



Installation and Maintenance Manual

Scale cylinder with brake (Monosashi-kun with brake)

Series CE2**-*



1 Safety Instructions

- This manual contains essential information for the protection of users and others from possible injury and/or equipment damage.
- Read this manual before using the product, to ensure correct handling, and read the manuals of related apparatus before use.
- Keep this manual in a safe place for future reference.
- These instructions indicate the level of potential hazard by label of "DANGER", "WARNING" or "CAUTION", followed by important safety information which must be carefully followed.
- To ensure safety of personnel and equipment the safety instructions in this manual and the product catalogue must be observed, along with other relevant safety practices.

⚠ DANGER	In extreme conditions, there is a possibility of serious injury or loss of life.
⚠ WARNING	If instructions are not followed there is a possibility of serious injury or loss of life.
⚠ CAUTION	If instructions are not followed there is a possibility of injury or equipment damage.

⚠ WARNING

- The compatibility of pneumatic equipment is the responsibility of the person who designs the pneumatic system or decides its specifications.**
Since the products specified here can be used in various operating conditions, their compatibility with the specific pneumatic system must be based on specifications or after analysis and/or tests to meet specific requirements.
- Only trained personnel should operate pneumatically operated machinery and equipment.**
Compressed air can be dangerous if an operator is unfamiliar with it. Assembly, handling or repair of pneumatic systems should be performed by trained and experienced personnel.
- Do not service machinery/equipment or attempt to remove components until safety is confirmed.**
 - Inspection and maintenance of machinery/equipment should only be performed after confirmation of safe locked-out control positions.
 - When equipment is to be removed, confirm the safety process as mentioned above. Switch off air and electrical supplies and exhaust all residual compressed air in the system.
 - Before machinery/equipment is re-started, ensure all safety measures to prevent sudden movement of cylinders etc. (Supply air into the system gradually to create back pressure, i.e. incorporate a soft-start valve).
- Do not use this product outside of the specifications. Contact SMC if it is to be used in any of the following conditions:**
 - Conditions and environments beyond the given specifications, or if the product is to be used outdoors.
 - Installations in conjunction with atomic energy, railway, air navigation, vehicles, medical equipment, food and beverage, recreation equipment, emergency stop circuits, press applications, or safety equipment.
 - An application which has the possibility of having negative effects on people, property, or animals, requiring special safety analysis.

⚠ CAUTION

- Ensure that the air supply system is filtered to 5 microns.

1 Safety Instructions (Continued)

Operating and Storage Environments

⚠ WARNING

- Environments to avoid**
Avoid using or storing the products in the following environments which may cause failures. If the products need to be used or stored in these environments, take necessary measures.
 - Place where ambient temperature exceeds the range of 0 °C to 50 °C.
 - Place where ambient humidity exceeds the range of 35% to 85% RH.
 - Place where condensation occurs due to sudden temperature change.
 - Place where atmosphere containing corrosive gas, flammable gas or organic solvent.
 - Place where atmosphere containing conductive powder such as dust, iron chips, oil mist, salt, or organic solvent, or splashing cutting chips, dust and cutting oil (water, liquid) over the products.
 - Place where the products are exposed to direct sunlight or radiated heat.
 - Place where strong electromagnetic noise is generated (place where strong electric field, strong magnetic field or surge is generated).
 - Place where static electricity is discharged or condition that the products have electrostatic discharge.
 - Place where strong high frequency is generated.
 - Place where damage by lightning is possible.
 - Place where vibration or impact is directly given to the products.
 - Condition that the products are deformed by force or weight applied.
- Do not use close to any objects, which are affected by magnets.**
Since magnets are built into the cylinders, do not place near magnetic disks, magnetic cards or magnetic tapes. The data may be destroyed.
- This product is class A equipment that is intended for use in an industrial environment.**

Design

⚠ WARNING

- There is a possibility of dangerous sudden movement by cylinders if sliding parts of machinery are twisted due to external forces, etc.**
In such cases, human injury may occur; e. g., by catching hands or feet in the machinery, or damage to the machinery may occur.

- Provide a cover to minimize the risk of human injury.**

When driving objects or moving parts of a cylinder there is a risk of human injury, design a structure to avoid contact with human body.

- Securely tighten all stationary parts and connected parts of cylinders to ensure that they will not become loose.**
Tighten cylinders securely especially when they are used in high frequency or in locations where direct vibration or impact shock, etc. will be applied to the body of the cylinder.
- Deceleration circuits or shock absorbers are needed in some cases.**
If a driven object travels at a high speed or is heavy, impact will not be sufficiently absorbed only with the cylinder cushion. In such cases, use a circuit to decelerate the cylinders speed before the cushion becomes effective or use external shock absorbers to reduce impact. Consider, taking the rigidity of machinery into account.
- Consider possible drop of pressure in circuit due to power loss.**
For cylinders used in clamping mechanism, the work piece may become loose due to less clamping force, caused by pressure drop in circuit at the time of power loss. Install safety devices to prevent human injury and machinery damage. Measures should be taken to prevent the dropping of hanging or lifting equipment.
- Consider possible loss of power sources.**
Measures should be taken to protect against human injury and machinery damage in the event that there is a loss of air pressure, electricity or hydraulic power.
- Design circuit to prevent sudden movement of a driven object.**
A driven object is operates quickly when pressure is supplied to one side of the piston after air in the cylinder is exhausted, in such cases where that cylinder is actuated by exhaust center type of directional control valve or started after residual air is exhausted from the circuit. At this time, human injury may occur; e.g., by catching hands or feet in the machinery, or damage to the machinery itself may occur. Therefore, the machine should be designed and constructed to prevent sudden movements.
- Consider emergency stops.**
Design the machinery so that human injury and/or damage to machinery and equipment will not occur when the machinery is stopped by a safety device under abnormal conditions, a power loss or a manual emergency stop.

1 Safety Instructions (continued)

- Consider actions when operation is restarted after an emergency stop or abnormal stop.**
Design the machinery so that human injury or equipment damage will not occur upon restart of operation. When the cylinder is required to return to the initial position, provide the equipment with a safe override.
- Construct the machinery so that moving objects and the moving parts of the cylinder with brake do not come into direct contact with the human body.**
- Use a balanced circuit in which lurching of the cylinder is prevented.**
When operation is locked in specified intermediate positions of the stroke, and air pressure is applied to only one side of the cylinder, the piston will lurch when the lock is released. This might cause injury or damage to machinery.

Selection

⚠ WARNING

- Confirm the specifications.**
The product in this manual is designed to be used only in industrial compressed air system. The product should not be used with pressures or temperatures outside the range of the specifications, as this may cause damage or malfunction, etc.
- Intermediate stop**
When cylinder piston is stopped intermediately by 3-position closed centre type of directional control valve, intermediate stop positions may not be as precise and exact as hydraulic operation due to compressibility of air. Valves and cylinders are not guaranteed for zero air leakage, and stop position may not be held for long periods of time. Consult SMC for long term holding of stop positions.
 - When a cylinder is in a no-load and locked state, the holding force (maximum static load) is the lock's ability to hold a static load that does not involve vibrations or shocks. To ensure braking force, the maximum load must be set as described below.
 - For constant static loads, such as for drop prevention: 35% or less of holding force (Maximum static load)

Note: For applications such as drop prevention, consider situations in which the air source is shut off, and make selections based on the holding force of

the spring locked state.

Do not use the pneumatic lock for drop prevention purposes.

- When kinetic energy acts upon the cylinder, such as when effecting an intermediate stop, there are constraints in terms of the allowable kinetic energy that can be applied to the cylinder in a locked state. Refer to the allowable kinetic energy of the respective series. Furthermore, during locking, the mechanism must sustain the thrust of the cylinder itself, in addition to absorbing the kinetic energy.
- Therefore, even within a given allowable kinetic energy level, there is an upper limit to the amount of the load that can be sustained.
- Maximum load for horizontal mounting: 70% or less of the holding force (Maximum static load) for spring lock
 - Maximum load for vertical mounting: 35% or less of the holding force (Maximum static load) for spring lock
 - In a locked state, do not apply impact, strong vibrations or rotational forces. Any impact, strong vibrations or rotational forces from external sources could damage or shorten the life of the lock unit.
 - Although the cylinder can be locked in both directions, be aware that its holding force is smaller in one of the directions. Holding force at piston rod extended side is approx. 15% less.

⚠ CAUTION

- Mount speed controller and adjust cylinder operation speed gradually from low speed to a desired speed.

Air Supply

⚠ WARNING

- Do not use the product out of the specified ranges for pressure and temperature to prevent equipment damage and malfunction.**
 - Operating pressure:
 - Driving part: 0.1 – 1.0 MPa
 - Braking part: 0.3 – 0.5 MPa
 - Fluid & ambient temperature: 0 to 60 °C
- Use clean air.**
Do not use this product with compressed air that includes chemicals, synthetic materials (including organic solvents), saline, corrosive gases, etc., as this may cause damage or malfunction.

1 Safety Instructions (continued)

⚠ CAUTION

- Install air filter.**
Install air filter before and in vicinity of valve. The filter should be able to collect particles of 5 microns or smaller. A large quantity of particles may cause malfunction of the pneumatic components.
- Install after cooler, air dryer, auto drain, etc.
Compressed air that includes excessive condensate may cause malfunction of valve and other pneumatic equipment. To prevent this, install after cooler, air dryer, auto drain, etc.

Pneumatic circuit

⚠ WARNING

- Be certain to use a pneumatic circuit which will apply balanced pressure to both sides of the piston when in a locked stop.**
(Refer to Piping section for recommended pneumatic circuit.)
In order to prevent the cylinder lurching after a locked stop, use a circuit which applies balanced pressure to both sides of the piston when restarting or when manually releasing the lock, thereby cancelling the force generated by the load in the direction of piston movement.
- Use a solenoid valve for unlocking which has a larger effective area, as a rule 50% or more of the effective area of the cylinder driving solenoid valve.**
(Refer to Piping section for recommended pneumatic components.)
The larger the effective area is, the shorter the locking time will be, and stopping accuracy will be improved.
- Place the solenoid for unlocking close to the cylinder, and no farther than the cylinder drive solenoid valve.**
The shorter the distance from the cylinder, the shorter the overrun amount will be, and stopping accuracy will be improved.
- Allow at least 0.5 seconds from a locked stop (intermediate stop of the cylinder) until release of the lock.**
When the locked stop time is too short, the piston rod may lurch at a speed greater than the control speed of the speed controller.

- When restarting, control the switching signal for the unlocking solenoid valve so that it acts before or at the same time as the cylinder drive solenoid valve.**
If the signal is delayed, the piston rod may lurch at a speed greater than the control speed of the speed controller.

Installation

⚠ WARNING

- Connect the rod end and the load with the lock released.**
- Ensure that the equipment operates properly before use.**

⚠ CAUTION

- Maintenance space**
When installing the products, allow space for maintenance.
- Installation of jigs**
When hardware and nuts are screwed onto the piston rod end, the piston rod should be fully retracted.
Use double nuts to fix the work piece since scale cylinder does not have any parallel flats on the rod.
- Do not give apply heavy impact and/or excessive moments when mounting the workpiece.**
External force other than allowable moment may cause vibration at the guide part and/or increase in the sliding resistance.
- Use the product in such a condition that the load is always applied in the axial direction of the piston rod.**
When the load is applied in directions other than cylinder axial direction, control the load by the use of a guide.
Perform a complete centring when cylinder is mounted.
- Be careful to avoid scratches or dents, etc. on the sliding sections of the piston rod.**

Wiring

⚠ WARNING

- Preparation for wiring**
Shut off the power before wiring (including insertion and removal of con

1 Safety Instructions (continued)

- nectors). Mount a protective cover on the terminal block after wiring.
- Check the power supply**
Make sure the power supply has sufficient capacity and voltages are within the specified range before wiring.
- Grounding**
Ground terminal block F.G. (Frame Ground). Do not ground it with devices generating strong electromagnetic noise.
- Check wiring**
Incorrect wiring may cause damage or malfunction of the products. Make sure the wiring is correct before operation.

CAUTION

- Separation of signal wires from power wire**
Avoid common or parallel wiring of signal and power wires to prevent malfunction due to noise.
- Wiring arrangement and fixation**
Avoid bending cables sharply at the connector part or the electrical entry into the wiring assembly.
Improper assembly may cause disconnection, which in turn causes malfunction. Fix cables close enough so as not to exert excessive force on to the connector.

Piping

CAUTION

- Before piping**
Remove cutting chips, cutting oil, dust, etc. in piping by flushing or cleaning before piping. Care should be taken especially that any cutting chips, cutting oil, dust, etc. do not exist after the filter.
- At piping**
 - Foreign matter should not enter. Entering of foreign matter will cause malfunction.
 - Cutting chips and sealing materials at piping threads should not enter valves when piping and fittings are screwed in.
Leave 1.5 to 2 threads when sealing tape is used.

Lubrication

CAUTION

- Lubrication of cylinder**
 - This cylinder is pre-lubricated and can be used without lubrication.
 - In the case of lubrication, use the equivalent of the turbine oil type 1 ISO VG32. Once lubrication is performed, it should be continued since the initial lubricant flows out causing malfunction.

Adjustment

CAUTION

- The locks are manually disengaged when the cylinder is shipped from the factory.**
Be sure to change them to the locked state before using the cylinder.
- Adjust the cylinder's air balance.**
In the state in which a load is attached to the cylinder, disengage the lock and adjust the air pressure on the rod side and the head side of the cylinder to obtain a load balance. By maintaining a proper air balance, the piston rod can be prevented from lurching when the lock is disengaged.
- Adjust the mounting position of detection devices such as autoswitches.**

Sensor unit

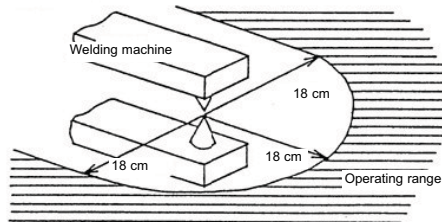
CAUTION

- Do not remove the sensor unit.**
The position and sensitivity of the sensor is adjusted properly before shipment.
Removing or replacing the sensor may cause malfunction.
- Operate the system with an external magnetic field of 14.5 mT or less.**
Strong magnetic field in the vicinity may cause malfunction, since CE2 sensor is magnetic type.

This is equivalent to a magnetic field of approximately 18 cm in radius

1 Safety Instructions (continued)

from a welding area using a welding current of almost 15,000 amperes. To use the system in a magnetic field that exceeds this value, use a magnetic material to shield the sensor unit.



- Do not pull sensor cable with excessive force**
Such action may cause failure.
 - Water shall be kept away from the sensor unit to avoid failure. (IP65 Protection)
- Power supply line**
Do not mount any switch or relay to power supply line (12 VDC to 24 VDC).

Maintenance and Check

WARNING

- Performing regular check**
Check regularly that the product does not operate with faults. Trained and experienced operators should do the checking.
- Dismantling of product and supply/exhaust of compressed air.**
Before dismantling, ensure that the drop and runaway preventing measures are properly provided; shut the power source of air supply, and exhaust the compressed air in the system. When starting operation again, operate the product with care after ensuring that measures for preventing extension are properly provided.
- Prohibition of disassembly and modification.**
To prevent accidents such as failures and electric shocks, do not remove the cover to perform disassembly or modification. If the cover has to be removed, shut off the power before removal.

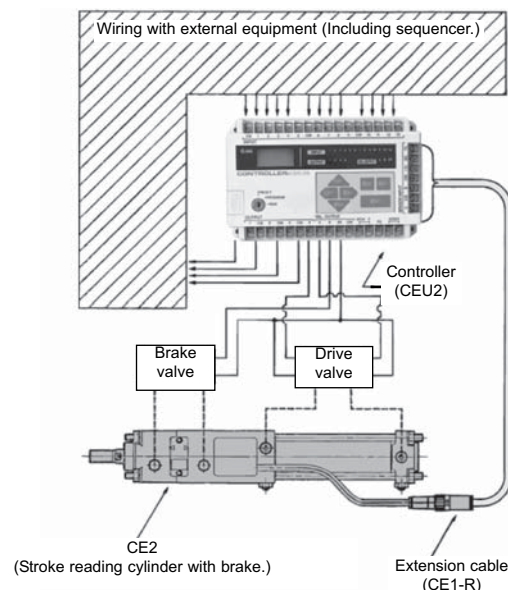
- Disposal**
Request a special agent for handling industrial waste to dispose the products.

2 Product Summary

The scale cylinder with brake (CE2 series) is an air cylinder that has a brake (lock) function and scaling function. Multiple positioning is available by using in combination with a specified controller (CEU2 series); dimension measurement, simple positioning and safety lock are available by using in combination with a counter (CEU1 or CEU5 series).
The braking function employs a lock system using both spring and air pressure. The magnetic scale on the piston rod is read by a magnet sensor. The resolution is 0.1 mm.

System Configuration

- CE2 + CEU2**

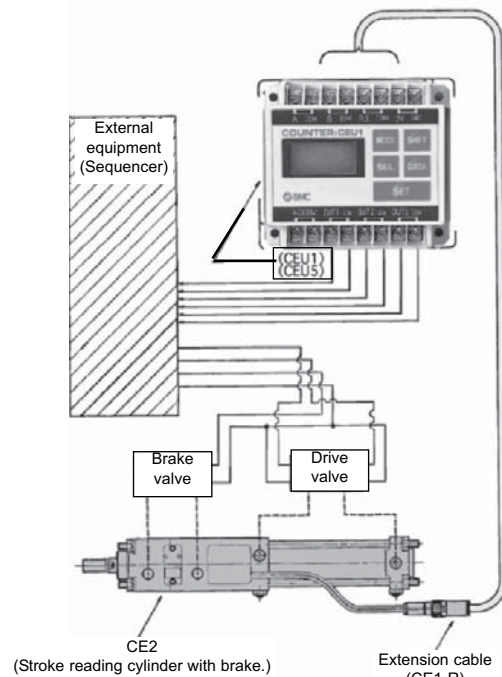


2 Product summary (continued)

The specified controller, CEU2, for multiple positioning, controls the brake valve and the drive valve.

- Refer to the operation manual of CEU2 for details.
- Prediction control and learning control achieve positioning with high repeatability.
- Retry function automatically corrects stopping position.

- CE2 + CEU1 (or CEU5)**



Suitable for simple positioning systems, and systems which require safety during measurement.

- Refer to the operation manuals of CEU1 (Preset counter) and CEU5 (Multi-counter) for details.
- Operation using the drive valve only is possible by using the manual lock release.

How to Order

- Stroke reading cylinder with brake**

CE2 B 40 - 100 × × × - × ×

Mounting Type	Autoswitch suffix. (Qty.)	
B Double end tapped	Nil 2 pcs.	
L Foot type	S 1 pc.	
F Front flange type	n n pcs.	
G Rear flange type		
C Single clevis type		
D Double clevis type		
T Center trunnion type		
Bore size	Connector	
40 40 mm	Nil Without connector	
50 50 mm	Z Without connector	
63 63 mm		
80 80 mm		
100 100 mm		
	Cushion	
	Nil Double side cushion	
	N Without cushion	
	R Rod cushion	
	H Head cushion	
	Bellows	
	Nil Double side cushion	
	N Without cushion	
	R Rod cushion	

Stroke (mm)	Standard stroke	
	No bellows	With bellows
40	25 to 850	25 to 700
50	25 to 800	25 to 650
63	25 to 800	25 to 650
80	25 to 750	25 to 600
100	25 to 750	25 to 600

Bore size	Available stroke (RFS)	
	No bellows	With bellows
40	To 1200	To 950
50	To 1150	To 900
63	To 1150	To 900
80	To 1100	To 900
100	To 1100	To 850

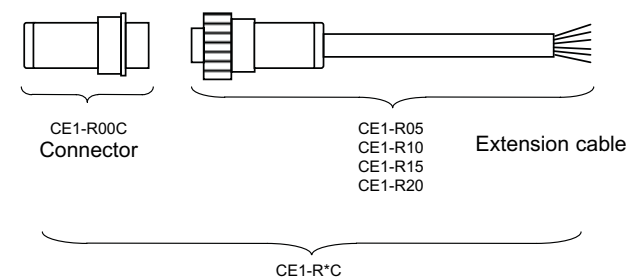
2 Product summary (continued)

Options

- 3-points preset counter**
CEU1 × - ×
 - Supply voltage: Nil 80 - 120 Vac, D 24 Vdc
 - Output transistor type: Nil NPN open collector, P PNP open collector
- Extension cable**
CE1-R × ×
 - Connector¹⁾: Nil Extension cable, C Extension cable & connector
 - Cable length: U5 5 m, 10 10 m, 15 15 m, 20 20 m
- Controller**
CEU2 ×
 - Output transistor type: Nil NPN open collector, P PNP open collector
- Multi-counter**
CEU5 × × - ×
 - Supply voltage: Nil 100 - 240 Vac, D 24 Vdc
 - Output to PC/PLC: Nil RS-232C, B RS-232C+BCD
 - Output transistor type: Nil NPN open collector, P PNP open collector

*1) A female connector is attached to one end of the extension cable.

The male connector is attached if symbol C is selected. The connector is the CE2**Z used for the cable terminal of the stroke reading cylinder with brake (CE2).



3 Selection

Troubleshooting

No.	Check point	Ans.	Go to
1	Is the cylinder's kinetic energy within the allowable range?	Yes: 2 No: A	A: Refer to the diagram below. Select correct cylinder specification.
2	Is the speed within the given range in diagram? And within specification?	Yes: 3 No: A	Acceptable kinetic energy diagram
3	Is the mounted load within the load specified in the diagram?	Yes: 4 No: A	
4	Is there interference due to electric noise?	Yes: 4.1 No: 5	
4.1	Can the signal cable be wired separately from the power line?	Yes: 5 No: B	
5	Is there interference due to magnetic noise?	Yes: 5.1 No: 6	
5.1	Can the system be operated at less than 14.5 mT or less?	Yes: 6 No: B	
6	Is there coolant, oil, water or dust present?	Yes: 6.1 No: 7	
6.1	Can the cylinder be protected with a cover?	Yes: 7 No: C	
7	Is the cylinder to be used for a positioning application?	Yes: 8 No: D	
8	Is reaction force or impact force applied during the positioning motion?	Yes: E No: 9	B: DO NOT USE! Count error will occur.
9	Is there any fluctuation of pressure, load, or piston speed?	Yes: F No: 10	C: DO NOT USE! Damage to sensor or product deterioration.
10	Is it possible to adopt the recommended pneumatic circuit in accordance with the cylinder's mounting orientation?	Yes: 11 No: F	D: The system is ready to use. Read the instruction manuals thoroughly prior to operating.
11	Can the directional control valve be installed separately?	Yes: 12 No: 11.1	E: This system cannot be used because its learning function will not work properly, which may lead to positioning failure.
11.1	Are there any pressure or speed fluctuations associated with the synchronized movement?	Yes: F No: 12	F: The system cannot be used because it is adversely affected by speed, load, and pressure fluctuations.
12	Can the proper air balance be attained in accordance with the cylinder's mounting orientation?	Yes: 13 No: G	G: The system can not be used because if the proper air balance cannot be attained, an excessive load will be applied to the brake unit.
13	Is the minimum setting interval for positioning more than 5 mm + tolerance?	Yes: 14 No: H	H: Positioning cannot be done when the distance is 5 mm + tolerance or less.
14	Is positioning carried out within 30 mm from the stroke end?	Yes: I No: 15	I: Operating conditions are restricted when positioning is carried out within 30 mm from the stroke end. Refer to the instruction manual of the controller for details.
15	Is it acceptable if it might run over the target position?	Yes: 16 No: J	J: There may be cases of overrun/retary during the positioning operation. If correction operation is not acceptable, the product can not be used.
16	If the position is outside the allowable range, is retry acceptable?	Yes: K No: 16.1	K: There is no problem in using the system. Please read this instruction manual and the instruction manual of the controller CEU2 thoroughly before use.
16.1	An error might occur if it is set to (number of trial again = 0) in order to prevent retry when the position is outside the allowable range. Is this acceptable?	Yes: K No: J	

4 Product Specifications

• **Cylinder specifications**

Bore size	ø40	ø50	ø63	ø80	ø100
Operating fluid	Air (Non-lube)				
Proof pressure	1.5 MPa				
Maximum operating pressure	Drive pressure: 1 MPa Brake pressure: 0.5 MPa				
Minimum operating pressure	Drive pressure: 0.1 MPa Brake pressure: 0.3 MPa				
Operating piston speed	50 to 500 mm/s <small>Note 1)</small>				
Ambient temperature	0 to 60 °C (No freezing)				
Brake method	Spring and pneumatic lock type				
Sensor cord length	ø7 to 500 mm oil-resistant				
Thread tolerance	6H				
Stroke length tolerance	~250 mm: +1.0, 251 – 1000 mm: +1.4 0				

Note 1) Be aware of the constraints in the allowable kinetic energy

• **Sensor Specifications**

Cable	ø7.6 core twisted pair shield wire (Oil, heat & flame resistant cable)
Maximum transmission distance	20.5 m (when using SMC cable and controller or counter)
Position detection method	Magnetic scale rod / Sensor head <Incremental type>
Magnetic field resistance	14.5 mT
Power supply	10.8 - 26.4 VDC (Power supply ripple: 1% or less)
Current consumption	35 mA (Max.)

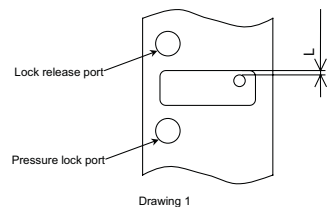
Resolution	0.1 mm/pulse
Accuracy	±0.2 mm <small>Note 1)</small>
Output type	Open collector (Max. 30 VDC, 50 mA)
Output signal	A or B phase difference output
Insulation resistance	500 VDC, 50 MΩ or more (between case and 12E)
Vibration resistance	33.3 Hz, 6.8 G, 2 hrs. each in X and Y directions 4 hrs in Z direction based upon JIS D1601
Impact resistance	30 G, 3 times each in X, Y and Z directions
Enclosure	IP65 (IEC Standard) Except connector
Extension cable (Optional)	5 m, 10 m, 15 m or 20 m

Note 1) This includes the digital display error of the controller (CEU2) or counter (CEU1, CEU5).

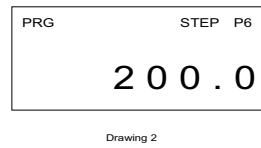
The overall accuracy after mounting on equipment will vary depending on the mounting conditions and environment. Therefore, the customer should calibrate the system as a whole.

• **Life of cylinder (Brake unit)**

The specified brake life is 2,000,000 cycles, but the brake life depends on the operating conditions. When the brake reaches its life limit, please return it to SMC for replacement of the brake unit. The guideline for replacement is when the rotation stopper pin dimension in drawing 1 becomes L=1 mm or less, or when the brake operation time (drawing 2) of the controller preset data 6(P6) becomes 200.0 (=2,000,000 times). (See operation manual of CEU2 for details).



4 Product Specifications (continued)



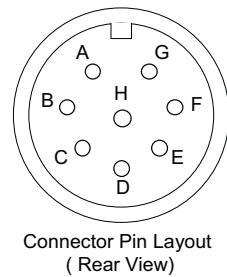
• **Operating conditions for 2,000,000 times**

Cylinder speed:	300 mm/s
Mounting load:	Horizontal: 50% or less
	Vertical: 35% or less (Within allowable kinetic energy)

5 Wiring

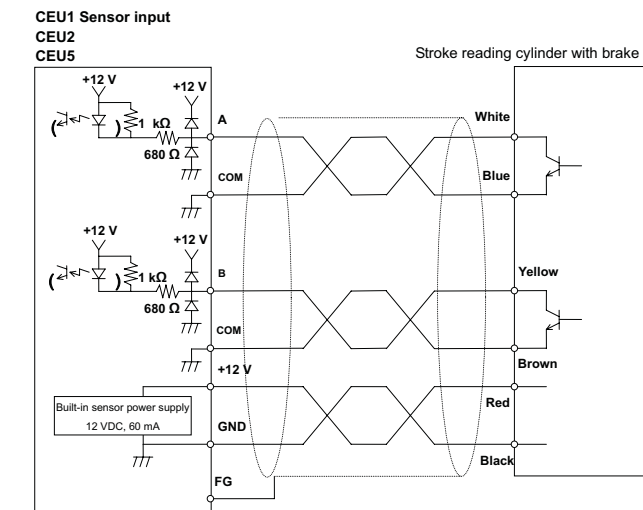
• **Connector and wiring table**

The table below shows combinations of contact mark and wire core colour. The connector pin layout shows the layout of CE2 with connector.



Contact mark	Core colour	Signal
A	White	A-phase
B	Yellow	B-phase
C	Brown	Com (0 V)
D	Blue	Com (0 V)
E	Red	12 -24 VDC
F	Black	0 V
G	Shield	Shield
H	-	Not used

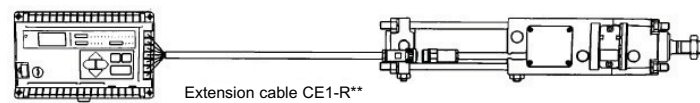
• **Wiring for Counter**



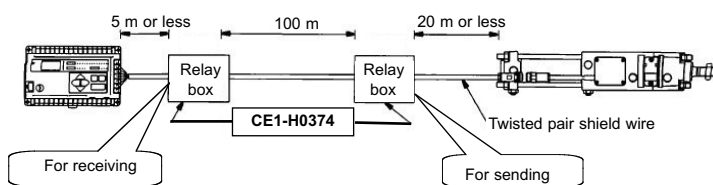
• **Connection of extension cable**

SMC cable CE1-R** shall be used. If the length is 20 m or longer, use the specified relay box (Part no.: CE1-H0374).

• **Connection example**



• **20 m or longer**



5 Wiring (continued)

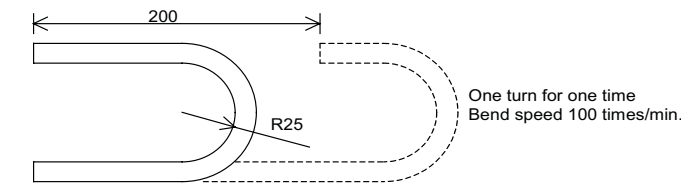
Relay box for sending:	Sending box	CE1-H0374-1
Relay box for receiving:	Receiving box	CE1-H0374-2

The part no CE1-H0374 is for a pair of relay boxes for sending and receiving. (CE1-H0374 consists of CE1-H0374-1 and CE1-H0374-2.)

CAUTION

• **Operation capability is confirmed at max. transfer distance 20.5 m. Do not use wiring longer than this. (If a longer distance is required use the relay boxes shown above.)**

- For clamping, care should be taken not to apply excess tension force to the cable connector and sensor connection. If the cable is bent during operation, the bend radius shall be 25 mm or larger.
- Sliding bend performance:
The number of times the wire can be bent in the conditions shown below before the wire breaks is 4,000,000 times.



• **Noise countermeasures**

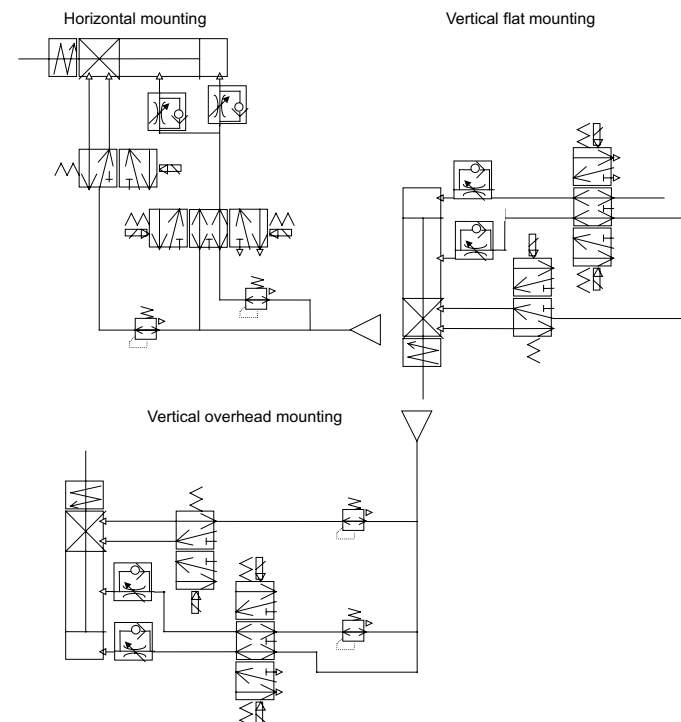
Follow the instructions below to prevent malfunction due to noise.

- Use SMC extension cable CE1-R** for CEU1, CEU2, CEU5. Ground the shield wire properly.
- Keep signal wires away from the power cables in wiring.
- Mount a ferrite core to signal cables for possible radiated noise effects

- of cable.
- Use stable power source for CEP1 power supply.
- Mount a noise filter for possible noise effects of power source.
- Please read the operation manual of CEU1, CEU2, or CEU5 depending on the counter or controller to be connected.
- Combination of this product and CEU1(P)-D complies with the EMC directive.

6 Piping

• **Example of Recommended Pneumatic Circuit**



6 Piping (continued)

• **Recommended pneumatic components**

Bore	Directional valve	Brake valve	Regulator	Piping	Silencer	Speed controller
ø40	VFS24□0R	VFS21□0	AR425	Nylon ø8/6	AN200-02	AS4000-02
ø50	VFS24□0R	VFS21□0	AR425	Nylon ø10/7.5	AN200-02	AS4000-02
ø63	VFS34□0R	VFS21□0	AR425	Nylon ø12/9	AN300-03	AS4000-03
ø80	VFS44□0R	VFS31□0	AR425	Nylon ø12/9	AN300-03	AS420-03
ø100	VFS44□0R	VFS31□0	AR425	Nylon ø12/9	AN400-04	AS420-04

If the operating environment is dusty, select a model with bellows.

CAUTION

• **Piping length from the cylinder to the solenoid valve shall be 1 m or less.**

• **Installation**

The brake and the rod cover are assembled with a tie rod for fixing the unit. Therefore, unlike a normal cylinder, this cylinder cannot be directly screwed into the machinery with cylinder tie rods. It is possible that the tie rod for fitting may become loose during replacement of the support bracket. When replacing the support bracket or re-tightening the tie rod for fitting the unit, use a socket wrench.

• **Air Balance**

Air balance must be adjusted to avoid frequent failures or inconsistency in stopping accuracy.

• **How to adjust**

• Start manual operation of controller or operate the directional valve and the manual operation of the brake valve to move the cylinder piston rod to the middle of the stroke. (Under operating conditions)

- Release the brake and adjust the regulator so that the cylinder does not extend or retract. Release the brake by manual operation of the brake valve, or switch the controller DIP switch No.2 to switch counting direction. (Refer to the CEU2 controller manual.)

• **After adjustment**

Ensure that the cylinder does not extend or retract by switching the brake lock and releasing with the manual brake valve several times. If the cylinder moves back and forth, further adjustment of the cylinder is necessary.

• **Perform final operation check**

Perform positioning to ensure that the cylinder does not retract too much or lurch immediately after the brake is released.

CAUTION

- Whenever the brake count direction is switched, reset the controller or turn the power off and on again. (Refer to the CEU2 controller manual.)
- For cushion type, do not constrict the cushion too much. If using a mechanical stopper, use shock absorbers to avoid impact and rebound.

7 Structure and Measuring Principle

• **Structure**

The piston rod has a magnetic scale on its circumference. The detection head of the sensor unit (encoder) is placed facing the scale. Along the piston rod travel, the sensor detects its magnetic signal. The sensor converts the signal to a pulse signal. The counter and the controller measure the signal.

Since the scale is placed around the whole circumference, measurement is possible even if the piston rod rotates.

- For stopping, both locking by air balance and locking by mechanical brake methods are used.
- For braking, both spring and air pressure are used. (See Chapter 8 for manual lock release, and manual change from lock released state to locked state.)

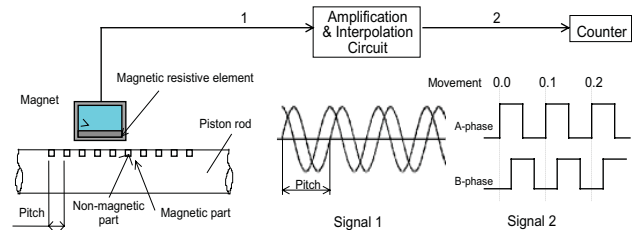
7 Structure and Measuring Principle (continued)

CAUTION

- When using the CE2 series, care should be taken regarding the following points, due to its structural characteristics.
- Use the product in such a condition that load is always applied in the axial direction of the piston rod. Offset load may cause abrasion of bearing and packing. In addition, measuring accuracy may deteriorate.
- Do not remove the sensor. The position and sensitivity of the sensor is adjusted properly. Removing or replacing the sensor may cause malfunction.
- Do not pull sensor cable with excessive force. Such action may cause detection failure and other failures.
- External magnetic field should be 14.5 mT or less. Strong magnetic field in the vicinity may cause malfunction since CE2 sensor is magnetic type.

This is equivalent to a field in a radius of about 18 cm from a welding part using welding current of about 15000 amperes. When the product is used in stronger magnetic field, take some measures for shielding by covering the sensor part with magnetic material.

Measuring Principle

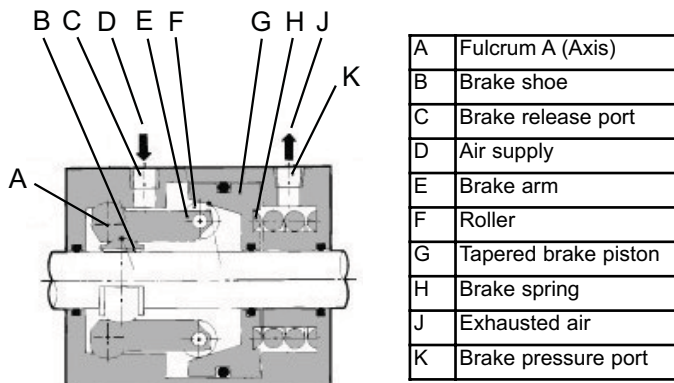


- The piston rod has a scale consisting of magnetic layer and non-magnetic layer with regular pitch.
- Along the travel of the piston rod, the detection head (magneto-resistive element built-in) of the sensor unit (encoder) detects this scale, then pulse signal of phase A or B is output.

By inputting this pulse signal to a counter (CEU1, CEU5, etc.), it is possible to measure with a resolution of 0.1 mm.

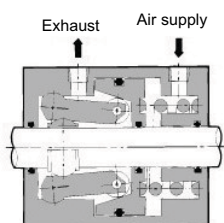
8 Brake mechanism

Operation Principle

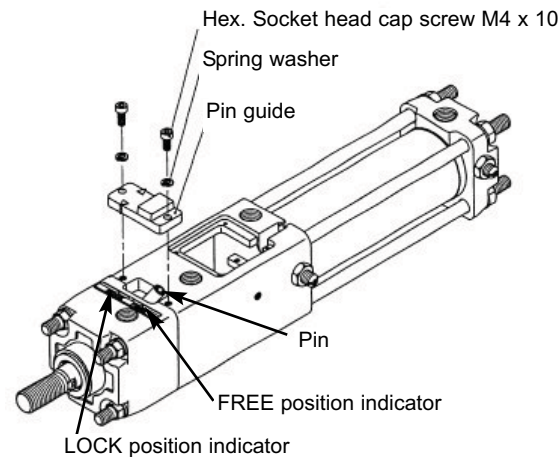


Air pressure is supplied from the brake release port and exhausted from the brake pressure port. The brake is released by pushing the brake piston in the opposite direction.

Brake released



Brake piston is pushed by air pressure from the brake pressure port and the spring. Vertical force generated by the brake piston taper is increased by the brake arm. The brake shoe is pushed onto the rod for braking.



Brake locked

8 Brake mechanism (continued)

Manual lock release procedure

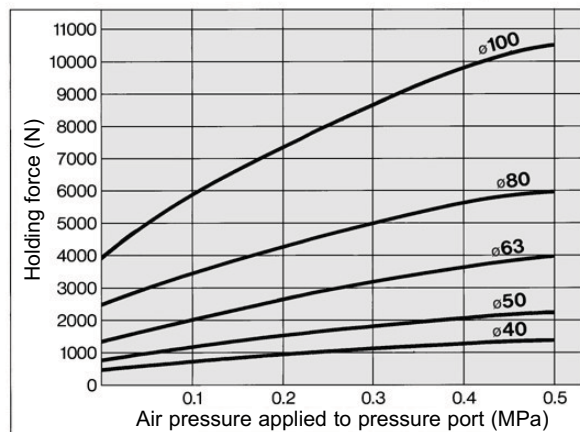
- Loosen two hex. socket head cap screws to remove the pin guide.
- Viewed from the rod end, a pin, which is inclined at 15° from the centre,

becomes visible.

- Supply air pressure of 0.3 MPa or more to the lock release port.
- Turn the pin 30° clockwise. If necessary use a wooden hammer, taking care not to damage the pin.

Procedure from lock released state to locked state.

This procedure shall be followed before operation after adjusting the mount axis.



- Loosen two hex. socket head cap screws to remove the pin guide.
- Viewed from the rod end, a pin, which is inclined at 15° from the centre, becomes visible.

Bore size (mm)	ø 40	ø 50	ø 63	ø 80	ø 100
Holding force (N)	882	1370	2160	3430	5390

- Supply air pressure of 0.3 MPa or more to the lock release port.
- Turn the pin 30° anti-clockwise. If necessary use a wooden hammer, taking care not to damage the pin.
- There is a hollow in the back of the pin guide, which is slightly larger than the pin. Match up the hollow and the pin, and fix the guide to the cover with the hex. socket head cap screws removed in the first step. The

sticking out part of the pin guide lines up with the word "LOCK" on the lock state label affixed to the cover surface.

Bore size (mm)	ø 40	ø 50	ø 63	ø 80	ø 100
Allowable kinetic energy (J)	1.42	2.21	3.53	5.69	8.83

Holding force of locking

- Holding force of locking using both spring and air pressure.

Holding force of spring lock (Max. static load)

Holding force of spring lock when air supply is cut.

Note) Holding force in the direction of piston rod retraction is decreased by approx. 15%.

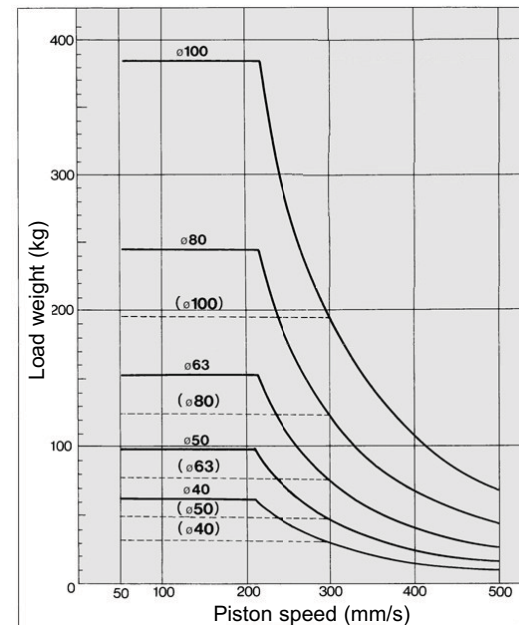
8 Brake mechanism (continued)

- Allowable kinetic energy when locked

- The allowable kinetic energy values in the table above correspond to the values when load ratio of 50% at 0.5 MPa and piston speed of 300 mm/s. No calculation is necessary when the parameters of the operating conditions are lower than these values.
- Use the formula below to calculate the kinetic energy of the load.

Ek: Kinetic energy (J), m: Load weight (kg), v: Piston speed (m/s)
 $Ek = 1/2 mv^2$

- Piston speed exceeds average speed before locking. To calculate the kinetic energy of the load, guideline of the piston speed is 1.2 times faster than average speed.
- The chart below shows the relationship between speed and load weight for each tube bore size. The area below the lines shows the allowable range of kinetic energy.
- During locked state, the lock mechanism absorbs the thrust of the cylinder in addition to the force of the kinetic energy. Therefore, to obtain braking



To maintain brake force, maximum load weight shall be; 70 % or less of maximum static load weight when mounted horizontally 35 % or less of maximum static load weight when mounted vertically 70 % and 35 % correspond to load ratio of 100 and 50% respectively for a theoretical thrust of 0.5 MPa.

force, load scale has an upper limit even when below the allowable kinetic energy line. Load shall be under the solid line for horizontal mounting, and dotted line for vertical mounting.

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