



ORIGINAL INSTRUCTIONS

Instruction Manual

Stroke Reading Cylinder with Brake

CE2**-* series



The intended use of this product is to convert an electrical signal into mechanical motion and provide position feedback signal using a sensor.

1 Safety Instructions

These safety instructions are intended to prevent hazardous situations and/or equipment damage. These instructions indicate the level of potential hazard with the labels of "Caution," "Warning" or "Danger." They are all important notes for safety and must be followed in addition to International Standards (ISO/IEC)^{*)}, and other safety regulations.

^{*)} ISO 4414: Pneumatic fluid power - General rules relating to systems.

ISO 4413: Hydraulic fluid power - General rules relating to systems.
IEC 60204-1: Safety of machinery - Electrical equipment of machines. (Part 1: General requirements)

ISO 10218-1: Robots and robotic devices - Safety requirements for industrial robots - Part 1: Robots.

- Refer to product catalogue, Operation Manual and Handling Precautions for SMC Products for additional information.
- Keep this manual in a safe place for future reference.

	Caution	Caution indicates a hazard with a low level of risk which, if not avoided, could result in minor or moderate injury.
	Warning	Warning indicates a hazard with a medium level of risk which, if not avoided, could result in death or serious injury.
	Danger	Danger indicates a hazard with a high level of risk which, if not avoided, will result in death or serious injury.

Warning

- Always ensure compliance with relevant safety laws and standards.**
- All work must be carried out in a safe manner by a qualified person in compliance with applicable national regulations.
- The compatibility of pneumatic equipment is the responsibility of the person who designs the pneumatic system or decides its specifications.
- Do not service machinery / equipment or attempt to remove components until safety is confirmed.
- Do not use the product outside of the specifications.
- Refer to the operation manual or catalogue on the SMC website (URL: <https://www.smcworld.com>) for further Safety Instructions.
- Special products (-X) might have specifications different from those shown in the specifications section. Contact SMC for specific drawings.

2 Specifications

- The Stroke Reading Cylinder is a cylinder with a built-in linear encoder and a brake function (using both spring and air pressure).
- The scale of the magnetic rod and magnetic sensor detects changes in piston position, and a pulse signal is output using an A/B quadrature pulse (90° nominal phase relationship).
- Position detection to 0.1 mm resolution is possible by inputting this signal to a CEU5 Multi Counter.
- Multiple positioning is available by using in combination with a specific controller (CEU2 series),

2.1 Cylinder specifications

Bore size	Ø40	Ø50	Ø63	Ø80	Ø100
Fluid	Air (non-lube)				
Proof pressure	Drive pressure: 1.5 MPa Brake pressure: 0.75 MPa				
Max. operating pressure	Drive pressure: 1.0 MPa Brake pressure: 0.5 MPa				
Min. operating pressure	Drive pressure: 0.1 MPa Brake pressure: 0.3 MPa				
Operating piston speed	50 to 500 mm/s				
Ambient & fluid temperature	0 to 60° (no freezing)				
Humidity	25 to 85% RH (no condensation)				
Brake method	Spring and Pneumatic lock type				
Stroke length tolerance	Up to 250 mm: +1.0 / -0 251 to 1000 mm: +1.4 / -0				
Sensor cable length	500 mm				
Thread tolerance	Class 6H				

2.2 Sensor specifications

Item	Specification
Cable	Ø7, 6-core twisted pair shielding wire (Heat resistance, oil resistance, flameproof)
Max. cable length	20.5 m ^{*)}
Position detection method	Incremental encoder (rod with magnetic scale, magnetic sensor)
Magnetic field resistance	14.5 mT
Power supply	10.8 to 26.4 VDC ±10%, ripple: 1% or less
Current consumption	50 mA max.
Resolution	0.1 mm / pulse
Accuracy	±0.2 mm (at 20°C) ^{*)}
Output type	Open collector (30 VDC, 50 mA max.)
Output signal	A/B phase difference output
Insulation resistance	500 VDC, 50 MΩ or more (case: between 12E)
Vibration proof	33.3 Hz, 66.7 m/s ² , 2 hours each in X and Y directions, 4 hours in Z direction, to JIS D1601
Impact resistance	30 G, 3 times each in X, Y and Z directions
Enclosure	IP65 (IEC60529) except connector
Extension cables option	5 m / 10 m / 15 m / 20 m

^{*)}1) When using the SMC cable with CEU# controller or counter.

^{*)}2) This accuracy 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.
When accuracy of the whole system is required, calibration should be performed by the end user.

3 Installation

3.1 Installation

Warning

- Do not install the product unless the safety instructions have been read and understood.
- Do not apply torque to the piston rod. Applying torque to the piston rod may cause damage and malfunction.
When hardware and nuts are screwed on to the piston rod end, the piston rod should be fully retracted.
Use double nuts to fix the work since the Scale Reading Cylinder does not have any parallel parts at the rod.
- Ensure that the equipment operates properly before use.
- When installing the product, always allow space for maintenance.
- Do not apply strong impact and / or excessive moment when work is mounted. External force other than the allowable moment may cause rattle at the guide part and / or increase in sliding resistance.
- Use the product in such a condition that load is always applied in the axial direction to the piston rod. When load is applied in other directions, regulate the load itself using a guide.
Perform a complete centering when the cylinder is mounted.
- Avoid using the product where the piston rod is subjected to a constant torque or where excessive impact is applied to the piston rod.
- Avoid scratches or dents on the sliding part of the piston rod.

3.2 Environment

Warning

- Do not use in an environment where corrosive gases, chemicals, salt water or steam are present.
- Do not use in an explosive atmosphere.
- Do not expose to direct sunlight. Use a suitable protective cover.
- Do not install in a location subject to vibration or impact in excess of the product specifications.
- Do not mount in a location exposed to radiant heat that would result in temperatures in excess of the product's specifications.
- Do not use in a place where condensation occurs due to sudden temperature change.

- Do not use in an atmosphere containing conductive powder such as dust and iron chips, oil mist, salt, or organic solvent, or splashed by cutting chips, dust and cutting oil (water, liquid).
- Do not use in a place where strong electromagnetic noise is generated, strong magnetic field or surge is generated.
- Do not use in a place where static electricity is discharged or in a condition where the product are exposed to electrostatic discharge.
- Do not use in a condition where the product is deformed by force or weight applied.
- Do not use the cylinder close to any objects which are affected by magnets, since magnets are used inside the cylinder.

3.3 Piping

Caution

- Before connecting piping make sure to clean up chips, cutting oil, dust etc.
- When installing piping or fittings, ensure sealant material does not enter inside the port. When using seal tape, leave 1.5 to 2 threads exposed on the end of the pipe/fitting.
- Tighten fittings to the specified tightening torque.
- Do not use the product outside of the specified ranges for pressure and temperature to prevent equipment damage and malfunction.
- Ensure that the air supply system is filtered to 5 microns.

3.4 Recommended Pneumatic Circuit

- Be sure to use a pneumatic circuit which will apply balanced pressure to both sides of the piston when in a locked stop position.
- Refer to the operation manual on the SMC website (URL: <https://www.smcworld.com>) for the recommended pneumatic circuit to be used for the actuation and brake operation.

3 Installation (continued)

3.5 Lubrication

Caution

- SMC products have been lubricated for life at manufacture, and do not require lubrication in service.
- If a lubricant is used in the system, use the equivalent of turbine oil type 1 ISO VG32. Once lubrication is performed, it should be continued since the initial lubricant will flow out causing malfunction.

3.6 Adjustment

- 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 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.

3.7 Sensor unit

Caution

- Do not remove the sensor.**
The position and sensitivity of the sensor is adjusted correctly. Removing or replacing the sensor may cause malfunction.
- Do not pull the sensor cable with excessive force.
Such action may cause detection failure.
- External magnetic field should be 145 mT or less.
A strong magnetic field in the close vicinity may cause malfunction since the sensor is a magnetic type sensor.
For example, this is equivalent to a magnetic field in a radius of approximately 18 cm from a welding gun using a welding current of about 15000 amperes. When the product is used near strong magnetic fields, take counter measures such as shielding the sensor part with a cover made from a magnetic material.

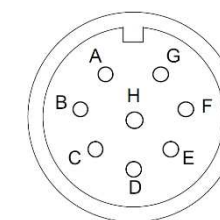
4 Wiring

4.1 Preparation for wiring

- Turn OFF the power before wiring (including the insertion and removal of connectors).
- Mount a protective cover over the terminal block after wiring.
- Make sure the power supply has sufficient capacity and voltages are within the specified range before wiring.
- Check the wiring. Incorrect wiring may cause damage or malfunction.

4.2 Connector Details

- The table below shows the connector pin layout and wire colours of the CE2 cylinder with connector.

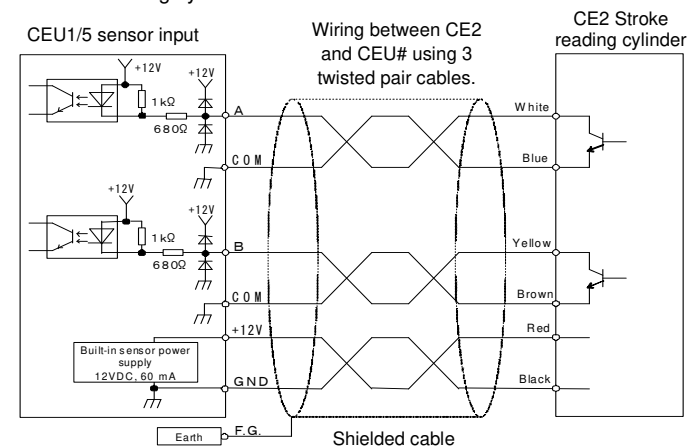


Pin No.	Wire colour	Signal
A	White	A-phase
B	Yellow	B-phase
C	Brown	COM (0V)
D	Blue	COM (0V)
E	Red	12 to 24 VDC
F	Black	0 V
G	Shield	Shield
H	-	Not used

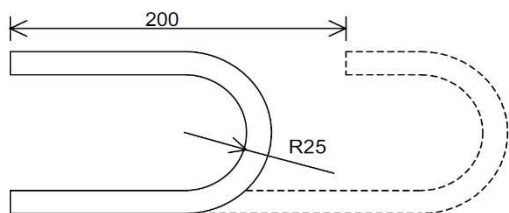
4 Wiring (continued)

4.3 Wiring of Counter / Controller

- Use SMC extension cable (Part No. CE1-R**) for wiring between the stroke reading cylinder and the CEU1 or CEU5.



- If the length of cable between the CE2 and CEU1/CEU5 is 20 m or longer, use the specified relay box (SMC Part No. CE1-H0374).
- 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).
- 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 (based on one turn for one time, bend speed 100 times/minute).



Caution

Follow the instructions below to prevent malfunction due to noise:

- Use SMC extension cable CE1-R** for CEU1/CEU5. Ground the shield wire properly.
- Keep signal wires away from power cables.
- Mount a ferrite core to signal cables to avoid radiated noise effects.
- Use a stable power source for the CE2 power supply.
- Mount a noise filter for possible noise effects of power source.
- Refer to the operation manual for the CEU1/CEU5 Controller or Counter on the SMC website (URL: <https://www.smcworld.com>).
- Separation of signal wires from power wires.
- Avoid common or parallel wiring of signal and power wires to prevent malfunction due to noise.
- Wiring arrangement and fixing
Avoid bending cables sharply near the connector or electrical entry in the wiring arrangement.
Improper arrangement may cause disconnection which in turn may cause malfunction. Fix cables close enough not to avoid excessive force to the connector.

4.4 Ground Connection

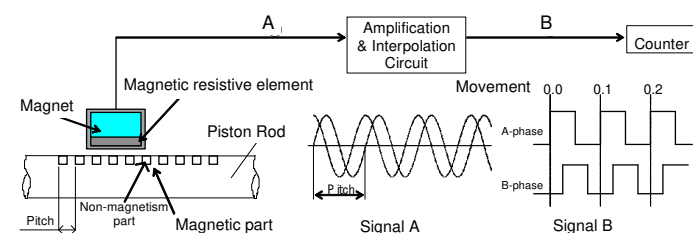
- Connect the product to ground using the Ground terminal block F.G.
- Individual grounding should be provided close to the product. Resistance to ground should be 100 ohms or less.

5 Operation Principle

- The piston rod has a magnetic scale on its circumference.
- The detection head of the sensor unit (encoder) is positioned facing the scale. Along the piston rod travel, the sensor detects its magnetic signal. The sensor converts the signal to a pulse output signal. The output signal is measured by the counter or 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.

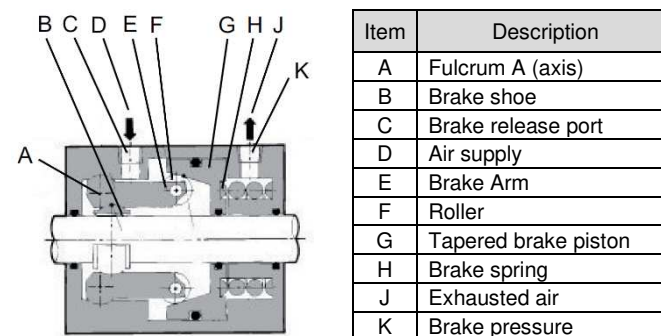
The scale cylinder is an air cylinder which has a function to output the piston stroke movement in the form of a pulse signal in 0.1 mm resolution.

Measuring Principle is as follows:

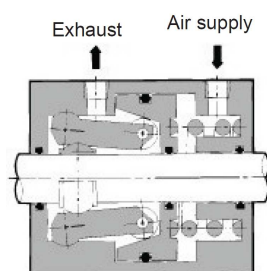


- The piston rod has a scale consisting of a magnetic layer and a non-magnetic layer with regular pitch.
- Along the travel of the piston rod, the detection head (magneto-resistive element) of the sensor unit (encoder) detects this scale, then a pulse signal of phase A/B is output.
- By inputting this pulse signal to a counter (CEU1, CEU5, etc.) it is possible to measure with a resolution of 0.1mm.

5.1 Brake mechanism



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

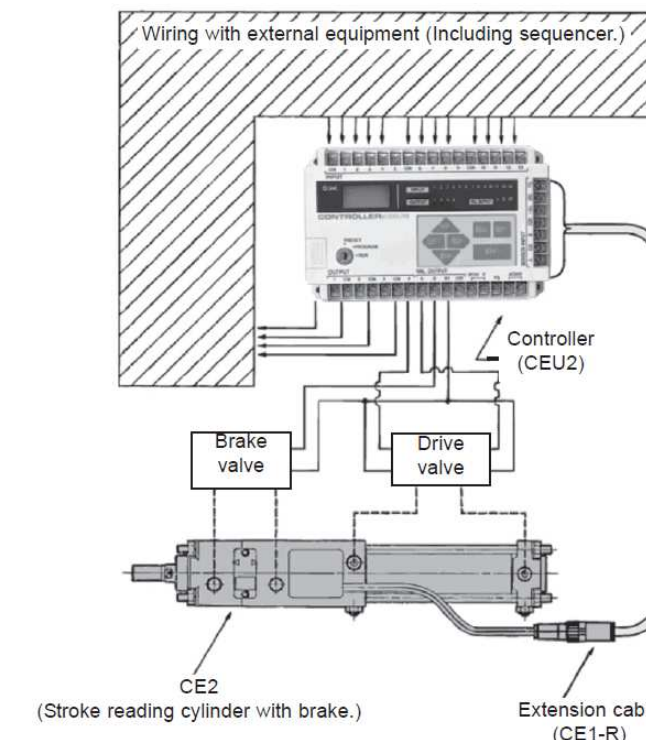


- The brake piston is pushed by air pressure from the brake pressure port and spring. Vertical force generated by the brake piston taper is increased by the brake arm. The brake shoe is pushed on to the rod for braking.
- Refer to the operation manual on the SMC website (URL: <https://www.smcworld.com>) for further details.

6 Product summary

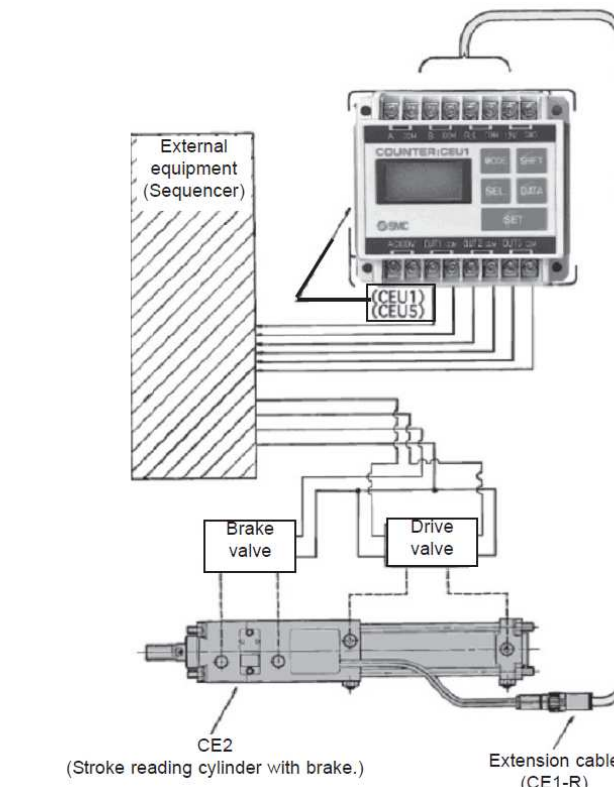
6.1 System Configuration – CE2 with CEU2 controller

- The brake valve and actuation valve are controlled by the specified controller, CEU2, for multiple positioning.
- Refer to the operation manual on the SMC website (URL: <https://www.smcworld.com>) for CEU2 details.



6.2 System Configuration – CE2 with CEU1 (or CEU5) counter

- Suitable for simple positioning systems, and systems which require safety during measurement.
- Refer to the operation manual on the SMC website (URL: <https://www.smcworld.com>) for the CEU1 (Preset counter) and CEU5 (Multi-counter) for details.



7 How to Order

Refer to the catalogue or operation manual on the SMC website (URL: <https://www.smcworld.com>) for the "How to Order" information.

8 Outline Dimensions

Refer to the catalogue or operation manual on the SMC website (URL: <https://www.smcworld.com>) for Outline dimensions.

9 Maintenance

9.1 General maintenance

Caution

- Not following proper maintenance procedures could cause the product to malfunction and lead to equipment damage.
- If handled improperly, compressed air can be dangerous.
- Maintenance of pneumatic systems should be performed only by qualified personnel.
- Before performing maintenance, turn off the power supply and be sure to cut off the supply pressure. Confirm that the air is released to atmosphere.
- After installation and maintenance, apply operating pressure and power to the equipment and perform appropriate functional and leakage tests to make sure the equipment is installed correctly.
- If any electrical connections are disturbed during maintenance, ensure they are reconnected correctly and safety checks are carried out as required to ensure continued compliance with applicable national regulations.
- Do not make any modification to the product.
- Do not disassemble the product, unless required by installation or maintenance instructions.
- Performing regular maintenance check**
Check regularly that the product does not operate with failures unsolved. Checks should be carried out by trained and experienced operators.

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 must be removed, turn OFF the power before removal.

10 Limitations of Use

10.1 Limited warranty and disclaimer/compliance requirements

Refer to Handling Precautions for SMC Products.

11 Product Disposal

This product shall not be disposed of as municipal waste. Check your local regulations and guidelines to dispose of this product correctly, in order to reduce the impact on human health and the environment.

12 Contacts

Refer to www.smcworld.com or www.smc.eu for your local distributor / importer.

SMC Corporation

URL : <https://www.smcworld.com> (Global) <https://www.smc.eu> (Europe)
SMC Corporation, 4-14-1, Sotokanda, Chiyoda-ku, Tokyo 101-0021, Japan
Specifications are subject to change without prior notice from the manufacturer.
© 2021 SMC Corporation All Rights Reserved.
Template DKP50047-F-085M