Target" magnet	NdFeB

Number	Description	Material
7	Adapter M12/M18	POM
8	“Driver” magnet	NdFeB
9	Rod M6	PA
10	Adapter kit	-

Not listed: NBR sealing elements

4.9 Overview of functions

Table 7: Overview of functions

Function	24 V	IO-Link	AS-i V3
Open and Closed position indication via high-visibility LED	×	×	×
Deactivating high-visibility LED (adjusting brightness of LED)	-	×	-
Electrical position feedback Open and Closed	×	×	×
Process input continuous valve position	-	×	-
On-site initialisation	×	×	×
Deactivating on-site initialisation	-	×	×
Remote initialisation	×	×	×
Operating mode feedback	-	×	×
Localisation function	-	×	×
Alternative signal colours	[1)]	×	×
Activating increased tolerances	-	×	-
Visual indication of errors	×	×	×
Visual indication of warnings	-	×	-
Feedback of error code and error description	-	×	-
Feedback of programmed limit positions	-	×	-
Feedback of initialisation status	-	×	-
Feedback of most recent switching cycles	-	×	-
Feedback of most recent limit positions	-	×	-
Diaphragm cycle counter	-	×	-
Actuator cycle counter	-	×	-
Total cycle counter	-	×	-
Power On counter	-	×	-
Diaphragm operating time counter	-	×	-
Total operating time counter	-	×	-
Switching cycle deviation warning can be enabled	-	×	-
Closed position deviation warning can be enabled	-	×	-
Diaphragm cycle counter warning can be enabled	-	×	-
Actuator cycle counter warning can be enabled	-	×	-
Operating time counter warning can be enabled	-	×	-

1 Required colour scheme to be indicated at the time of ordering. Changes at a later stage are not an option.

4.10 Ordering key

Table 8: Ordering key

Ordering example: SK-i.	**3**	**1**	**0**	**24**	**0M**	**30**	**00**	**01**
Product generation	3	|		|	|	|	|	|
Housing material		|		|	|	|	|	|
Plastic		1		|	|	|	|	|
Stainless steel		2		|	|	|	|	|
Interface				|	|	|	|	|
24 V				24	|	|	|	|
IO-Link				IO	|	|	|	|
AS interface				AS	|	|	|	|
Control					|	|	|	|
0 MV					0M	|	|	|
1 MV (SF/OF)					1M	|	|	|
2 MV (AZ)					2M	|	|	|
Size						|	|	|
Standard (max. stroke 30 mm)						30	|	|
High (max. stroke 60 mm)						60	|	|
Approval							|	|
EU							00	|
Mounting options[2)]								
SISTO-C LAP.520 MD 30 - MD 65 K63								01
SISTO-C LAP.520 MD 65 K80 - MD 115 K100								02
SISTO-C LAP.520 MD 115 K160								03
SISTO-C LAP.520 MD 168								04
SISTO-C LAP.520 MD 202								05
SISTO-16/-20 LAP.520 MD 40 - MD 65 K63								01
SISTO-16/-20 LAP.520 MD 65 K80 - MD 115 K100								02
SISTO-16/-20 DLAP.230 MD 115 K100								02
SISTO-16/-20 DLAP.230 MD 115 K125/K160								03
SISTO-16/-20 DLAP.230 MD 168								04
SISTO-16/-20 DLAP.230 MD 202								05
SISTO-16S LAP.520 MD 40								01
SISTO-16S DLAP.230 MD 65								12
SISTO-16S DLAP.230 MD 92 - MD 115 K100								02
SISTO-16S DLAP.230 MD 115 K112 - K160								03
SISTO-16S DLAP.230 MD168								04
SISTO-16S DLAP.230 MD 202								05
SISTO-KB DLAP.230 DN 15 - 40								02
SISTO-KB DLAP.230 DN 50 - 80								04
SISTO-KB DLAP.230 DN 100								06

2 Further mounting variants available on request

4.11 Name plate

Table 9: Name plate

Manufacturer's mark	SISTO
Type series / model	SK-i.310/.320
Part number (PN)	42.....
Serial number (SN)	xxxxxx
Connection data	e.g. 24 V DC
Maximum current input	e.g. max. 80 mA
CE conformity marking	CE

4.12 Scope of delivery

- SK-i.310/.320
- Adapter kit
- Operating manual

4.13 Dimensions and weights

For dimensions and weights refer to the Technical Data section. (⇨ Section 5.9, Page 26)

5 Technical data

5.1 Permissible ambient conditions

Table 10: Permissible ambient conditions

Characteristic	Value
Permissible operating temperature	-20 °C to +60 °C
Relative humidity	Max. 80 % (non-condensing)
Environment	Use inside buildings
Altitude	Up to 2000 m (NN)
Installation position	Any
Enclosure to EN 60529	IP65 (with closed cover only)
	IP67 (only with closed cover and exhaust line for exhaust air)

5.2 Standards and technical codes / directives

Standards

Enclosure to EN 60529	IP65/IP67
Appliance class to EN 61140	Safety class III

Directives

EMC Directive	2014/30/EU
RoHS Directive	2011/65/EU
Machinery Directive	2006/42/EC

5.3 Displacement/position measurement system

Table 11: Displacement/position measurement system

Characteristic	Value
Measurement principle	Hall effect sensor
Measuring range	0 - 32 mm/0 - 62 mm

NOTE

Incorrect valve travel recording

Valve travel recording is performed via Hall effect sensors and an integrated permanent magnet. External magnetic fields can interfere with and distort valve travel recording.

Where possible, rule out external magnetic fields, for example those created by permanent magnets in the vicinity of the device, or ensure that they are kept as far away as possible.

5.4 Technical data of SISTO-SK-i.310/.320 24 V

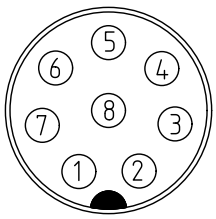
Table 12: Electrical data of SISTO-SK-i.310/.320 24 V

Feature	Value
Electrical connection	8-pin M12 round plug connector
Supply voltage [V]	24 +/- 10 %
Current input [mA]	Approx. 80
Duty ratio	100 %
Digital outputs	24 V, max. 100 mA, short-circuit-proof ▪ Open ▪ Closed ▪ Fault
Digital inputs	24 V, low: 0 - 3 V, high: 18 - 24 V ▪ Remote initialisation

Table 13: Electrical data of SISTO-SK-i.310/.320 24 V with solenoid valve

Feature	Value
Current input [mA]	Approx. 140
Additional digital input	24 V, low: 0 - 3 V, high: 18 - 24 ▪ Solenoid valve

Table 14: Pin assignment of SISTO-SK-i.310/.320 24 V

Connector	Pin	Assignment
	1	+ 24 V
	2	DO Open
	3	0 V
	4	DO Closed
	5	DI Initialising
	6	DI Solenoid valve[3)]
	7	DO Fault
	8	Not used

3 With integrated solenoid valve only

5.5 Technical data of SISTO-SK-i.310/.320 IO-Link

Table 15: Electrical data of SISTO-SK-i.310/.320 IO-Link

Feature	Value
Electrical connection	5-pin M12 round plug connector
Port class	A
Supply voltage [V]	24 (+/-25 %)
Current input [mA]	Approx. 90
Duty ratio	100 %

Table 16: Specification of SISTO-SK-i.310/.320 IO-Link

Specification	
Version	IO-Link V1.1.4
Transmission Rate	38400 bit/s (COM2)
Minimum Cycle Time	20 ms
SIO mode	Not available, i.e. feedback of valve position via 24 V DO not possible
Data Storage class	2: Semi-automatic DS (initialisation must be carried out after replacing the device, (⇨ Section 7, Page 32))
Exception	24_01_wake-up readiness delay_signed (The device's start time exceeds the permitted time of 300 ms. The SK-i is ready for operation after a device start time of max. 10 s.)

Table 17: Electrical data of SISTO-SK-i.310/.320 IO-Link with solenoid valve

Feature	Value
Current input [mA]	Approx. 140

Table 18: Inputs (process data input)

Subindex	Bit offset	Data type	Function	Logic
1	0	Boolean	OPEN position	0 = "Not open" position 1 = "Open" position
2	1	Boolean	CLOSED position	0 = "Not closed" position 1 = "Closed" position
4	3	2-bit UInteger	Operating mode	0 = Normal operation 1 = Initialisation mode 2 = Localisation 3 = Not initialised
5	7	17-bit Integer	Valve position [µm]	- 5,000 - +65,000

Table 19: Outputs (process data output)

Subindex	Bit offset	Data type	Function	Logic
1	0	Boolean	Operate valve[4)]	0 = Solenoid valve not operated 1 = Solenoid valve operated
2	1	Boolean	Start initialisation	0 = Normal operation 1 = Initialisation mode
3	2	Boolean	Localisation	0 = Normal operation 1 = Activate localisation

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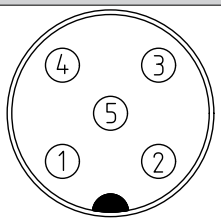
4 With integrated solenoid valve only

Table 20: Pin assignment of SISTO-SK-i.310/.320 IO-Link

Connector	Pin	Assignment
	1	+24 V
	2	Not used
	3	GND
	4	C/Q IO-Link
	5	Not used

Parameter overview of SISTO-SK-i.310/.320 IO-Link

The table (⇨ Table 22) shows an overview of internal device parameters available via IO-Link.

Table 21: Symbols key

Symbol	Description
R	Parameter with read-only access
W	Parameter with read / write access

Table 22: Parameter overview of SISTO-SK-i.310/.320 IO-Link

Index	Designation	Access (see (⇨ Table 21))	Default	Logic
Identification				
21	Serial Number	R	-	Factory serial number
22	Hardware Version	R	-	Factory hardware version
23	Firmware Version	R	-	Factory firmware version
24	Application-Specific Tag	W	-	Application-specific information
25	Function Tag	W	-	Function-specific information
26	Location Tag	W	-	Localisation-specific information
64	Actuator Type	R	0	0 = Unknown 1 = OF 2 = SF
65	Device Part Number	R	00000000	SISTO part number
66	Solenoid Valve Type	R	9	0 = No solenoid valve 1= 1 solenoid valve 2= 2 solenoid valves 9 = Unknown
67	PCS Ident Number	W	-	System PCS number
Initialization				
68	Valve Initialized	R	False	False: Valve not initialised True: Valve initialised
69	Initialize Via Magnetic Key	W	True	False: Disabled True: Enabled
Position sensor				
70	Valve Position [µm]	R	0	Current valve position in [µm]
71	Valve Stroke [µm]	R	0	Valve travel after initialisation
72	Valve End Position Open	R	0	Programmed limit position, open
73	Valve End Position Closed	R	0	Programmed limit position, closed
74	Factor Extended Tolerances [%]	W	100	Position tolerance factor
75	Extended Tolerances Enable	W	False	False: Disabled True: Enabled
Signaling				

Index	Designation	Access (see (⇨ Table 21))	Default	Logic
76	Color Index Error	W	1 = Red	Allocation of one of the pre-defined colours (⇨ Table 6)
77	Color Index Valve Closed	W	2 = Green	
78	Color Index Valve Open	W	4 = Orange	
79	Color Index Not Initialized	W	3 = Blue	
80	Color Index Initialization Active	W	7 = White	
81	Color Index Warning	W	5 = Yellow	
82	LED Warning Mode	W	0	0 = Disabled 1 = Steady 2= Flashing
83	LED Brightness [%]	W	100	0 = LED off 100 = Maximum brightness
Counter				
84	Power On Counter	R	0	Device start counter
85	Operating Hours Since Start Counter	R	0	Operating hours counter since last device start
86	Operating Hours Counter	R	0	Operating hours counter
87	Diaphragm Cycles Counter	W	0	Diaphragm cycle counter
88	Diaphragm Operating Hours Counter	W	0	Diaphragm operating hours counter
89	Valve Cycles Counter	W	0	Actuator cycle counter
Diagnosis				
90	Valve Open Duration [ms][5)]	R	0	Duration of valve opening
91	Valve Close Duration [ms][5)]	R	0	Duration of valve closing
92	Last Valve Position Open [µm]	R	0	Last open position
93	Last Valve Position Closed [µm]	R	0	Last closed position
94	Last Valve Stroke [µm][5)]	R	0	Last valve travel
95	Difference Closed Position To Initialized Warning Threshold [µm]	W	0	Deviation between programmed and last closed position
96	Valve Open Duration Warning Threshold [ms]	W	0	Limit value for valve opening duration
97	Valve Close Duration Warning Threshold [ms]	W	0	Limit value for valve closing duration
98	Diaphragm Cycles Warning Threshold	W	0	Limit value for diaphragm cycle counter
99	Diaphragm Lifetime Warning Threshold [h]	W	0	Limit value for diaphragm service life
100	Valve Cycles Warning Threshold	W	0	Limit value for actuator cycle counter

By default, the limit values are set to 0 and the warnings are disabled.

The warnings are enabled by setting the limit values.

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5 The parameter is only displayed on the second complete switching cycle (open + close).

5.6 Technical data of SISTO-SK-i.310/.320 AS i

Table 23: Electrical data of SISTO-SK-i.310/.320 AS-i

Feature	Value
Electrical connection	5-pin M12 round plug connector
Supply voltage [V]	26,5 - 31,6
Current input [mA]	Approx. 90
Duty ratio	100 %
AS-i specification	V3.0

Table 24: Electrical data of SISTO-SK-i.310/.320 AS-i with solenoid valve

Feature	Value
Current input [mA]	Approx. 140

Table 25: AS interface profile

Characteristic	Value
Profile designation	S-7.A-E
I/O configuration	7
ID code	A
ID1 code	7
ID2 code	E

Table 26: Inputs of SISTO-SK-i.310/.320 AS-i (AS-i master perspective)

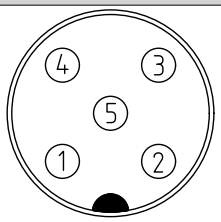
Bit	Function	Logic
DI0	OPEN position	0 = “Not open” position 1 = “Open” position
DI1	CLOSED position	0 = “Not closed” position 1 = “Closed” position
DI2	Ready	0 = Normal operation 1 = Initialisation mode
DI3	Fault	0 = Normal operation 1 = Fault Alternating at 1 Hz = valve not initialised

Table 27: Outputs of SISTO-SK-i.310/.320 AS-i (AS-i master perspective)

Bit	Function	Logic
DO0	Operate valve[6)]	0 = Solenoid valve not operated 1 = Solenoid valve operated
DO1	Localisation	0 = Normal operation 1 = Activate localisation
DO2	Start initialisation	0 = Normal operation 1 = Initialisation mode

6 With integrated solenoid valve only

Table 28: Pin assignment

Connector	Pin	Assignment
	1	AS-i +
	2	Not used
	3	AS-i -
	4	Not used
	5	Not used

Parameter overview of SISTO-SK-i.310/.320 AS-i

Table 29: Parameter overview of SISTO-SK-i.310/.320 AS-i

Parameter			
P0		In-situ programming	0 = Active 1 = Disabled
P1	P2	-	-
0	0	LED colours	Normal colours
0	1		Inverted colours
1	0		Alternative colour scheme active ▪ CLOSED: RED ▪ OPEN: GREEN ▪ ERROR: ORANGE
1	1		Reserve

5.7 Additional technical data of SISTO-SK-i.310/.320 with solenoid valve

Table 30: Pneumatic data

Characteristic	Value
Threaded port	Internal thread M5
Flow rate [l_N/min.]	19
P max. [bar]	8

NOTE

The pressure applied must not exceed the maximum control pressure of the process valve.

SISTO-SK-i.310/.320 with solenoid valve is suitable for compressed air as control fluid in accordance with ISO 8573-1.

Table 31: Quality grade of air as control fluid

	Operation above 0 °C	Operation down to -20 °C
Quality grade	5.4.3	5.3.3
Filter	40 µm	40 µm
Oil concentration	≤ 1 mg/m³	≤ 1 mg/m³
Dew point	≤ +3 °C	≤ -20 °C

For determining the required air quality consider the specifications of all components used in the system.

5.8 Pneumatic connection

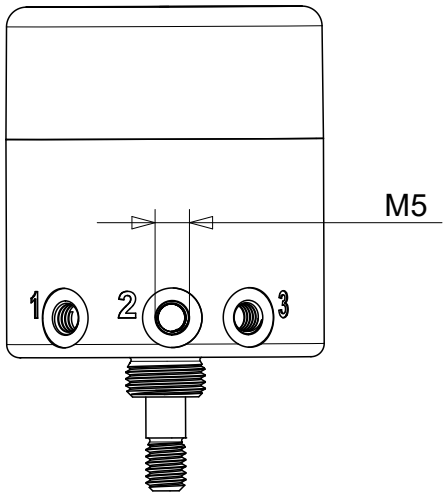
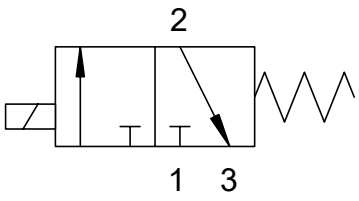


Fig. 3: Pneumatic connection of SK-i.310/.320

Table 32: Terminal configuration

Connection	Assignment	Connection
1	Air supply	
2	Actuator	
3	Air outlet	

5.9 Dimensions and weights

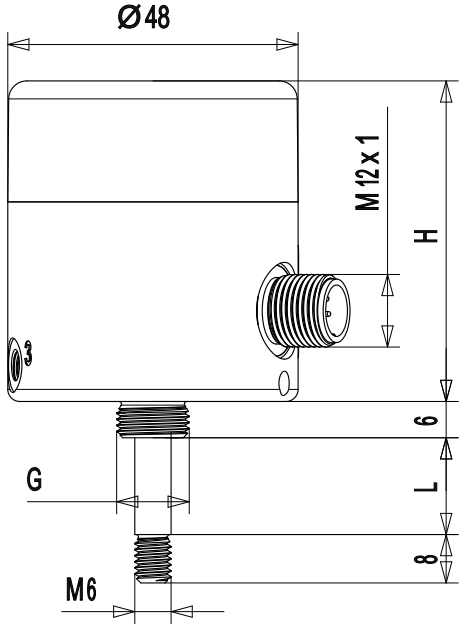


Fig. 4: SISTO-SK-i.310/.320

5.9.1 Mechanical data

Table 33: Dimensions table of SISTO-SK-i.310/.320

Order code for mounting on valve (⇨ Section 4.10, Page 16)	**01**	**02**	**03**	**04**	**05**
MD	**30 - 65 K63**	**65 K80 - 115 K100**	**115 K125 - K160**	**168**	**202**
Adapter thread G	M12 × 1	M18 × 1			
L [mm]	19	32	38	60	69
Rod length [mm]	31	44	50	72	81
Size [mm]	30			60	
Height H [mm]	53			83	
Diameter [mm]	48				
Weight [kg] SK-i.310	0,07			0,08	
Weight [kg] SK-i.320	0,19			0,31	

6 Assembly / Installation

6.1 General information/Safety regulations

DANGER

Use in potentially explosive atmospheres

Explosion hazard!

- ▷ Never use the position feedback unit in potentially explosive atmospheres.

DANGER

Magnetic radiation

Malfunction of or interference with pacemakers or implanted defibrillators due to permanent magnets (“target” magnet / “driver” magnet)!

Interference with magnetic data carriers, electronic devices, components and instruments!

- ▷ Persons wearing such devices must maintain a sufficient safety distance.

CAUTION

Magnetic attraction

When handling the “target magnet”, strong acceleration can occur due to magnetic attraction of objects in the vicinity!

- ▷ Maintain a sufficient safety distance.
- ▷ Take special care when handling permanent magnets.

CAUTION

Loss of function

Damage to the pneumatic unit!

- ▷ The following fluids must not be supplied to the position feedback unit’s air supply connections:
- ⇨ No liquids
- ⇨ No aggressive fluids
- ⇨ No solids-laden fluids
- ⇨ No combustible fluids

CAUTION

Risk of damage!

- ▷ The cover of SK-i.310/.320 must not be removed.

NOTE

When using the position feedback unit in a humid environment, ensure that moisture can run off and does not penetrate the housing.

The position feedback unit’s housing must not be subjected to mechanical loads. When laying the connection cables and the existing pneumatic lines, ensure that forces are not transmitted to the position feedback unit.

NOTE

Regularly check that the electrical and pneumatic connections and the connection to the pneumatic valve actuator are properly installed.

The operator is responsible for the safety of the system into which the position feedback unit is integrated.

6.2 Installation instructions

⚠ WARNING

Improper assembly / installation

Risk of injury!

- Assembly/installation must be carried out by qualified specialist personnel using suitable tools (⇨ Section 11.1, Page 38) .
- Shut down the system before performing work on the SISTO-SK-i.310/.320 position feedback unit.
- Before returning the unit to service, observe all instructions on commissioning/start-up. (⇨ Section 7, Page 32)

CAUTION

Incorrect mounting or connection

Incorrect commissioning/start-up!

- Check whether the position feedback unit has been properly mounted onto the valve actuator.
- Prior to commissioning/start-up, check whether the electrical and pneumatic connections have been properly connected.

The installation must be carried out carefully and in accordance with the following instructions. (⇨ Section 6.2.1, Page 29)

SISTO-SK-i.310/.320

In addition, installation and commissioning are also shown in an animation which can be accessed via the link or the QR code.

https://www.youtube.com/watch?v=-EIKERrT2cO

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6.2.1 Mounting the position feedback unit onto the process valve

6.2.1.1 Mounting the position feedback unit onto the SISTO-C LAP.520 valve actuator

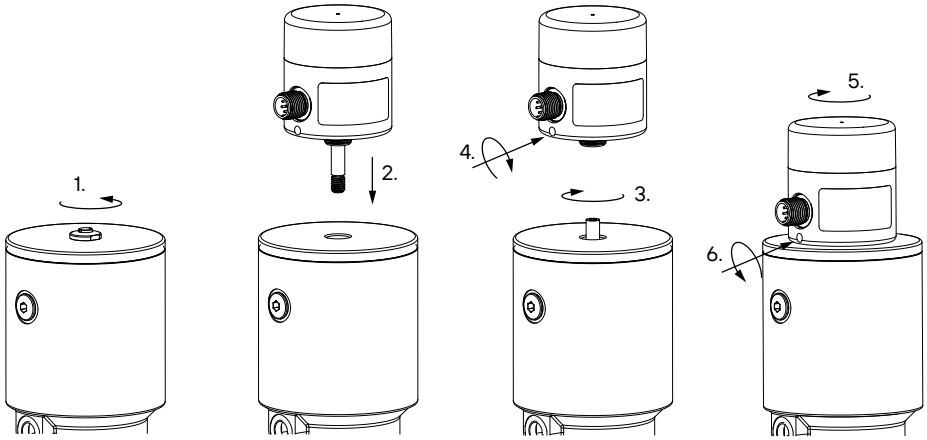


Fig. 5: Individual installation steps

1. Remove the guide bush and the position indicator from the pneumatic valve actuator.
2. Pull the (magnetically coupled) M6 rod (⇨ Fig. 2) out of the position feedback unit.
3. Screw the M6 rod into the valve actuator's piston rod.
4. Screw in the lateral grub screw (max. 1 Nm) to secure the adapter to the position feedback unit.
5. Screw the position feedback unit into the valve actuator's thread M12/M18 (accessory) until it will not go any further, and tighten it slightly. This re-establishes the magnetic connection between the rod and the integrated "target" magnet.
6. Undo the lateral grub screw by one turn so that the position feedback unit can be freely positioned. This prevents the position feedback unit from being removed unintentionally.

6.2.1.2 Mounting the position feedback unit onto the SISTO industrial valve (SISTO-16/-20/-KB)

Mounting is performed in the same way as described in (⇨ Section 6.2.1.1, Page 29).

1. Screw the rod into the thread of the valve actuator's piston rod.
2. Screw the adapter (⇨ Fig. 2) into the valve actuator's M12/M18 thread (accessory).

6.2.1.3 Mounting the position feedback unit onto linear valves from other manufacturers

The position feedback unit can be mounted onto valves from other manufacturers upon request.

Unless described otherwise in separate instructions, mounting is performed in the same way as per (⇨ Section 6.2.1.1, Page 29).

1. Screw the rod into the thread of the actuator's piston rod.
2. Screw the adapter (⇨ Fig. 2) into the actuator's thread (accessory).

The safety instructions in the Safety section also apply. (⇨ Section 2.7, Page 10)

6.2.2 Electrical installation

DANGER

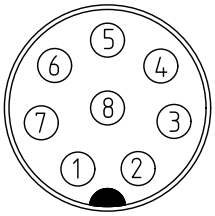
Use in potentially explosive atmospheres

Explosion hazard!

▷ Never use the position feedback unit in potentially explosive atmospheres.

1. Check the supply voltage and the voltage of the digital inputs.
2. Fit the M12 socket to the M12 plug on the position feedback unit by exerting slight pressure and screw it in place. Watch the correct position of the misplug protection feature.

Table 34: Pin assignment of SISTO-SK-i.310/.320 24 V

Connector	Pin	Assignment
	1	+ 24 V
	2	DO Open
	3	0 V
	4	DO Closed
	5	DI Initialising
	6	DI Solenoid valve[7)]
	7	DO Fault
	8	Not used

6.2.3 Pneumatic installation (for position feedback unit with solenoid valve only)

WARNING

Danger due to pressure

Risk of injury!

▷ Prior to undoing the air supply connections, release the pressure from the supply line, vent the line and secure it against refilling.

Sk-i.310/.320 position feedback units with integrated solenoid valve(s) are supplied with pre-fitted tube connections (for pneumatic tubing with an outside diameter of 6 mm).

Position feedback unit with 1 solenoid valve

Take the following steps prior to commissioning/start-up:

1. Connect air supply port 1 (⇨ Fig. 3) with the compressed air supply system available on site.
2. Connect actuator port 2 (⇨ Fig. 3) with the control air port of the pneumatic actuator.
3. Optional: Replace the silencer in threaded port 3 (⇨ Fig. 3) with a tube connector if the exhaust air is to be released via an exhaust line.
4. Check that all pneumatic connections are correct and tight.

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7 With integrated solenoid valve only

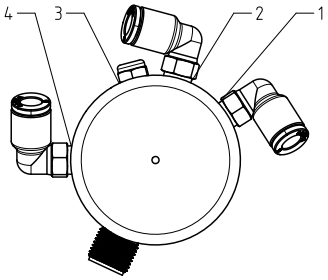

Fig. 6: Pneumatic connection (2 solenoid valves)

Position feedback unit with 2 solenoid valves

Take the following steps prior to commissioning/start-up:

1. Connect air supply port 1 (⇨ Fig. 6) with the compressed air supply system available on site.
2. Connect actuator port 2 (⇨ Fig. 6) with the control air port of the pneumatic actuator (lower pressure chamber).
3. Connect actuator port 4 (⇨ Fig. 6) with the control air port of the pneumatic actuator (upper pressure chamber).
4. Optional: Replace the silencer in threaded port 3 (⇨ Fig. 6) with a tube connector if the exhaust air is to be released via an exhaust line.
5. Check that all pneumatic connections are correct and tight.

CAUTION

Reducing the flow rate on vent connection port 3

Increased pressure in the upper housing section

- ▹ Do not use chokes or similar devices in vent connection port 3.
- ▹ Ensure that the vent lines are unpressurised at all times.
- ▹ Connect the vent lines without transmitting any stresses or strains and avoid any kinks.

6.3 Exchanging the adapter kit

The SISTO Sk-i.310/.320 position feedback unit is supplied (as per ordering key (⇨ Section 4.10, Page 16)) with an adapter kit that matches the specified valve size.

If the position feedback unit is to be used for another actuator size, the adapter kit can be exchanged. Checking the compatibility using the ordering key (⇨ Section 4.10, Page 16) / Dimensions (⇨ Section 5.9.1, Page 26) .

Alternative adapter kits can be obtained from SISTO Armaturen.

Exchanging the adapter kit:

1. Observe the measures to be taken for shutdown. (⇨ Section 9.3, Page 35)
2. Undo the M3 x 12 grub screw by two turns. (⇨ Fig. 2)
3. Remove the rod with “target” magnet and adapter from the position feedback unit.
4. Insert a new rod with “target” magnet and new adapter into the position feedback unit.
5. Secure the M3 x 12 grub screw (max. 1 Nm).
6. Pull the (magnetically coupled) rod out again to mount the position feedback unit onto the actuator.
7. Screw the rod into the actuator. Screw on the position feedback unit. (⇨ Section 6.2.1, Page 29)

6.4 Mounting onto linear valves from other manufacturers

NOTE

SISTO-SK-i.310/.320 position feedback units can also be mounted onto linear valves from other manufacturers upon request. Clarify technical details with SISTO Armaturen in advance.

7 Commissioning/Start-up

7.1 Prerequisites for commissioning/start-up

⚠ WARNING

Automatic valve movement during initialisation

Risk of injury and hazard to the production process!

- ▷ The valve is opened and closed during commissioning. This procedure is automatic for variants with integrated solenoid valve. It must therefore be ensured that no hazardous situation can occur as a result.

CAUTION

Incorrect mounting or connection

Incorrect commissioning/start-up!

- ▷ Check whether the position feedback unit has been properly mounted onto the valve actuator.
- ▷ Prior to commissioning/start-up, check whether the electrical and pneumatic connections have been properly connected.

NOTE

- ▷ If the position feedback unit is supplied mounted on a SISTO valve, the complete assembly is ready for operation at a control pressure of 5.5 to 6 bar (not including operating pressure).
- ▷ If the position feedback unit is supplied without a valve, it must be initialised once for proper operation.

NOTE

Incorrect initialisation

- ▷ When initialising the unit, always ensure that no operating pressure is present at the process valve.
- ▷ Start initialisation with the process valve in the fail-safe position (NO/NC).

NOTE

Re-initialisation is recommended if

- ▷ the available control pressure in the system has been changed,
- ▷ the mechanical limit positions have been changed.

Fig. 7: High-visibility LED (1) / magnetic sensor for in-situ initialisation (2)

7.2 Performing initialisation

1. Switch on the power supply.
   - After the supply voltage has been switched on, the device boots up for approx. 10 seconds. The LED flashes in the warning colour yellow.
2. The valve actuator must be in the fail-safe position.
3. Start initialisation:
   - **In situ using a programming magnet:** Hold the programming magnet against the magnetic sensor for at least 2 seconds (⇨ Fig. 7) (position 2). When the LED flashes white, remove the magnet again.
   - **Remote initialisation via PLC**: Apply a voltage of 24 V to the teach-in input (pin 5) for at least 0.5 s. (⇨ Table 34)
4. Operate the valve actuator:
   - **Position feedback unit (0 MV):** Operate the valve actuator via an external pneumatic valve.
   - **Position feedback unit with integrated solenoid valve (1 MV):** The integrated solenoid valve is switched off automatically.
5. When the valve is operated, the position feedback unit automatically detects whether the actuator is opening or closing.
   - Movement in opening direction: The LED flashes orange.
   - Movement in closing direction: The LED flashes green.
6. The valve actuator moves to the active limit position.
   - The white LED signals the detection of the limit position.
7. Move the valve actuator into the fail-safe position:
   - **Position feedback unit (0 MV):** Switch off the external pneumatic system to move the valve actuator into the fail-safe position.
   - **Position feedback unit with integrated solenoid valve (1 MV):** The integrated solenoid valve is switched off automatically.
8. The valve actuator moves into the fail-safe position:
   - The white LED signals the detection of the limit position.
9. Completion of initialisation:
   - The limit position is saved and signalled via the LED.
   - The alternating voltage is switched off at the Fault output (pin 7) (see pin assignment table (⇨ Table 34)).
10. The position feedback unit is ready for operation.

When initialised, the integrated solenoid valve can be switched via the switching input (optional).

8 Maintenance and Cleaning

8.1 Maintenance

The SISTO-SK-i.310/.320 position feedback unit is maintenance-free.

Regularly check that all electrical and pneumatic connections are properly connected.

8.2 Cleaning

CAUTION

Aggressive cleaning agents

Cleaning using a high-pressure cleaner

Damage to the position feedback unit!

- ▷ The position feedback unit must not be cleaned with aggressive cleaning agents or high-pressure cleaners.
- ▷ Always observe the enclosure type.
- ▷ If there are any concerns about the resistance of the housing to a cleaning agent, consult SISTO Armaturen.

Clean position feedback units using a damp cloth.

9 Shutdown / Removal

9.1 Resetting the position feedback unit to factory settings

- Hold programming magnet against the magnetic sensor for 60 seconds.
- When the LEDs flash red, remove the programming magnet.

9.2 Shutdown

⚠ WARNING

Improper shutdown/removal

Risk of injury!

▷ Shut down the systems before performing work on the position feedback unit and the valve.

CAUTION

Improper shutdown/removal

Damage to the position feedback unit!

▷ All work on the position feedback unit must only be performed by qualified personnel.

▷ Always use suitable tools (⇨ Section 11.1, Page 38) to ensure proper functioning of the position feedback unit.

NOTE

When working on electrical devices, observe the applicable accident prevention regulations and safety regulations.

9.3 Measures to be taken for shutdown

- Steps to be taken prior to working on the system:

1. Switch off the power supply.
2. Secure the equipment against unintentional start-up.
3. Verify that the equipment is de-energised.

- Prior to undoing the air supply connections:

1. Shut off the pressure supply from the supply line.
2. Vent the line.
3. Secure the line against refilling.

9.4 Removing the position feedback unit

Removal must only be carried out when the device is shut down.
(⇨ Section 9.2, Page 35)

1. Ensure that the M3 grub screw is secured, otherwise tighten by hand (max. 1 Nm).
2. Remove the position feedback unit from the valve actuator by turning it anti-clockwise.
3. Remove the rod from the valve actuator by turning it anti-clockwise.

10 Trouble-shooting

Symbol	Description
○	Off
●	On
✷	Flashing
x	Undefined

SISTO-SK-i.310/.320 operating status

Code[8]	Status LED	DO Open	DO Closed	DO Fault	Operating status description	Remedy
-	○	○	○	○	No supply voltage	Check the supply voltage.
-	✷ Yellow	○	○	○	Device boots up.	Wait for approx. 10 seconds.
Initialisation						
W001	✷ Blue	○	○	✷	Sk-i not initialised	Start initialisation.
W000	✷ White/orange	○	○	✷	Initialisation active (movement towards the open position)	-
W000	● White	○	○	✷	Initialisation (open position reached)	-
W000	✷ White/green	○	○	✷	Initialisation active (movement towards the closed position)	-
W000	● White	○	○	✷	Initialisation (closed position reached)	-
Operation						
-	✷ Orange	✷	○	○	Operation (movement towards the open position)	-
-	● Orange	●	○	○	Operation (open position reached)	-
-	✷ Green	○	✷	○	Operation (movement towards the closed position)	-
-	● Green	○	●	○	Operation (closed position reached)	-
W010	✷ Yellow[9] / valve-position LED colour	x	x	○	Diaphragm cycle counter exceeded	Check diaphragm and replace if required; reset cycle counter.
W011		x	x	○	Actuator cycle counter exceeded	Check actuator and replace if required; reset cycle counter.
W020		x	x	○	Valve opening duration exceeded	Check valve function.
W021		x	x	○	Valve closing duration exceeded	Check valve function.
W022		x	x	○	Diaphragm service life exceeded	Check diaphragm and replace if required; reset cycle counter.
W030		x	x	○	Deviation between current and programmed closed position detected (due to plastic deformation of diaphragm)	Check diaphragm and replace if required; reset cycle counter.

The specified LED colour is as per standard configuration. (⇨ Section 4.6, Page 13)

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8 The code can be read via IO-Link interface.

9 This function is controlled via the “LED Warning Mode” (Index 84 (⇨ Table 22)) parameter.

Error messages of SISTO-SK-i.310/.320

Code[8)]	Status LED	DO Open	DO Closed	DO Fault	Operating status description	Remedy
E000	● Red	○	○	●	The device is not calibrated.	1. Re-start the device. 2. If the error persists, send the device to the manufacturer.
E001	● Red	○	○	●	General system error	
E010	✷ Red	x	x	●	Valve travel sensor module error	1. Check whether the "target" magnet is available. 2. Re-start the device. 3. If the error persists, send the device to the manufacturer.
E020	✷ Red	x	x	●	Communication error (process interface)	Check the process interface.
E050	✷ Red/white	○	○	●	Initialisation not successful (no valve movement detected within permissible time period)	▪ Check the compressed air supply. ▪ Check the valve for proper functioning. ▪ Perform re-initialisation. The error is active for a time period of 5 minutes and is then automatically deleted.
E051		○	○	●	Initialisation not successful (valve movement not completed within permissible time period)	
E052		○	○	●	Initialisation not successful (deviation between the start position and end position)	
E100	✷ Red	●/○	○/●	●	Inconsistent limit position error (valve position does not match the switching status of the integrated solenoid valve)	▪ Check the compressed air supply. ▪ Check the valve for proper functioning. ▪ Perform re-initialisation.
E101	✷ Red/orange	○	○	●	The valve's requested limit position (open) is not reached.	
E102	✷ Red/green	○	○	●	The valve's requested limit position (closed) is not reached.	
E103	✷ Red	○	○	●	Valve position greater than saved open position	▪ Check the control pressure. ▪ Perform re-initialisation.
E104	✷ Red	○	○	●	Valve position less than saved closed position	▪ Perform re-initialisation. ▪ Inspect the diaphragm.

The specified LED colour is as per standard configuration. (⇨ Section 4.6, Page 13)

If there are several active errors or warnings, only the message with the highest priority is signalled. The priority of the error and warning messages corresponds to the order in the table (highest priority first). Errors have priority over warnings.

11 Accessories

11.1 Set comprising programming magnet, Allen key and lanyard

Order number: 42504056

Fig. 8: Accessories for SISTO-SK-i.310/.320

12 Declaration of Incorporation

12.1 Declaration of Incorporation of Partly Completed Machinery

Declaration of Incorporation within the meaning of EC Machinery Directive 2006/42/EC, Annex IIB

Manufacturer:

SISTO Armaturen S.A.
18, rue Martin Maas
6468 Echternach (Luxembourg)

The manufacturer herewith declares for the partly completed machinery:

Position feedback unit, type SK-i.310/.320, for mounting onto linear pneumatic valve actuators

- The following essential requirements of the Machinery Directive 2006/42/EC, Annex IIB, are applicable and have been fulfilled:
  - 1.1.2, 1.1.3, 1.1.4, 1.1.5, 1.1.6,
  - 1.2.1, 1.2.2, 1.2.3,
  - 1.3.2, 1.3.3, 1.3.4, 1.3.7, 1.3.8, 1.3.8.1
  - 1.4.1.1, 1.4.2.1,
  - 1.5.1, 1.5.2, 1.5.3, 1.5.4, 1.5.7, 1.5.8,
  - 1.6.1, 1.6.3, 1.6.4,
  - 1.7.1.1, 1.7.1.2, 1.7.2, 1.7.4, 1.7.4.1, 1.7.4.2

The technical literature has been prepared in accordance with Annex VII, Part B.

Further applicable directives:

- **EMC Directive 2014/30/EU**
- **RoHS Directive 2011/65/EU**

Note: The partly completed machinery covered by the present Declaration of Incorporation must not be put into service until the final machinery into which it is to be incorporated is in conformity with the provisions of Directive 2006/42/EC.

Echternach, 17 June 2025

Bernd Hackenberger
Head of Design and Development

13 EU Declaration of Conformity

13.1 EU Declaration of Conformity

Manufacturer:

SISTO Armaturen S.A.
18, rue Martin Maas
6468 Echternach (Luxembourg)

The manufacturer herewith declares that the product:

Position feedback unit, type SK-i.310/.320, for mounting onto linear pneumatic valve actuators

- is in conformity with the provisions of the following directives as amended from time to time:
  - **2011/65/EU Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment (RoHS)**
  - **2014/30/EU: Electromagnetic Compatibility**

Echternach, 17 June 2025

Bernd Hackenberger
Head of Design and Development

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