SMC

DOCUMENT No.: CE*-OML0058-A

MONOSASHI-KUN WITH BRAKE(CE2)
OPERATION MANUAL

PRODUCT NAME : MONOSASHI-KUN WITH BRAKE

MODEL : CE2

- Read this operation manual carefully to understand before installation and operation.
- Pay extra attention on the clause concerning the safety.
- Keep this operation manual available whenever necessary.

SMC CORPORATION

Contents

Specifications are subject to change without prior notice

Chapter 1 : Read before Use

These safety instructions are intended to prevent a hazardous situation and/or equipment damage. These instructions indicate the level of potential hazard by label of "Caution", "Warning", or "Danger". To ensure safety, follow the instructions below as well as ISO/IEC, JIS[*1)] and other safety laws[*2)].

⚠ Caution	Operator error could result in injury or equipment damage.
⚠ Warning	Operator error could result in serious injury or loss of life.
⚠ Danger	In extreme conditions, there is a possible result of serious injury or loss of life.

* 1) ISO 4414: Pneumatic fluid power - General rules relating to systems
ISO 10218-1: 2006: Robots for industrial environments - Safety requirements - Part 1: Robot
IEC 60204-1: Safety of machinery - Electrical equipment of machines - Part 1:General requirements
JIS B 8370: General Rules for Pneumatic systems
JIS B 9960-1: Safety of machinery - Electrical equipment of machines - Part 1: General requirements
JIS B 8433-1:2007: Robots for industrial environments - Safety requirements - Part 1: Robot

* 2) Labor Safety and Sanitation Law etc.

⚠Warning

1. 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 are used in various operating conditions, their compatibility for the specific pneumatic system must be based on specifications or after analysis and/or tests to meet your specific requirements. Ensuring the initial performance and safety are the responsibility of the person who decides the compatibility of the pneumatic system. Pneumatic systems should be constructed after full review of the details of the products other than specifications and possibilities of failures by checking the latest product information.
2. Only trained personnel should operate poneumaticallly operated machinery and equipment.
   Assembly, handling, or repair of pneumatic systems should be performed by trained and experienced operators.
3. Do not service machinery/equipment or attempt to remove component until safety is confirmed.
   a. Inspection and maintenance of machinery/equipment should only be performed after confirmation of safe locked-out control positions.
   b. When equipment is to be removed, confirm the safety process as mentioned above. Cut the supply pressure for this equipment and exhaust all residual compressed air in the system.
   c. Before machinery/equipment is re-started, take measure to prevent shooting-out of cylinder piston rod etc.
4. Contact SMC and take necessary safety measures if the products are to be used in any of the following conditions:
   a. Conditions and environments beyond the given specifications, or if products are used outdoors.
   b. Installation on equipment in conjunction with atomic energy, railway, air navigation, vehicles, medical equipment, food and beverages, recreation equipment, emergency stop circuits, press applications, or safety equipment.
   c. An application which has the possibility of having negative effects on people, property, or animals, requiring special safety analysis.
   d. When used in an interlock circuit, dual interlock such as mechanical protection is necessary in case of accident. Periodical inspection is also necessary to confirm proper operation.

Operating and Storage Environments

⚠Warning

1. **Envionments 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 those environments, take necessary measures.
   a. Place where ambient temperature exceeds the range of 0°C to 50°C.
   b. Place where ambient humidity exceeds the range of 35% to 85% RH.
   c. Place where condensation occurs due to sudden temperature change.
   d. Place where atmosphere containing corrosive gas, flammable gas or organic solvent.
   e. Place where atmosphere containing con-ductive powder such as dust and iron chips, oil mist, salt, or organic solvent, or splashing cutting chips, dust and cutting oil (water , liquid) over the products.
   f. Place where the products are exposed to direct sunlight or radiated heat.
   g. Place where strong electromagnetic noise is generated (place where strong electric field, strong magnetic field or surge is generated).
   h. Place where static electricity is discharged or condition that the products have electrostatic discharge.
   i. Place where strong high frequency is gene-rated.
   j. Place where damages of thunder are expected.
   k. Place where vibration or impact is directly given to the products.
   l. Condition that the products are deformed by force or weight applied.
2. **Do not close any objects which are affected by magnets.**
   Since magnets are built in cylinders, do not close magnetic disks, magnetic cards or magnetic tapes. The data may be destroyed.

Precaution on Design

⚠Warning

1. **There is a possibility of dangerous sudden action by cylinders if sliding parts of machi-nery 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 itself may occur.
2. **Provide a cover to minimize the risk of human injury.**
   When a driven object or moving parts of a cylinder may cause the risk of human injury, design a structure to avoid contact with human body.
3. **Securely tighten all stationary parts and connected parts of cylinders so 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.
4. **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 cylinder speed before the cushion becomes effective or use external shock absorbers to reduce impact. At this time, take the rigidity of machinery into account.
5. **Consider possible drop of pressure in circuit due to power outage.**
   For cylinders used in clamping mechanism, a work may become loose due to less clamping force by pressure drop in circuit at the time of power outage. Install safety devices to prevent human injury and machinery damage. Measures should be taken to prevent drop of hanging or lifing equipment.
6. **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.
7. **Design circuit to prevent shooting out of a driven object.**
   A driven object is quickly shot out when pressure is supplied from one side of the piston after air in the cylinder is exhausted in such cases 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 shooting out.

8. **Consider emergency stops.**
Design the machinery so that human injury and/or damage to machinery and equipment will not be caused when machinery is stopped by a safety device under abnormal conditions, a power outage or a manual emergency stop.

9. **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.

10. 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.

11. 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

1. **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.

2. **Intermediate stop**
When cylinder piston is stopped intermediately by 3-position closed center 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 in a long period of time. Consult SMC for long term holding of stop positions.

3. 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.

①For 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.

②When 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

③In 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.

④Although 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

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

Air Supply

⚠Warning

1. **Do not use the product out of the specified ranges for pressure and temperature to pre-vent equipment damage and mal-function.**

①Operating pressure:
Actuating part: 0.1 – 1.0MPa
Braking part: 0.3 – 0.5MPa

②Fluid & ambient temperature: 0 to 60°C

2. **Use clean air.**
Do not use the product with compressed air includes chemicals, synthetic materials (including organic solvents), salinity, corrosive gases, etc., as this may cause damage or malfunction.

⚠Caution

1. **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 drain may cause malfunction of pneumatic components.
2. **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

1. 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 Chapter 6 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 canceling the force generated by the load in the direction of piston movement.
2. 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 drive solenoid valve.

   (Refer to Chapter 6 for recommended pneumatic components.)

   The larger the effective area is, the shorter the locking time will be, and stopping accuracy will be improved.
3. 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.
4. 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.
5. 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

1. Connect the rod end and the load with the lock released.
2. **Ensure that the equipment operates properly before the use.**
3. **Operation manual**
Do not install the products unless the safety instruction have been read and understood.
Keep this operation manual on file for future reference.

⚠Caution

1. **Maintenance space**
When installing the products, allow space for maintenance.
2. **Installation of jigs**
When hardware and nuts are screwed into the piston rod end, the piston rod should be fully retracted.
~~Use double nuts to fix a work since Precision MONOSASHI-KUN (Scale Reading Cylinder) does not have any parallel parts at the rod.~~
3. **Do not give strong impact and/or excessive moment when work is mounted.**
External force other than allowable moment may cause rattle at guide part and/or increase in sliding resistance.
4. **Use the product in such a condition that load is always applied in the axial direction of the piston rod.**
When load is applied in other directions than cylinder axial direction, regulate the load itself by the guide.
Perform a complete centering when cylinder is mounted.
5. Be careful to avoid scratches or dents, etc. on the sliding sections of the piston rod.

Wiring

⚠Warning

1. **Preparation for wiring**
   Shut off the power before wiring (including insertion and removal of connectors). Mount a protective cover on the terminal block after wiring.
2. **Check the power**
   Make sure the power has sufficient capacity and voltages are within the specified range before wiring.
3. **Grounding**
   Ground terminal block F.G. (Frame Ground). Do not ground it with devices generating strong electromagnetic noise.
4. **Check wiring**
   Incorrect wiring may cause damage or malfunction of the products. Make sure the wiring is correct before operation.

⚠Caution

1. **Separation of signal wires from power wire**
   Avoid common or parallel wiring of signal and power wires to prevent malfunction due to noise.
2. **Wiring arrangement and fixation**
   Avoid bending cables sharply at connector part or electrical entry in wiring arrangement.
   Inproper arrangement may cause disconnection which in turn causes malfunction. Fix cables close enough not to give excessive force to the connector.

Piping

⚠Caution

1. **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 a filter.
2. **At piping**
   ①Foreign matter should not enter. Entering of foreign matter will cause malfunction.
   ②Cutting 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 seal tape is used.

Lubrication

⚠Caution

1. **Lubrication of cylinder**
   ①This cylinder is pre-lubricated and can be used without lubrication.
   ②In case of lubrication, use a 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

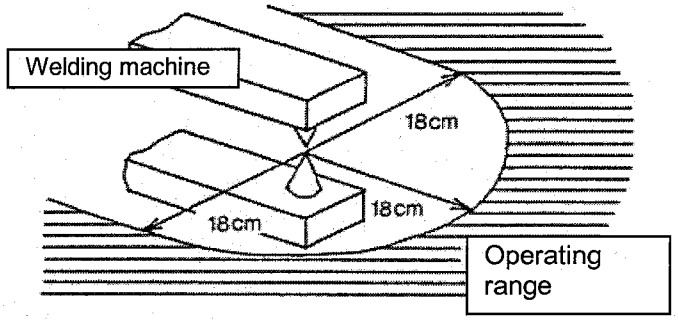
⚠Caution

1. 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.
2. 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.
3. Adjust the mounting position of detection devices such as autoswitches.

Sensor unit

⚠Caution

1. 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.
2. Operate the system with an external magnetic field of 14.5mT 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 18cm in radius 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



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

Maintenance and Check

⚠ Warning

1. **Performing regular check**
   Check regularly that the products do not operate with failures unsolved. Check should be done by trained and experienced operators.
2. **Dismantling of product and supply/exhaust of compressed air.**
   Before dismantling, ensure that drop preventing and runaway preventing treatments are properly provided, shut the power source of air supplied, and exhausts compressed air in the system. When starting operation again, operate the product with care after ensuring that a treatment for preventing extrusion is properly provided.
3. **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.
4. **Disposal**
   Request a special agent for handling industrial waste to dispose the products.

Chapter 2: Product Summary

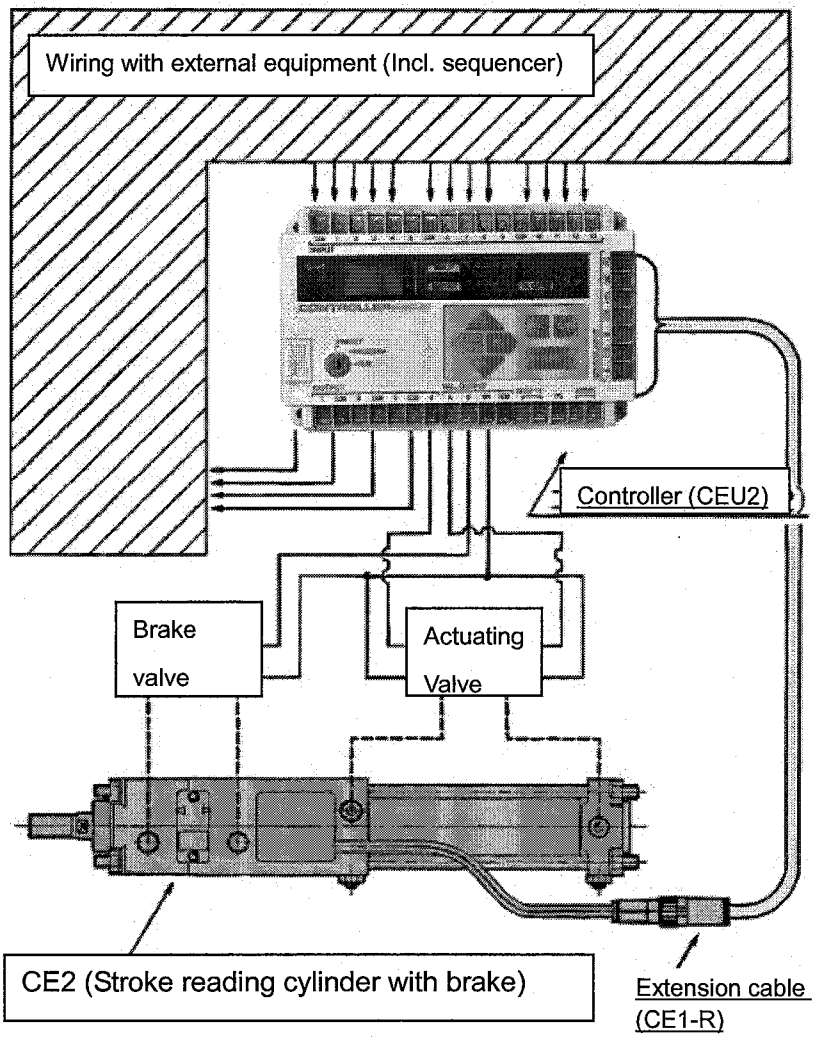
The Stroke Reading Cylinder (CE2 series) is an air cylinder that has a brake (lock) function and scaling function. Multiple positioning is available by using in combination with a specified controller (CEU2 series), and dimension measurement and simple positioning, and safety lock are available by using 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 0.1mm.

2-1 System Configuration

・CE2 + CEU2

The brake valve and the actuation valve are controlled by the specified controller, CEU2, for multiple positioning. ⇒ Refer to operation manual of CEU2 for details.



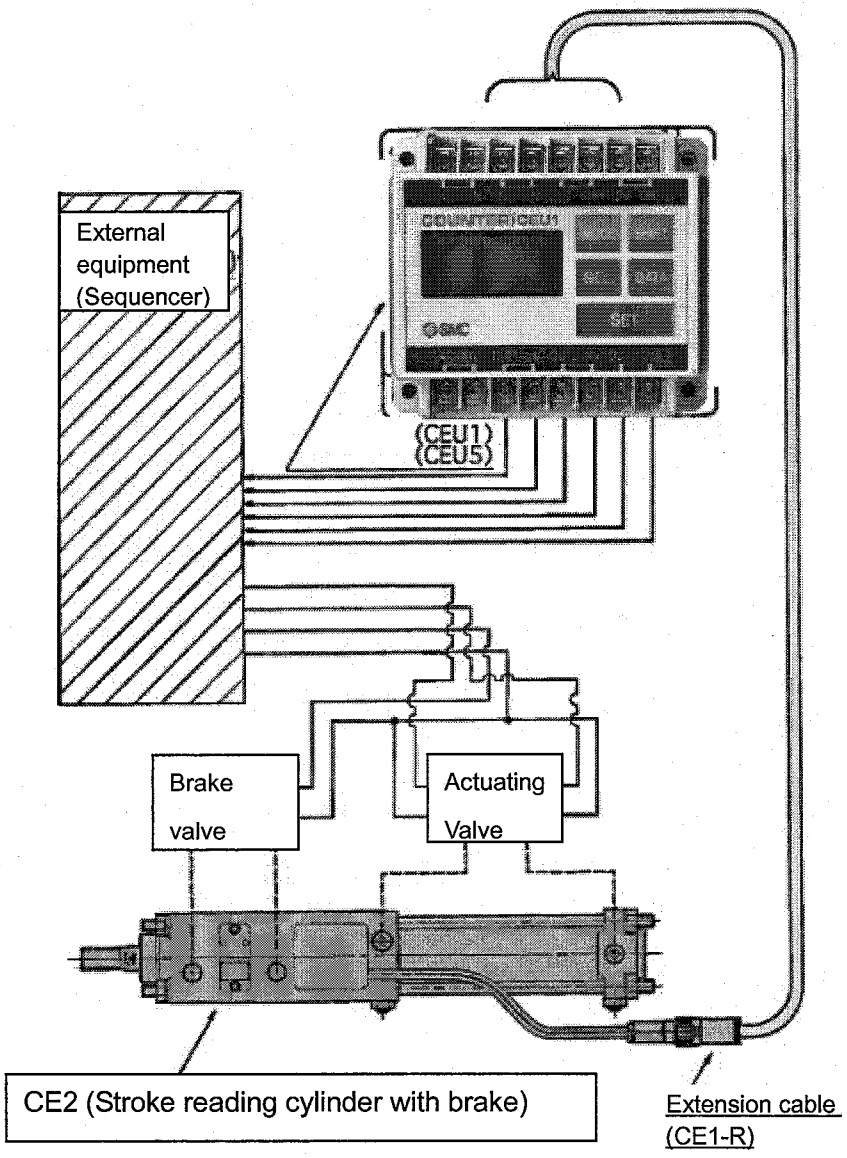
・Prediction control and learning control achieve positioning with high repeatability.

・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 only with actuation valve is available by manual lock release.

2-2 How to Order

2-2-1 Stroke Reading Cylinder with brake

CE2 B 40 – 100 ※ ※ ※– ※ ※

Mounting Type

B	Double end tapped
L	Foot type
F	Front flange type
G	Rear flange type
C	Single clevis type
D	Double clevis type
T	Center trunnion type

Bore size

40	40mm
50	50mm
63	63mm
80	80mm
100	100mm

Stroke (mm)

(See below)

Bellows

Nil	No bellows
J	Nylon tarpaulin
K	Heat resistant tarpaulin

Cushion

Nil	Double side cushion
N	Without cushion
R	Rod cushion
H	Head cushion

Connector

Nil	With connector
Z	No connector

Autoswitch type

(See below)

Autoswitch suffix

Autoswitch suffix (qty.)

Nil	2 pcs.
S	1 pc.
n	n pcs.

Bore size (mm)	Std. 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 (mm)	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

Applicable autoswitch types

Refer to the autoswitch catalog for details.

2-2-2 Options

Controller

CEU2※

Output transistor type

Nil	NPN open collector output
P	PNP open collector output

3-Points Preset Counter

CEU1※−※

Supply voltage

Nil	80 to 120VAC
D	DC24V

Output transistor type

Nil	NPN Open collector
P	PNP Open collector

Multi Counter

CEU5※※−※

Base part number

Supply voltage

Nil	100 to 240VAC
D	DC24V

Output to PC/PLC

Nil	RS-232C
B	RS-232C+BCD

Output transistor type

Nil	NPN Open collector
P	PNP Open collector

Extension Cable

CE1−R※※

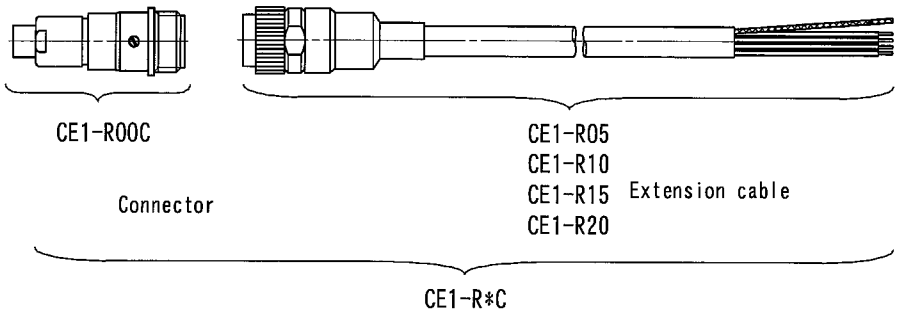
Connector *1)

Nil	Extension cable
C	Extension cable & connector(CE1-R00C)

Cable Length

05	5m
10	10m
15	15m
20	20m

*1) A female connector is attached to one end of the extension cable.
The male connector which is attached if symbol C is selected is the same connector (CE2**-*Z) used for the cable terminal of the stroke reading cylinder with brake (CE2).



Chapter 3: Selection

Flow Chart to Confirm Utility

Beginning

Is the cylinder's kinetic energy Within the allowable range?

NO

YES

Is the speed within the given range in the diagram? And, within specifications?

NO

YES

Does the mounted load exceed the load given in the diagram?

NO

YES

Selection O.K.

Is the any influence of noise?

NO

Is it possible for cable of stroke reading cylinder to be wired separately from the power line?

NO

YES

YES

Are there any magnetic influence?

NO

Can the system be operated below 14.5mT ?

NO

Do not use it since it will result in a miscount.

YES

YES

Is coolant, oil, water, or dust present?

NO

Is it possible to take measures such as protecting the cylinder with a cover?

NO

The system cannot be used because these elements could damage the sensor or promote the deterioration.

YES

YES

Will you do a positioning motion?

NO

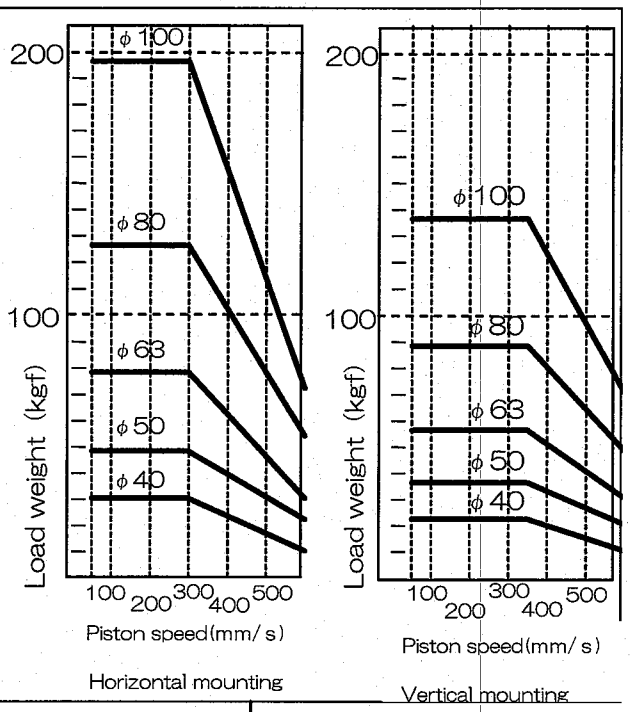
There is no particular problem in using the system. Read the instruction manual thoroughly for this item and counter (CEU1 or CEU5) prior to operation.

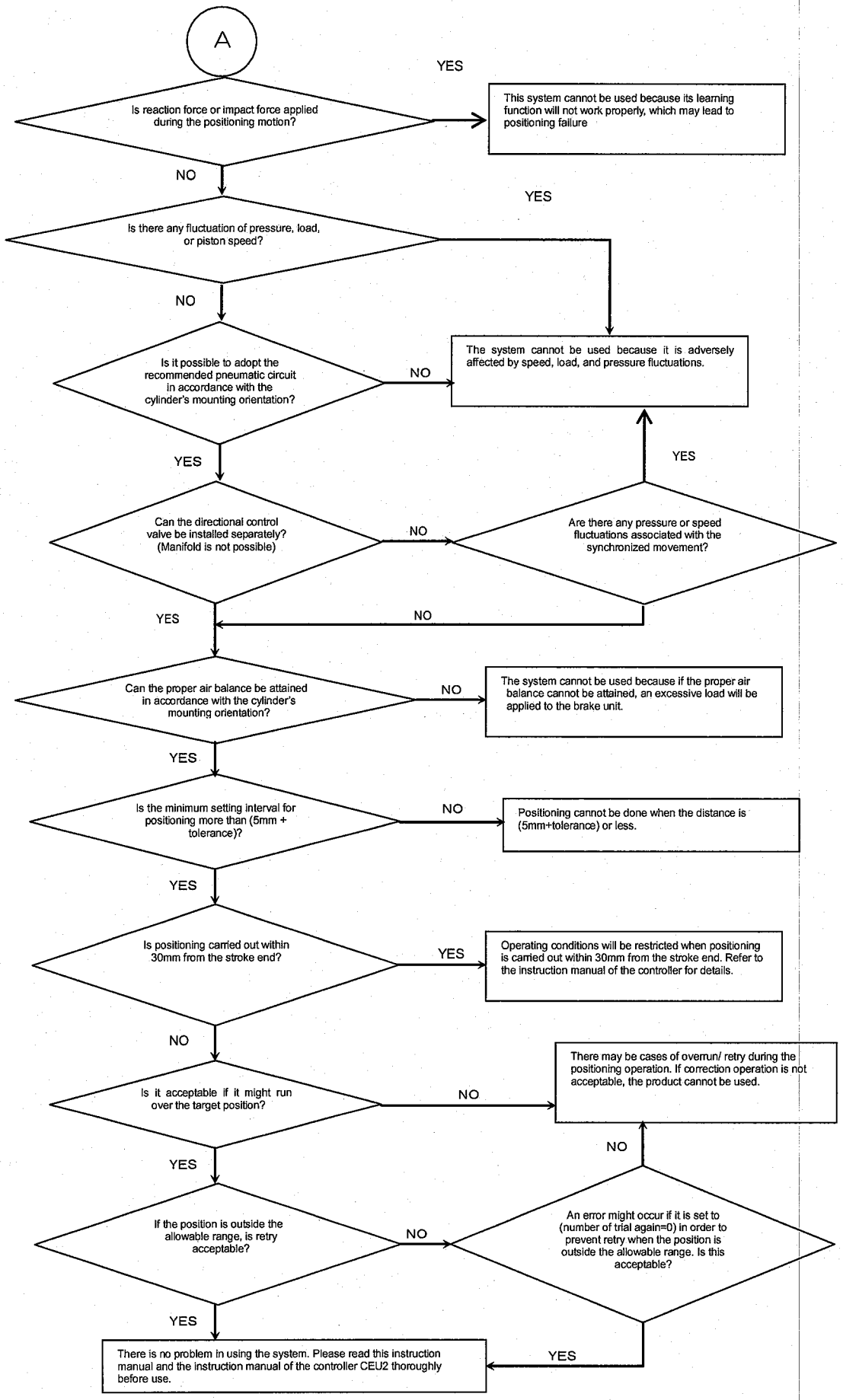
YES

A

Allowable Kinetic Energy Diagram

Refer to the diagram and select again.

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Is reaction force or impact force applied during the positioning motion?
YES
This system cannot be used because its learning function will not work properly, which may lead to positioning failure
NO
Is there any fluctuation of pressure, load, or piston speed?
YES
NO
Is it possible to adopt the recommended pneumatic circuit in accordance with the cylinder's mounting orientation?
NO
The system cannot be used because it is adversely affected by speed, load, and pressure fluctuations.
YES
Can the directional control valve be installed separately? (Manifold is not possible)
NO
Are there any pressure or speed fluctuations associated with the synchronized movement?
YES
YES
NO
Can the proper air balance be attained in accordance with the cylinder's mounting orientation?
NO
The system cannot be used because if the proper air balance cannot be attained, an excessive load will be applied to the brake unit.
YES
Is the minimum setting interval for positioning more than (5mm + tolerance)?
NO
Positioning cannot be done when the distance is (5mm+tolerance) or less.
YES
Is positioning carried out within 30mm from the stroke end?
YES
Operating conditions will be restricted when positioning is carried out within 30mm from the stroke end. Refer to the instruction manual of the controller for details.
NO
Is it acceptable if it might run over the target position?
NO
There may be cases of overrun/ retry during the positioning operation. If correction operation is not acceptable, the product cannot be used.
YES
If the position is outside the allowable range, is retry acceptable?
NO
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?
NO
YES
There is no problem in using the system. Please read this instruction manual and the instruction manual of the controller CEU2 thoroughly before use.
YES

Chapter 4: Product Specifications

4-1 Cylinder specifications

Bore size	φ40	φ50	φ63	φ80	φ100
Operating fluid	Air (Non-lube)				
Proof pressure	1.5MPa				
Max. operating pressure	Actuation pressure : 1MPa Brake pressure 0.5MPa				
Min. operating pressure	Actuation pressure : 0.1MPa Brake pressure 0.3MPa				
Operating piston speed	50 to 500 mm/s Note 1)				
Ambient temp.	0 to 60°C (No freezing)				
Brake method	Spring and pneumatic lock type				
Sensor cord length	Φ7 to 500mm Oil-resistant				
Thread tolerance	6H				
Stroke length tolerance	～250mm : $^{+1.0}_{0}$、 251～1000mm : $^{+1.4}_{0}$				

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

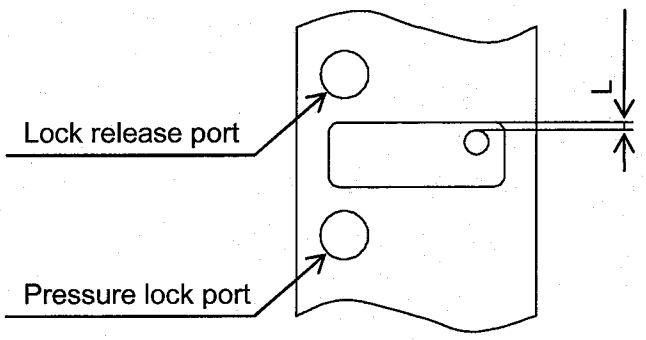
4-2 Sensor Specifications

Cable	φ7.6 core twisted pair shield wire (Oil, heat & flame resistant cable)
Maximum transmission distance	20.5m (when using SMC cable and controller or counter)
Position detection method	Magnetic scale rod / Sensor head <Incremental type>
Magnetic field resistance	14.5mT
Power supply	DC10.8V to 26.4V (Power supply ripple : 1% or less)
Current consumption	35mA (Max.)
Resolution	0.1mm/pulse
Accuracy	±0.2mm Note 1)
Output type	Open collector (Max.DC30V, 50mA)
Output signal	A/B phase difference output
Insulation resistance	DC500V, 50MΩ or more (between case and 12E)
Vibration resistance	33.3Hz 6.8G 2hrs. each in X and Y directions 4hrs in Z direction based upon JIS D1601
Impact resistance	30G 3 times each in X,Y and Z directions
Enclosure	IP65 (IEC Standard) Except connector
Extension cable (Option)	5m, 10m, 15m, 20m

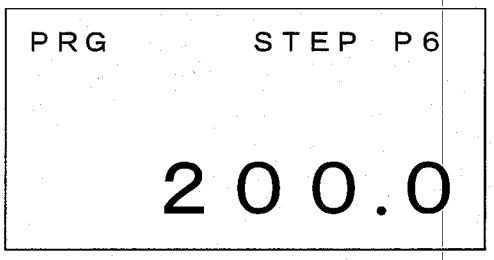
Note 1) This includes the digital display error of the controller (CEU2) or counter (CEU1, CEU5).
The overall accuracy after mounting on equipment will vary depending on the mounting conditions and environment. Therefore, the customer should calibrate the system as a whole.

4-3 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=1mm 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).



Drawing 1



Drawing 2

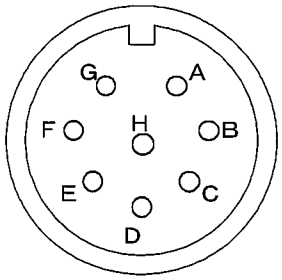
Operating conditions for 2,000,000 times

Cylinder speed	300mm/sec	
Mounting load	Horizontal: 50% or less	
	Vertical: 35% or less	(Shall be within allowable kinetic energy)

Chapter 5: Wiring

5-1 Connector Wiring Table

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



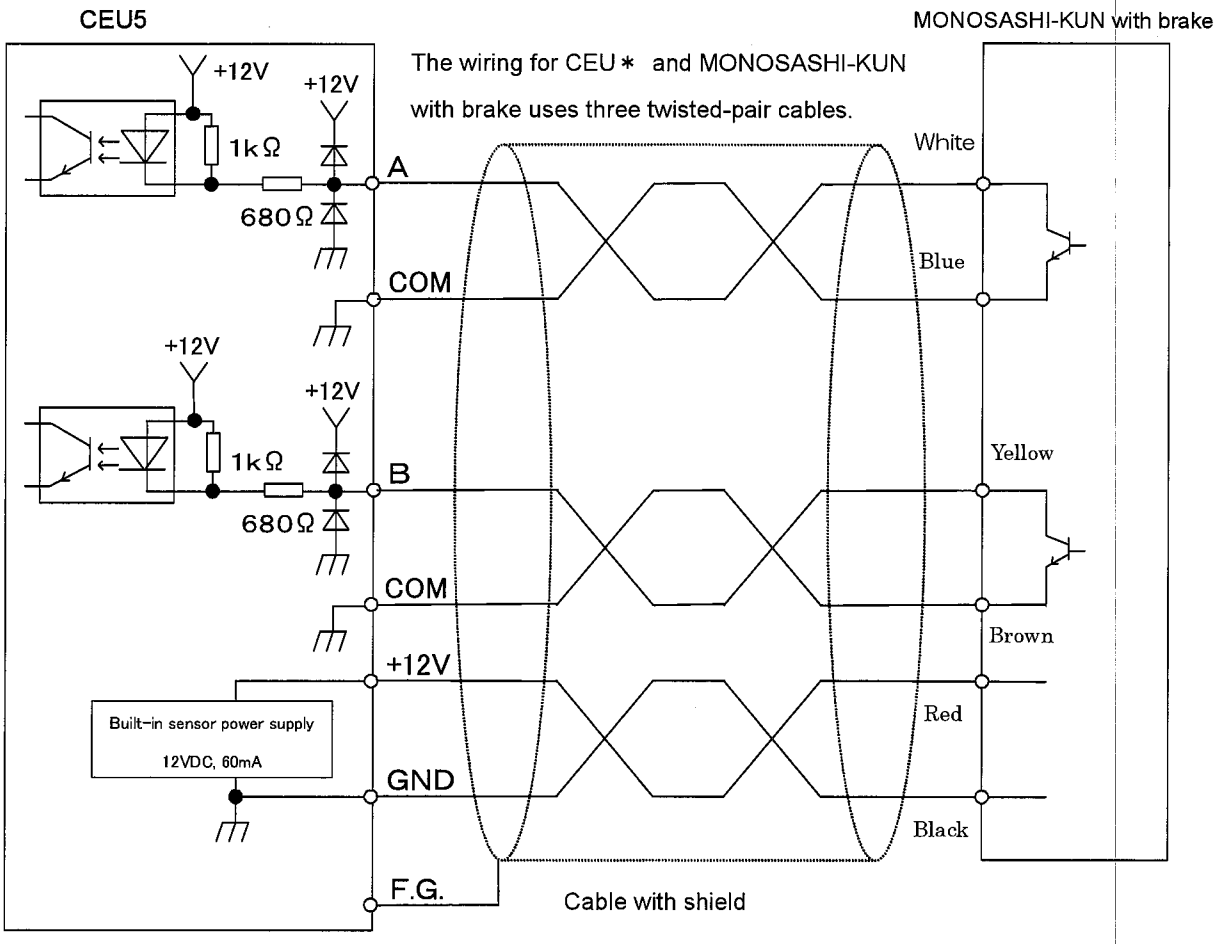
Connector Pin Layout

Combinations of contact mark and core color

Contact Mark	Core Color	Signal
A	White	A-phase
B	Yellow	B-phase
C	Brown	COM(0V)
D	Blue	COM(0V)
E	Red	12 to 24VDC
F	Black	0V
G	Shield	Shield
H	—	Unused

5-2 Wiring for Counter

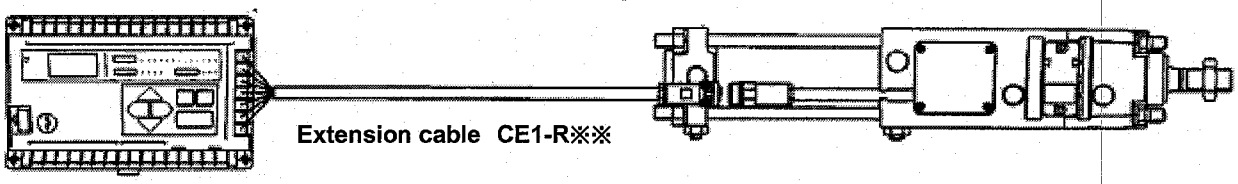
CEU1 Sensor input
CEU2
CEU5

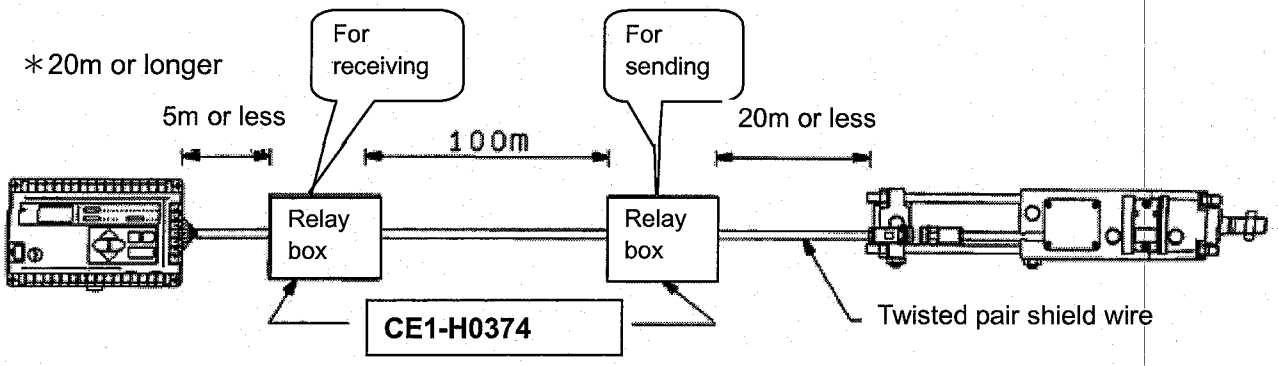


5-3 Connection of extension cable

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

＊Connection example





Relay box for sending: Sending box CE1-H0374-1

Relay box for receiving: Receiving box CE1-H0374-2

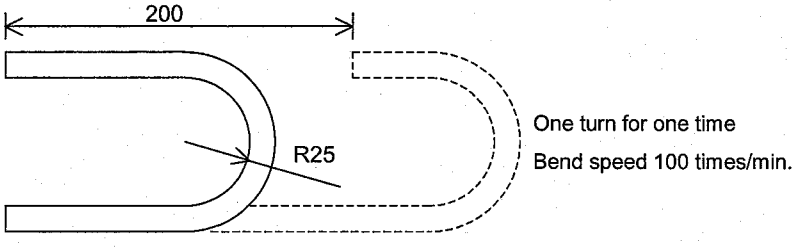
The part no CE1-H0374 is for a pair of relay boxes for sending and receiving.

(CE1-H0374 consists of CE1-H0374-1 and CE1-H0374-2.)

⚠ **Caution Operation capability is confirmed at max. transfer distance 20.5m. Do not use wiring longer than this. (If this distance is exceeded, 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 25mm 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



5-4 Noise countermeasures

Follow the instructions below to prevent malfunction due to noise.

（1） Use SMC extension cable CE1-R** for CEU1, CEU2, CEU5. Ground the shield wire properly.

（2） Keep signal wires away from the power cables in wiring.

（3） Mount a ferrite core to signal cables for possible radiated noise effects of cable.

（4） Use stable power source for CEP1 power supply.

（5） Mount a noise filter for possible noise effects of power source.

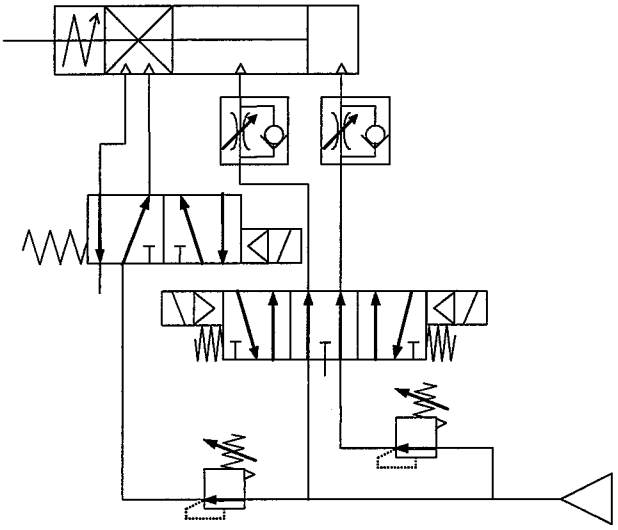
（6） Please read the operation manual of CEU1, CEU2, or CEU5 depending on the counter or controller to be connected.

（7） Combination of this product and CEU1(P)-D complies with the EMC directive (2004/108/EC).

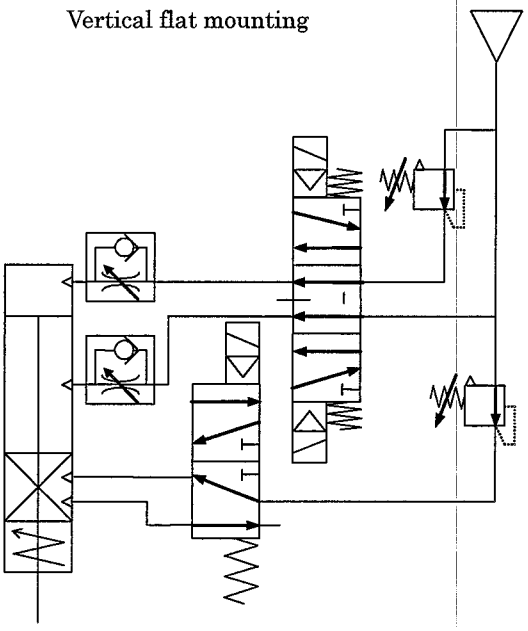
Chapter 6: Piping

6-1 Example of Recommended Pneumatic

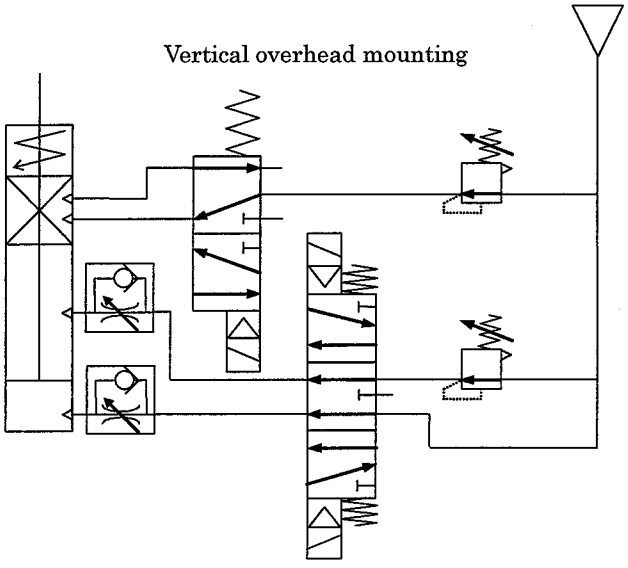
Horizontal mounting



Vertical flat mounting



Vertical overhead mounting



Recommended pneumatic components

Bore	Directional valve	Brake valve	Regulator	Piping	Silencer	Speed controller
φ40	VFS24□0R	VFS21□0	AR425	Nylon φ8/6	AN200-02	AS4000-02
φ50	VFS24□0R	VFS21□0	AR425	Nylon φ10/7.5	AN200-02	AS4000-02
φ63	VFS34□0R	VFS21□0	AR425	Nylon φ12/9	AN300-03	AS4000-03
φ80	VFS44□0R	VFS31□0	AR425	Nylon φ12/9	AN300-03	AS420-03
φ100	VFS44□0R	VFS31□0	AR425	Nylon φ12/9	AN400-04	AS420-04

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

Please install the silencer responding to it necessary.

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

6-2 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 rod. It is possible that the tie rod for fixing may become loose during replacement of the support bracket. When replacing the support bracket or retightening the tie rod for fixing the unit, use a socket wrench.

6-3 Air Balance

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

How to adjust

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

(2) 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 operation manual of controller (CEU2)

(3) 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.

(4) 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 operation manual of controller (CEU2).**

⚠ **Caution For cushion type, do not constrict the cushion too much.**

If using a mechanical stopper, use shock absorbers to avoid impact and rebound.

Chapter 7: Structure and Measuring Principle

7-1 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 pulse signal. The signal is measured by the counter and the controller.

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 method 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.)

⚠ **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 strongly.**

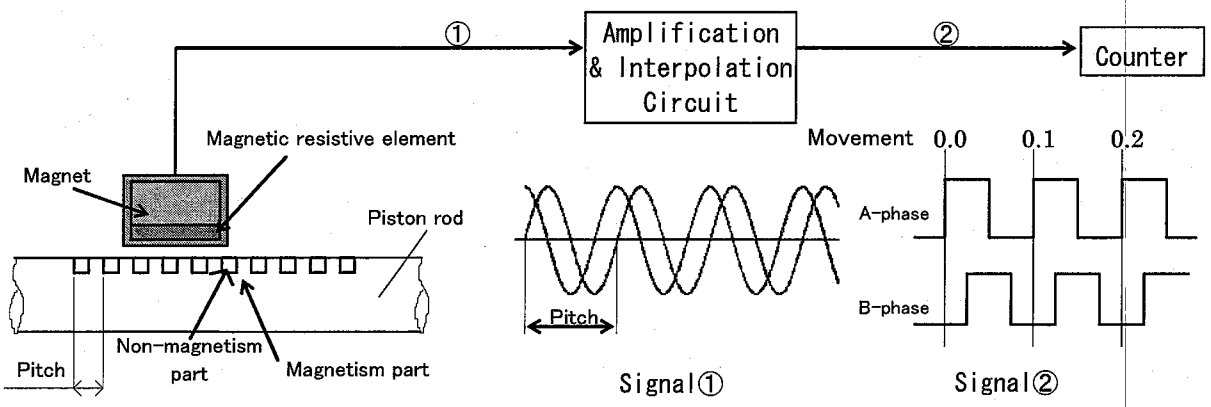
  Such action may cause detection failure and other failures.

- **External magnetic field should be 14.5mT 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 filed, take some measures for shield by covering the sensor part with magnetic material.

7-2 Measuring Principle



① The piston rod has a scale consisting of magnetic layer and non-magnetic layer with regular pitch.

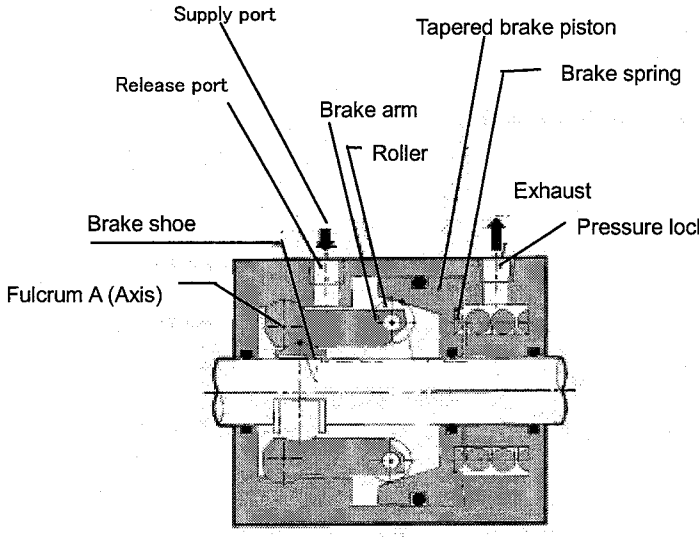
② Along the travel of the piston rod, the detection head (magneto-resistive element built-in) of the sensor unit (encoder) detects this scale, then pulse signal of phase A/B is output.

③ By inputting this pulse signal to a counter (CEU1, CEU5, etc.), it is possible to measure with a resolution of 0.1mm.

Chapter 8 Brake mechanism

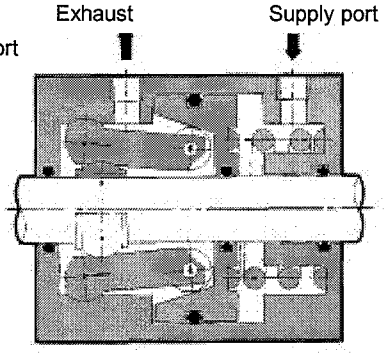
8-1 Operation Principle

Brake released



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

Brake locked



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

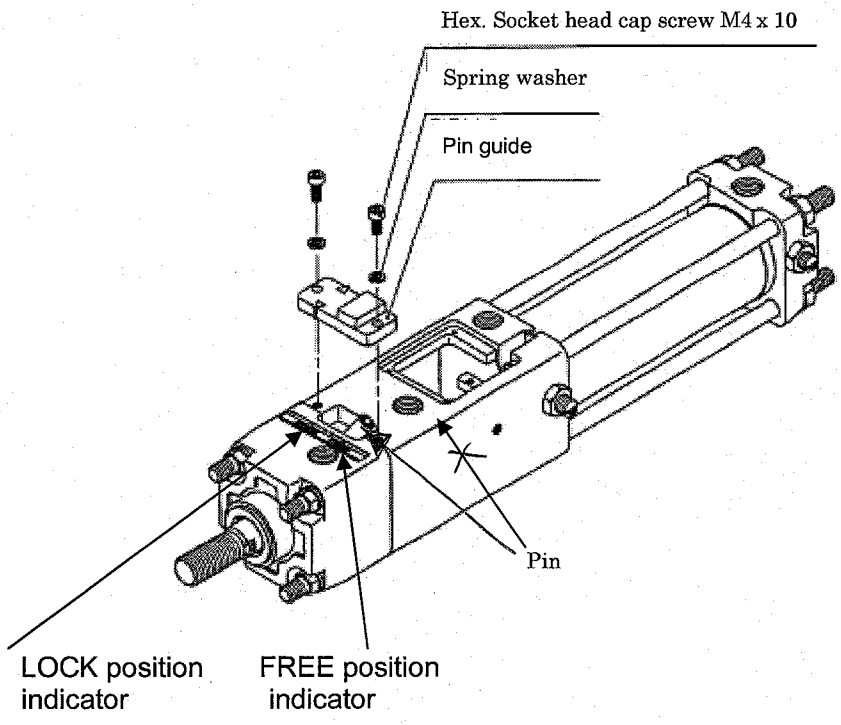
8-2 Manual lock release procedure

(1) Loosen two hex. socket head cap screws to remove the pin guide.

(2) Viewed from the rod end, a pin which is inclined by 15 degrees from the center becomes visible.

(3) Supply air pressure of 0.3MPa or more to the lock release port.

(4) Turn the pin 30 degrees clockwise so that it is not damaged by the wooden hammer.



8-3 Procedure from lock released state to locked state.

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

(1) Loosen two hex. socket head cap screws to remove the pin guide.

(2) Viewed from the rod end, a pin which is inclined by 15 degrees from the center becomes visible.

(3) Supply air pressure of 0.3MPa or more to the lock release port.

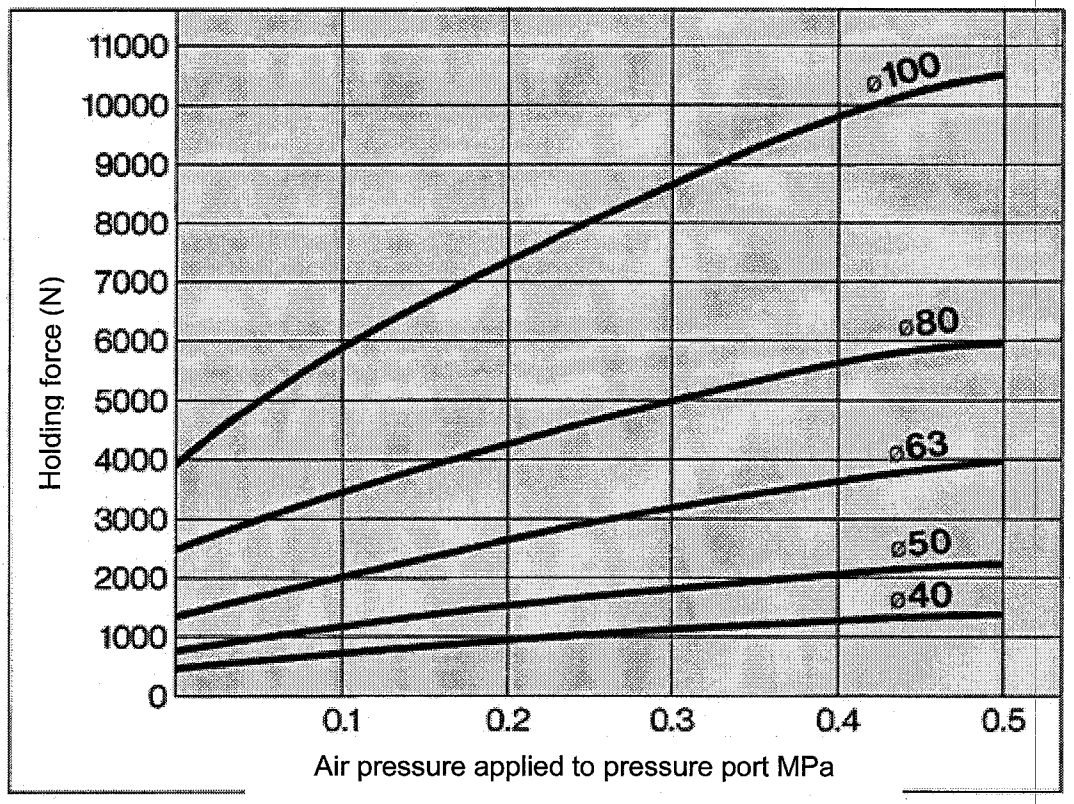
(4) Turn the pin 30 degrees clockwise so that it is not damaged by the wooden hammer.

(5) 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 to the cover with the hex. socket head cap screws removed in step (1). The sticking out part of the pin guide lines up with the word "LOCK" on the lock state label affixed to the cover surface.

⚠ **Caution** **Do not hit or rotate the pin. This may twist or damage the pin.**

8-4 Holding force of locking

(1) Holding force of lock using both spring and air pressure.



(2) Holding force of spring lock (Max. static load)

(Holding force of spring locking when air supply is cut)

Bore size (mm)	Φ40	Φ50	Φ63	Φ80	Φ100
Holding force (N)	882	1370	2160	3430	5390

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

8-5 Allowable kinetic energy when locked

Bore size (mm)	Φ40	Φ50	Φ63	Φ80	Φ100
Allowable kinetic energy (J)	1.42	2.21	3.53	5.69	8.83

(1) The allowable kinetic energy values in the table above correspond to the values when load ratio of 50% at 0.5Mpa and piston speed of 300mm/s. No calculation is necessary when the parameters of the operating conditions are lower than these values.

(2) 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)

$Ek = 1/2\ mv^2$

(3) 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.

(4) 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.

(5) During locked state, the lock mechanism absorbs the thrust of the cylinder in addition to the load kinetic energy. Therefore, to obtain braking 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.