CKD

SM-353499-A

INSTRUCTION MANUAL

SPEED CONTROLLER

SCL2
SCD2

- Please read this instruction manual carefully before using this product, particularly the section describing safety.
- Retain this instruction manual with the product for further consultation whenever necessary.

2nd
CKD Corporation

For Safety Use

To use this product safety, basic knowledge of pneumatic equipment, including materials, piping, electrical system and mechanism, is required (ISO 4414 *1 JIS B 8370 *2).

We do not bear any responsibility for accidents caused by any person without such knowledge or arising from improper operation.

Our customers use this product for a very wide range of applications, and we cannot keep track of all of them. Depending on operating conditions, the product may fail to operate to maximum performance, or cause an accident. Thus, before placing an order, examine whether the product meets your application, requirements, and how to use it.

This product incorporates many functions and mechanisms to ensure safety. However, improper operation could result in an accident. To prevent such accidents **read this operation manual carefully for proper operation.**

Observe the cautions on handling described in this manual, as well as the following instructions:

Additionally, the caution is classified into the following three groups, “CAUTION”, “WARNING”, and “DANGER”, to identify the degree of the danger it presents and possible hazard.

⚠DANGER: Failure to pay attention to DANGER notices may cause a situation that results in a fatality or serious injury and that requires urgent addressing.

⚠WARNING: Failure to pay attention to WARNING notices may result in a fatality or serious injury.

⚠CAUTION: Failure to pay attention to WARNING notices may result in injury or damage to equipment or facilities.

*1) ISO 4414 : Pneumatic fluid power ··· Recommendations for the application of equipment to transmission and control systems.

*2) JIS B 8370 : General rule for pneumatic systems

[SM-353499-A]

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SCL2
SCD2
Speed Controller

Manual No. SM-353499-A

Dec.28.2004
Revision : Jul.03.2013

1. PRODUCT

1.1 Specification

1) SCL2 series

Model / Item			SCL2-04			SCL2-06	SCL2-08		SCL2-10		
O.D. of the applied pipes		mm	ϕ1.8	ϕ1.8/ϕ4	ϕ4	ϕ6	ϕ6	ϕ8	ϕ8	ϕ10	ϕ12
Working fluid			Compressed air								
Max. working pressure		MPa	0.7		1.0						
Min. working pressure		MPa	0.1								
Proof pressure		MPa	1.05		1.5						
Fluid temperature		℃	5 to 60 (Not be frozen *3)								
Ambient temperature		℃	0 to 60 (Not be frozen)								
Weight		g	13	12	11.5	16	32	33	53	57	59
Needle speed rotation			12 (15)								
Free flow	Flow rate	l/min(ANR)	(13)		130	300	400	550	900	1100	1200
	Effective sectional area	mm^2	(0.2)		1.9	4.5	6	8	13.5	16.5	18
Controlled flow	Flow rate	l/min(ANR)	(10)		130(13)	300(13)	400	550	900	1100	1200
	Effective sectional area	mm^2	(0.15)		1.9(0.2)	4.5(0.2)	6	8	13.5	16.5	18

Note1: The flow rate atmospheric conversion rate at 0.5MPa.
Note2: Values in parentheses ( ) indicate the fine speed type.
Note3: The adiabatic expansion may cause freezing depending on the quality (dew point) of the air.

2) SCD2 series

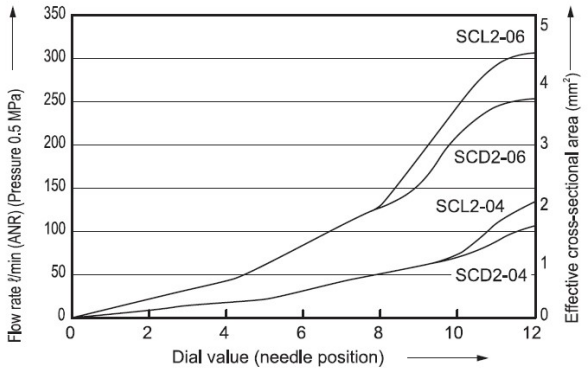
Model / Item		SCD2-04			SCD2-06	SCD2-08		SCD2-10		
O.D. of the applied pipes	mm	ϕ1.8	ϕ1.8/ϕ4	ϕ4	ϕ6	ϕ6	ϕ8	ϕ8	ϕ10	ϕ12
Working fluid		Compressed air								
Max. working pressure	MPa	0.7		1.0						
Min. working pressure	MPa	0.1								
Proof pressure	MPa	1.05		1.5						
Fluid temperature	℃	5 to 60 (Not be frozen *3)								
Ambient temperature	℃	0 to 60 (Not be frozen)								
Weight	g	23	22	21.5	29	63	64	108	112	114
Needle speed rotation		12 (15)								
Flow rate	l/min(ANR)	(10)		100(13)	250(13)	330	400	750	850	900
Effective sectional area	mm^2	(0.15)		1.5(0.2)	3.7(0.2)	5	6	11	12.5	13

Note1: The flow rate atmospheric conversion rate at 0.5MPa.
Note2: Values in parentheses ( ) indicate the fine speed type.
Note3: The adiabatic expansion may cause freezing depending on the quality (dew point) of the air.

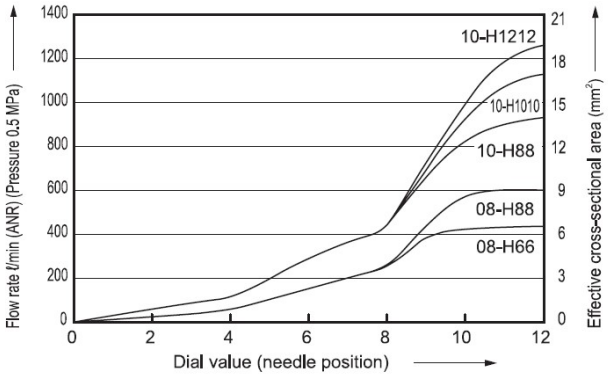
1.2 Flow characteristic

1) Flow characteristic option: Standard type

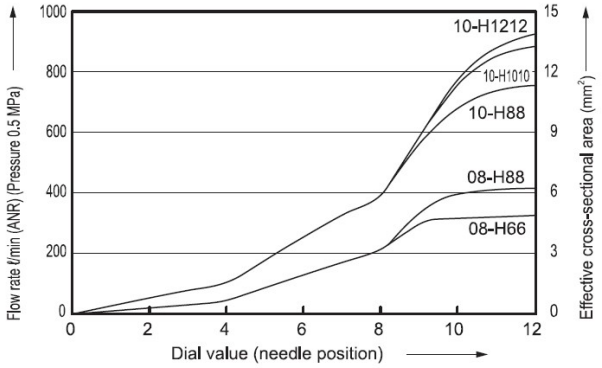
(a) SCL2-04, SCL2-06, SCD2-04, SCD2-06



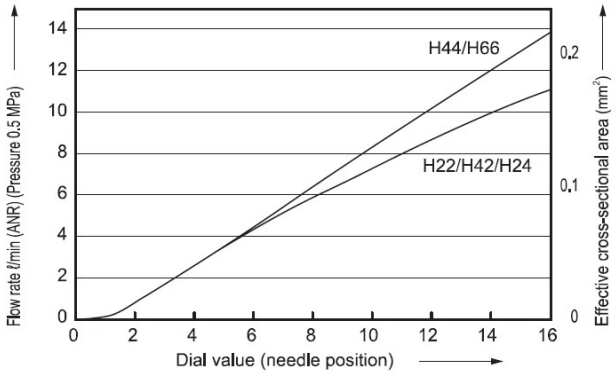
(b) SCL2-08, SCL2-10



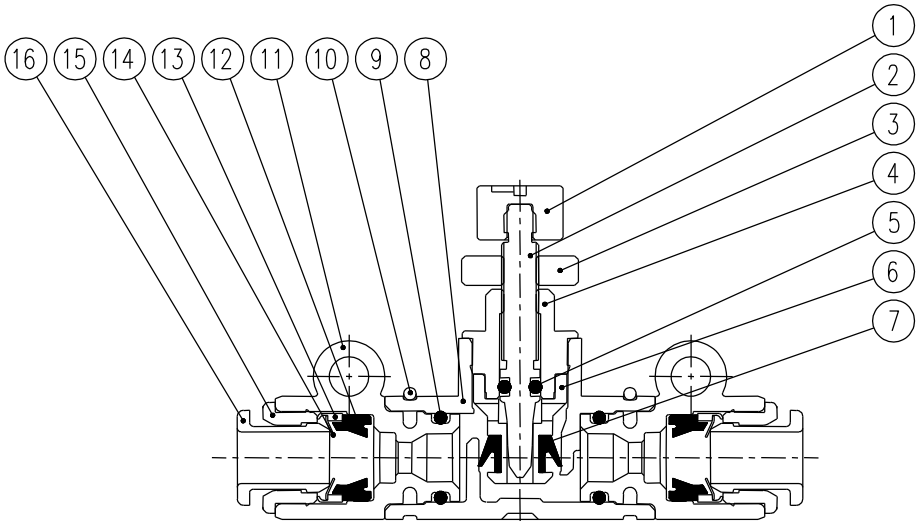
(c) SCD2-08, SCD2-10



2) Flow characteristic option: Fine speed type



1.3 Internal structure drawing and major parts list

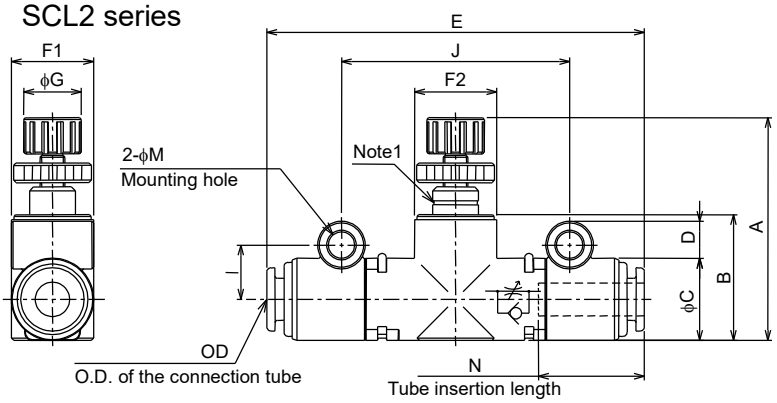


No.	Part name	Material	No.	Part name	Material
1	Knob	Polyethylene terephthalate resin	10	Stop ring	Stainless steel
2	Needle	Brass	11	Joint case	Polyethylene terephthalate resin
3	Lock nut	Brass	12	Packing	Nitrile rubber
4	Guide ring	Brass	13	Holder	Body size: 04/06…Brass
5	O-ring	Nitrile rubber			Body size: 08/10…polyethersulfone
6	Check mount	Brass	14	Chuck	Stainless steel
7	Check packing	Hydrogenated nitrile rubber	15	Outer ring	Brass
8	Body	Polyethylene terephthalate resin	16	Push ring	Polyethylene terephthalate resin
9	O-ring	Nitrile rubber			

* All polyethylene terephthalate is flame retardant resin.
* All brass parts are given electroless nickel plating.

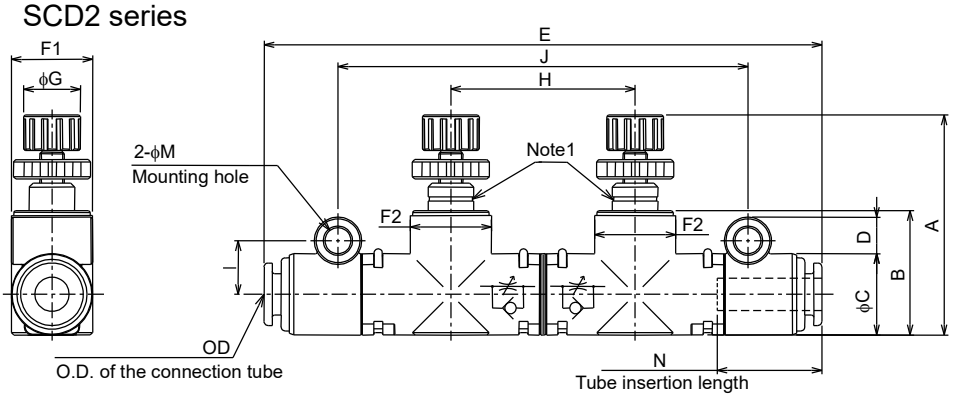
1.4 Envelop dimensions

1) SCL2 series



Model code	OD	A		B	C	D	E	F1	F2	G	I	J	M	N
		MIN	MAX											
SCL2-04-H22	ϕ1.8	27.1	31.6	15.3	10	4.5	50.8	10	10.6	7	6.6	27.8	3.3	-
SCL2-04-H42	ϕ4/ϕ1.8						48.4							12.9/-
SCL2-04-H24	ϕ1.8/ϕ4						48.4							-/12.9
SCL2-04-H44	ϕ4						46							12.9
SCL2-06-H66	ϕ6	28.8	33.3	17.7	12	5.6	49.4	12	12.2	7	8.1	30.8	4.3	13.7
SCL2-08-H66	ϕ6	38	44.5	22.9	15	5.6	64	15	15.5	11	9.5	41		18
SCL2-08-H88	ϕ8						66.5							19
SCL2-10-H88	ϕ8	44	50.5	29.7	20	5.1	71	20	20.5	11	11.5	47		19
SCL2-10-H1010	ϕ10						75							21
SCL2-10-H1212	ϕ12				20.4	4.9	79							22

2) SCD2 series



Model code	OD	A		B	C	D	E	F1	F2	G	H	I	J	M	N
		MIN	MAX												
SCD2-04-H22	ϕ1.8	27.1	31.6	15.3	10	4.5	73.5	10	10.6	7	22.7	6.6	50.5	3.3	-
SCD2-04-H42	ϕ4/ϕ1.8						71.1								12.9/-
SCD2-04-H24	ϕ1.8/ϕ4						71.1								-/12.9
SCD2-04-H44	ϕ4						68.7								12.9
SCD2-06-H66	ϕ6	28.8	33.3	17.7	12	5.6	73.9	12	12.2	7	24.5	8.1	55.3	4.3	13.7
SCD2-08-H66	ϕ6	38	44.5	22.9	15	5.6	97.5	15	15.5	11	34	9.5	75		18
SCD2-08-H88	ϕ8						100								19
SCD2-10-H88	ϕ8	44	50.5	29.7	20	5.1	111	20	20.5	11	40.5	11.5	87.5		19
SCD2-10-H1010	ϕ10						115								21
SCD2-10-H1212	ϕ12				20.4	4.9	119								22

Note1: The fine speed type is marked with a slit in this position.
Note2: Dimensions F1 and F2 indicate an oval.

2. SAFETY PRECAUTIONS FOR INSTALLATION AND REPLACEMENT

⚠WARNING:

1) Always use the product under the specified conditions.
2) Before replacing the joint or a tube connected to it, stop the air supply and make sure that no residual pressure is present inside the pneumatic circuit.
3) When connecting a tube to the joint, insert the tube firmly until it makes contact with the tube end piece of the joint. Make sure that the tube will not come out of the joint before running the system.

3. CAUTION

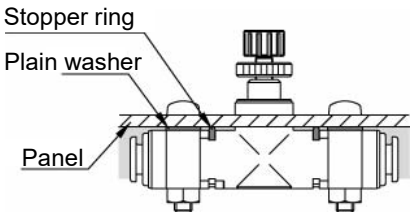
3.1 Design and Selection

1) Use this product within the proper specified range.
   Contact CKD when using the product outside specifications or for special applications.
   - If used outside specifications, product functions may not be attained and safety cannot be guaranteed.
   - There are cases when this product cannot be used for special applications or in special environments.
     These include special applications requiring safety including nuclear energy, railroad, aviation, vehicle, and medical devices or applications coming into contact with beverages or food, amusement equipment, emergency shutoff circuits, press machines, brake circuits, and safety devices.
2) Check that the product can withstand the working environment.
   - This product cannot be used in an environment where functional obstacles could occur.
     This includes high temperatures, a chemical atmosphere, or where chemicals, vibration, moisture, water drip or gas are present.
   - Do not use this product where cutting oil, coolant, or spatter could occur.
3) Do not use this product in a circuit where ozone is generated intentionally.
   The check packing deteriorates in high density ozone while it has sufficient ozone resistance against ozone generating naturally with compressed air.
4) This product cannot be used as a stop valve with zero leakage. Slight leakage is allowed in product specifications.
5) Avoid installing this product outdoors or where it is exposed to direct sunlight.
6) Fully understand characteristics of compressed air before designing the pneumatic circuit.
   - If instantaneous stopping and holding are required during an emergency stop, functions equivalent to mechanical, hydraulic or electrical methods cannot be anticipated.
   - Pop out, ejection, and leaks caused by air compressibility and expansion.
7) Install a “pressure switch” and “shut-off valve” on the device’s compressed air supply side.
   - The pressure switch is used to disable operation if set pressure cannot be reached. The shut-off valve
8) Indicate the maintenance conditions in the device’s instruction manual.
   - The product’s function can drop markedly with working status, working environment, and maintenance, and can prevent safety from being attained. With correct maintenance, the product functions can be used to the fullest.
9) Rubber parts deteriorate and life is shortened if very dry air is used.
10) Do not use regular joints at places where static charges cause problems. Otherwise system faults or failures may be caused. Anti-static joints and anti-static tubes are recommended at such places.

3
CAUTION

3.2 Installation and Adjustment

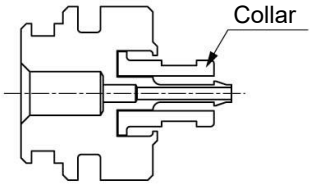
1) Do not apply pressure when rotating the mounting hole.
2) In case of panel mount, the stopper ring interferes with the panel face. Add a plain washer between the mounting hole and panel.



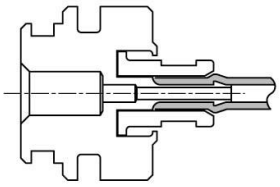
3) The torque of tightening the bolt in the mounting hole may not exceed the value specified in the table below.

Model	Tightening torque
SCL(D)2-04	0.5N·m
SCL(D)2-06/08/10	0.8N·m

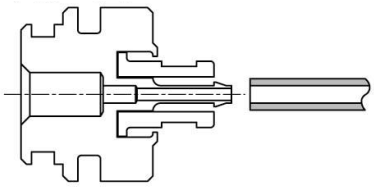
4) An oscillated or twisted product will cause disconnection of the tube. Fix the product, using bolts or a tying band, when performing piping.
5) Connect the air fiber (ϕ1.8 joint) according to the operation method (steps① through⑤) shown below.



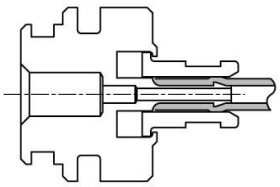
① Insert the collar until it stops.



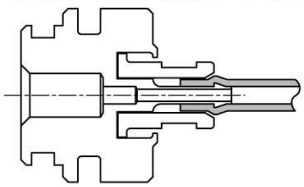
④ Insert Air Fiber until it stops.



② Cut the tip of Air Fiber perpendicularly.



⑤ Pull the collar to lock Air Fibers.



③ Insert Air Fiber properly while checking visually.

6) Always flush just before piping pneumatic component.
   - Any foreign matter that has entered during piping must be removed so it does not enter the pneumatic component.

7) When supplying compressed air for the first time after connecting pipes, do not apply high pressure suddenly.
   - Piping connection could be dislocated or the piping tube flies off, leading to accidents.

8) When supplying compressed air for the first time after connecting pipes, confirm that no air is leaking from any pipe connections.
   - Apply a leakage detection agent on pipe connections with a brush, and check for air leaks.

9) Pipe so that piping connection does not deviate by the device's movement, vibration, tension, etc.
   - Control of actuator speed will be disabled if piping on the exhaust side of the pneumatic circuit is disengaged.
   - When using the chuck holding mechanism, the chuck will be released creating a hazardous state.
   - Confirm that the tube has been inserted properly, and make sure that there is no tension during use. The tube could be dislocated or damaged if there is any tension.

10) Take care of the following when using nylon or urethane tube.
   - Use the designated tube and CKD plastic plug (GWP Series). Do not use metal plugs.

     Tube outer diameter accuracy

     Nylon tube ····· Within ±0.1mm

     Urethane tube (to ϕ6) ····· Within ±0.1mm

     (ϕ8 to) ····· Within $^{+0.1}_{-0.15}$ mm

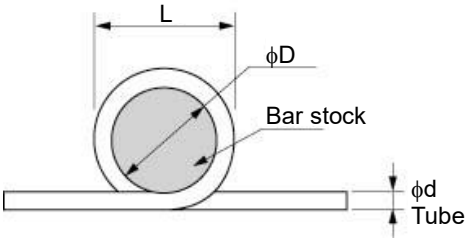
     Use a tube with a hardness of 92° or more. If a tube that does not satisfy diameter accuracy or hardness is used, chucking force may drop or the tube may come off or be difficult to insert.
   - When using the standard push-in joint for the spiral tube, fix the base of the tube with a hose band. Holding force drops if the tube rotates.
   - Cut the tube with a dedicated cutter, and cut a right angle.
   - Do not use a worn or damaged tube that could be crush or rupture.
   - Do not reuse a tube that could be deteriorated and deformed.
   - Do not let the tube directly contact other structures. It could wear and break.
   - Make sure that the joint and tube are not twisted or pulled, and that moment load is not applied.

3
CAUTION

11) Use a tube that is within the minimum bending radius but is long enough to avoid sudden bends.
   - Consider changes in the tube length caused by pressure when the tube is connected, and provide sufficient length within the tube's minimum bending radius.
   - Measurement method

   (1) Minimum tube length (JIS B 8381)

   The radius of a bar stock causing deformation ratio η to be 25% with a tube wound closely around the bar stock is indicated.

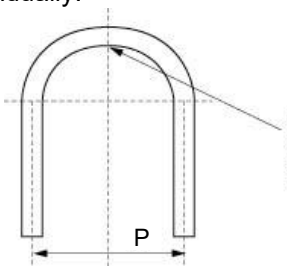


$$\eta = \left(1 - \frac{L - D}{2d}\right) \times 100$$

η : Deformation ratio (%)
d : Outside diameter of tube (mm)
L : Measurement amount (mm)
D : Diameter of bar stock (mm)
(Two times the minimum bending radius)

   (2) Minimum bending radius

   Check the radius at a tube diameter deformation ratio of 10% while simply bending the tube gradually.



Let the minimum mounting pitch P at a deformation ratio of 10% be P.

Minimum mounting radius = P/2

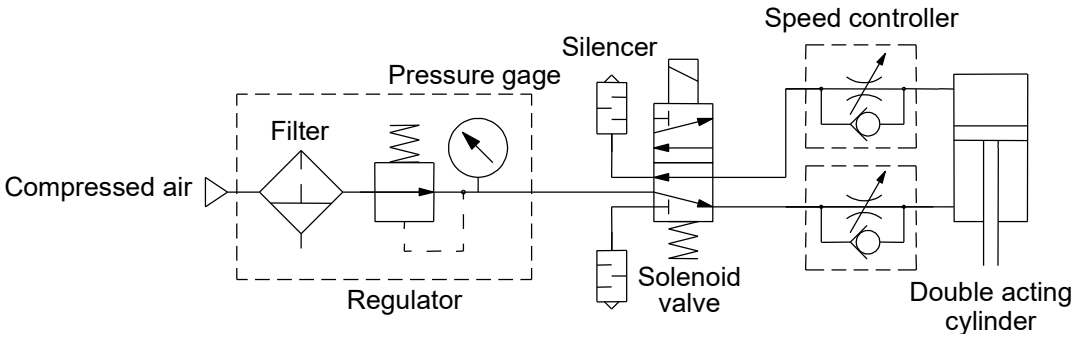
12) Secure sufficient space around pneumatics components for installation, removal, and piping work.
13) Install an air filter just before the circuit using the pneumatics components.
14) Avoid using this product for constantly rotating or oscillating applications.
   - Joint could be damaged.
15) Avoid using this product in places with high vibration or impact.
16) Check that lock nuts are not loose.
   - Actuator speed cannot be controlled if the lock nut is loose.
17) Check the needle valve speed or rotation.
   - A stopper mechanism is provided, but damage could result if the needle is turned too far. Check the product's of rotation.
18) Do not turn the knob too forcibly when fully closing or opening the knob (within 0.05N-m). As well, do not pinch the lock nut when adjusting the needle. Otherwise the needle will gall or be broken.
19) Check the direction of flow.
   - Reverse installation will cancel speed adjustment, causing the actuator to jump out.
20) During speed adjustment of the actuator, first fully close the needle, and then gradually open it to adjust.
   - An open needle will cause the actuator to jump out suddenly. Check that the needle is fully closed before opening it.
   - Turn the needle clockwise to close it. Turn the needle counterclockwise to open it.

4. OPERATION

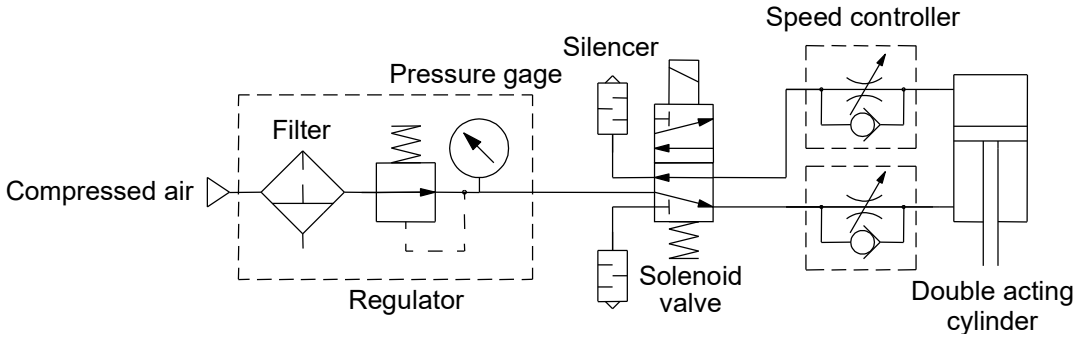
4.1 Fundamental circuit diagram

1) Speed Controller [SCL2]

■ Meter-out connection

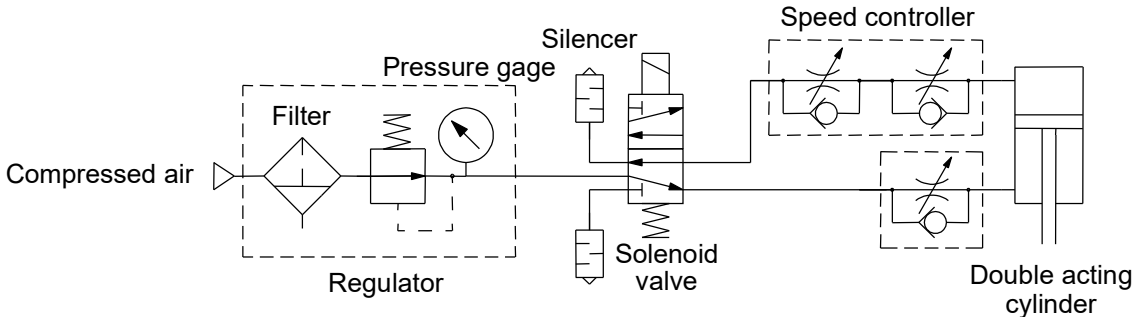


■ Meter-in connection

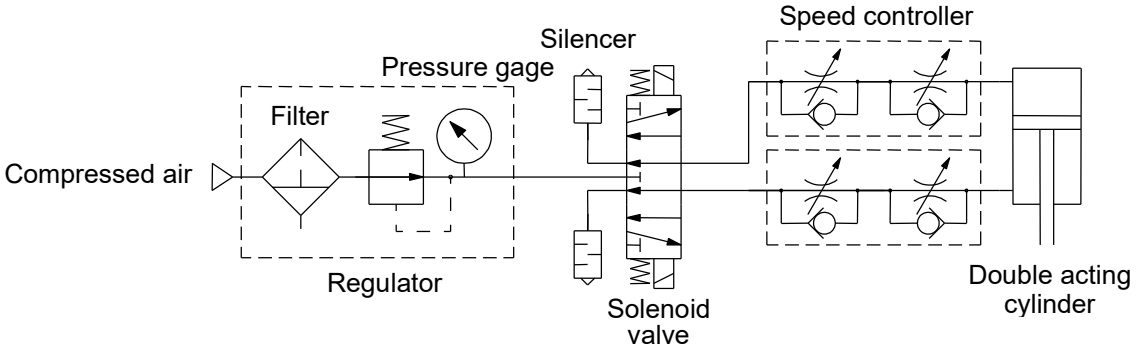


2) In/Out speed controller [SCD2]

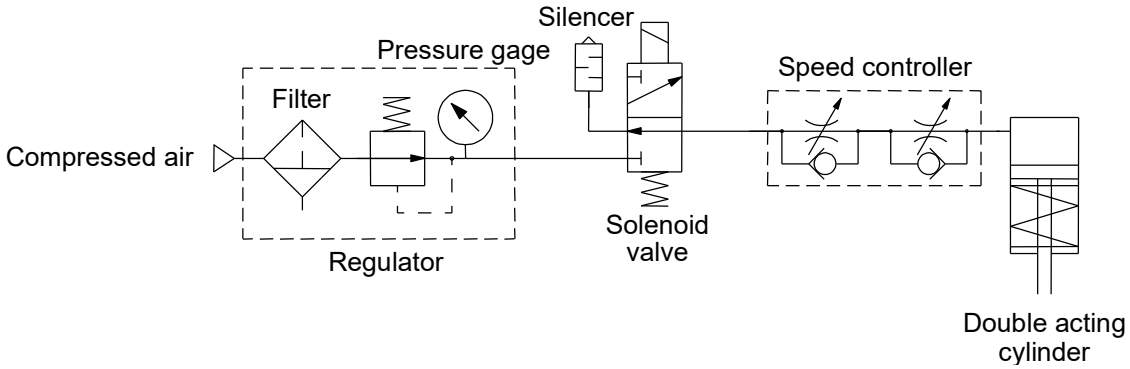
■ Example of preventive circuit against jumping out on PUSH side at fine speed drive



■ Example of preventive circuit against jumping out at initial action after residual pressure discharge inside cylinder



■ Example of reciprocal speed control circuit for single acting cylinder



4.2 How to adjust the cylinder speed

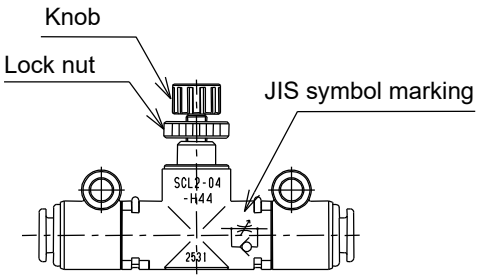
1) Adjustment using speed controller (SCL2)
Turn the knob clockwise to close, or turn it counterclockwise to open.
Clockwise rotation reduces the cylinder speed while counterclockwise rotation increases it.

< Speed adjustment at meter-out circuit >

(1) Turn the knob clockwise to fully close it before connecting the piping. Next, while observing the direction according to the JIS symbol specified on the main body, connect the piping and add the pressure.

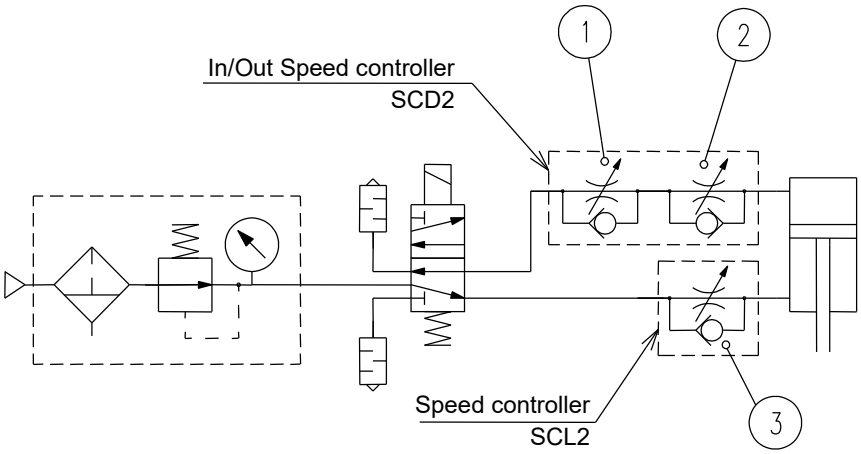
(2) Turn the knob counterclockwise up to the necessary cylinder speed. Adjust the speed while increasing the cylinder speed.

(3) After the knob position is adjusted, do not fail to tighten the lock nut.



2) Adjustment using in/out speed controller (SCD2)
Turn the knob clockwise to close, or turn it counterclockwise to open.
Clockwise rotation reduces the cylinder speed while counterclockwise rotation increases it.

< Example of speed adjustment of preventive circuit against jumping out:
Prevention against jumping out upon cylinder push >



(1) Before adding pressure, fully close the meter-out knobs (①and③) and fully open the meter-in knob②.

(2) Speed adjustment on push side

I) Turn knob③ counterclockwise up to the necessary cylinder speed.

II) Turn knob② clockwise to throttle the suction flow rate until jumping out at the push is eliminated.

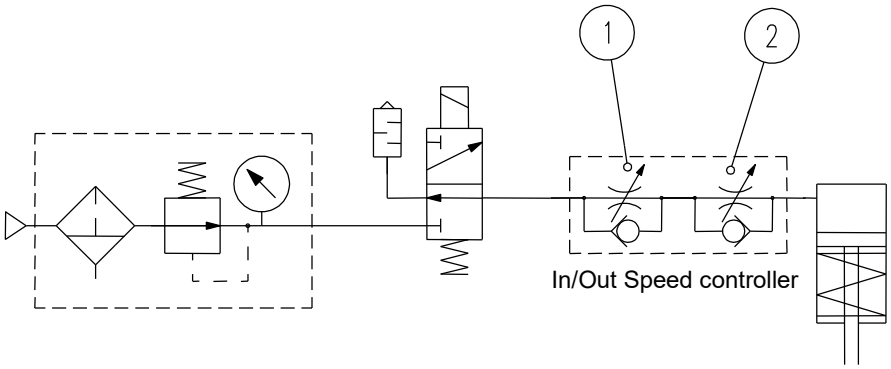
III) If the cylinder speed is reduced during adjustment in step II), turn knob③ to adjust the speed again.

(3) Adjustment of speed on pull side
Turn knob① to adjust.

(4) After the cylinder speed is adjusted, do not fail to tighten the lock nut.

* If cylinder jumping out before adjustment gives ill effects on devices, reduce the flow rate with knob② in advance before adjusting the speed.

< Speed adjustment of single acting cylinder >



(1) Before adding pressure, turn the knob clockwise to fully close.

(2) Use the knob specified in the table, according to the cylinder type and controlling direction, to adjust the speed.

(3) After adjusting the cylinder speed, do not fail to tighten the lock nut.

	Speed adjustment on push side	Speed adjustment on pull side
Pushing cylinder	Knob ②	Knob ①
Pulling cylinder	Knob ①	Knob ②

5. HOW TO ORDER

1) Speed controller

SCL2 - 04 - H44 - F
(a) (b) (c)

2) In/Out Speed controller

SCD2 - 04 - H44 - F
(a) (b) (c)

(a) Body size		(b) O.D. of the applied pipes		(c) Flow characteristics	
04	M5 standard	H22	ϕ1.8	No code	Standard type
06	1/8 standard	H42	A side : ϕ4 / B side : ϕ1.8	F	Fine speed type
08	1/4 standard	H24*	A side : ϕ1.8 / B side : ϕ4		
10	3/8 standard	H44	ϕ4		
		H66	ϕ6		
		H88	ϕ8		
		H1010	ϕ10		
		H1212	ϕ12		

(a) Body size - Combination of (b) O.D. of the applied pipes and (c) Flow characteristics

		Body size			
		04	06	08	10
O.D. of the applied pipes	H22	○			
	H42	○			
	H24*	○			
	H44	●○			
	H66		●○	●	
	H88			●	●
	H1010				●
	H1212				●

● Flow characteristics: Standard type
○ Flow characteristics: Fine speed type
indicates an unavailable combination.

* H24 may not be selected with SCD2. Use H42.

: Explanatory drawing for combination of O.D. of the applied pipes (H24/H42 only)