



# Stroke Reading Cylinder and Counter

## Series CE

### CEP1/CEU5

Resolution: 0.01 mm (Accuracy  $\pm 0.02$  mm)

Output function: RS-232C BCD

Output: 5 points (Bank switching: 20 points)  
31 points (Binary output)

23045



- RE<sup>A</sup><sub>B</sub>
- REC
- C□X
- C□Y
- MQ<sup>Q</sup><sub>M</sub>
- RHC
- MK(2)
- RS<sup>Q</sup><sub>G</sub>
- RS<sup>H</sup><sub>A</sub>
- RZQ
- MI<sup>W</sup><sub>S</sub>
- CEP1
- CE1
- CE2
- ML2B
- C<sup>1</sup><sub>G</sub>5-S
- CV
- MVGQ
- CC
- RB
- J
- D-
- X
- 20-
- Data

**High Precision Stroke Reading Cylinder**  
**Series CEP1**

ø12, ø20



P. 10-12-8

**Stroke Reading Cylinder**  
**Series CE1**

ø12, ø20, ø32, ø40  
ø50, ø63



P. 10-12-18

**Multi-counter**  
**Series CEU5**



P. 10-12-27

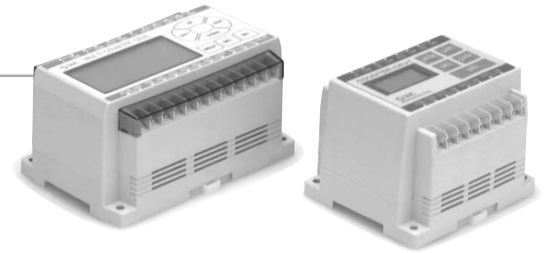
**3-point Preset Counter**  
**Series CEU1**



P. 10-12-30

# Achieve rationalization of production lines

## Stroke reading cylinder with position feedback



Measurement is possible throughout the full stroke range.

Tolerances of preset values can be set. (CEU1, CEU5)

Tolerances can be set for preset values.

CEU1: ± set tolerance

CEU5: + set tolerance, - set tolerance (separate settings)

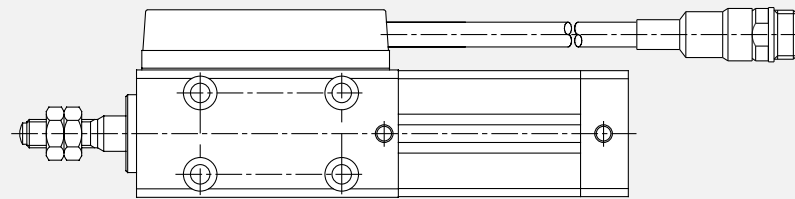
The home position can be anywhere within the cylinder stroke.

→ When the counter is reset by pressing the cylinder rod to the reference plane, that point becomes the home position.

### Simple operation

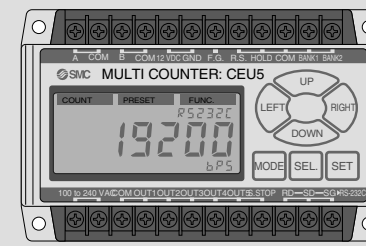
#### High Precision Stroke Reading Cylinder (CEP1)

- Resolution: 0.01 mm (Accuracy ±0.02 mm)
- Special scraper now standard (IP-67)
- 2 types of seal material available (Made to Order)
- Power supply voltage 12 to 24 VDC



- Auto switch mounting orientation can be freely selected (3 mounting surfaces)

#### Multi-counter (CEU5)

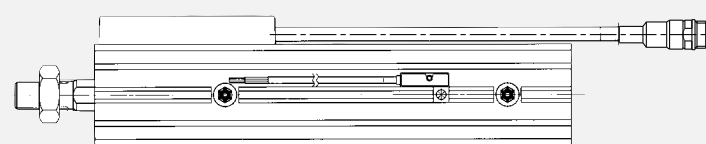


- Output terminal: 5 points
- Number of output settings: 20 points (Bank switching), 31 points (Binary output)
- Communication function with RS-232C
- With BCD output (Option)
- Maximum counting speed 100 kHz
- Prescale function
- With multiplication switching (1, 2, 4 multiplication)
- DIN rail mountable
- 6 digits count display

Includes all functions of the CEU1.

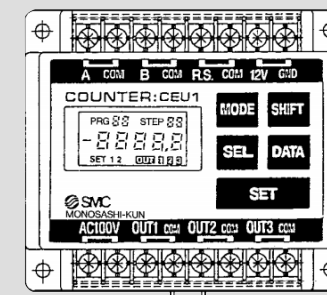
#### Stroke Reading Cylinder (CE1)

- Resolution: 0.1 mm (Accuracy ±0.2 mm)
- Water resistance improved by changing the sensor unit filler.



- Power supply voltage 12 to 24 VDC
- Abundant stroke variations
- Improved noise resistance

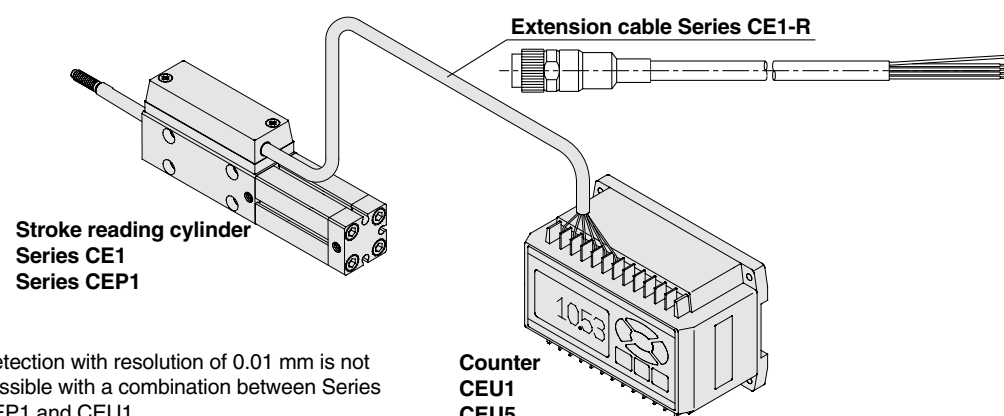
#### 3-point Preset Counter (CEU1)



- Output terminal: 3 points
- DIN rail mountable
- Hold output, Comparison output, One shot output

### Series Variations

#### System Configuration



Note) Detection with resolution of 0.01 mm is not possible with a combination between Series CEP1 and CEU1.



#### Series CE1

Bore size (mm)	Standard stroke (mm)										Manufacturable stroke range		
	25	50	75	100	125	150	175	200	250	300		400	500
12	●	●	●	●	●	●	●	●	●	●	●	●	25 to 150
20	●	●	●	●	●	●	●	●	●	●	●	●	25 to 300
32		●	●	●	●	●	●	●	●	●	●	●	25 to 400
40				●	●	●	●	●	●	●	●	●	25 to 600
50							●	●	●	●	●	●	25 to 600
63								●	●	●	●	●	25 to 600

#### Series CEP1

Bore size (mm)	Standard stroke (mm)			
	25	50	75	100
12 equivalent	●	●	●	●
20 equivalent	●	●	●	●

#### CEU1

Power supply voltage	Output transistor mode	
	NPN	PNP
100 VAC	●	●
24 VDC	●	●

#### CEU5

Power supply voltage	Count data output	Output transistor mode			
		RS-232C+BCD		RS-232C	
		NPN	PNP	NPN	PNP
100 to 240 VAC		●	●	●	●
24 VDC		●	●	●	●

#### Extension Cable

Cable length (m)			
5	10	15	20
●	●	●	●

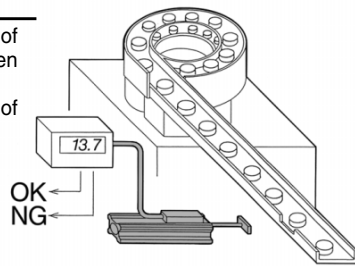


- RE<sup>A</sup><sub>B</sub>
- REC
- C□X
- C□Y
- MQ<sup>o</sup><sub>M</sub>
- RHC
- MK(2)
- RS<sup>o</sup><sub>G</sub>
- RS<sup>H</sup><sub>A</sub>
- RZQ
- MI<sup>w</sup><sub>S</sub>
- CEP1
- CE1
- CE2
- ML2B
- C<sup>J</sup><sub>G</sub>-S
- CV
- MVGQ
- CC
- RB
- J
- D-
- X
- 20-
- Data

## Application Example

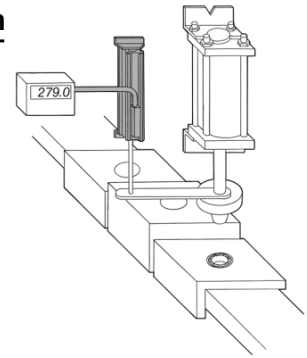
### Parts inspection

Measures the dimensions of parts, discriminates between good and defective articles, and prevents the mingling of different parts, etc.



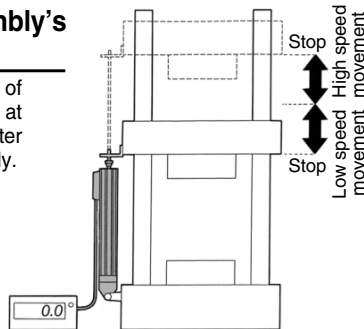
### Confirmation of press-in

Can confirm the press-in of a hydraulic cylinder by detecting its stroke. Even if the size of the workpiece changes, the point of press-in completion can be easily changed.



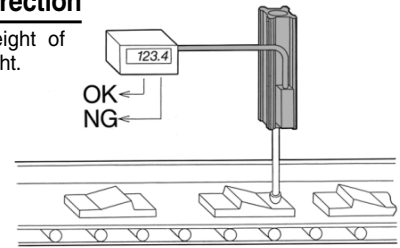
### Detection of die assembly's deceleration point

Since the deceleration point of the die assembly can be set at will, it can be easily changed after replacement of the die assembly.



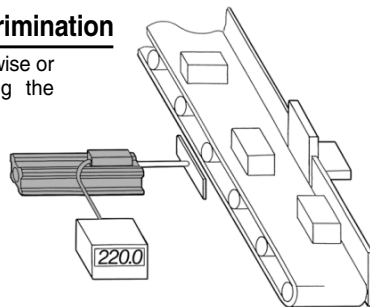
### Discrimination of direction

Maintains a constant height of measuring workpiece height.



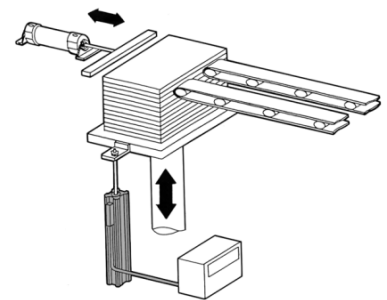
### Length/breadth discrimination

Distinguishes either lengthwise or crosswise while correcting the position of a workpiece.



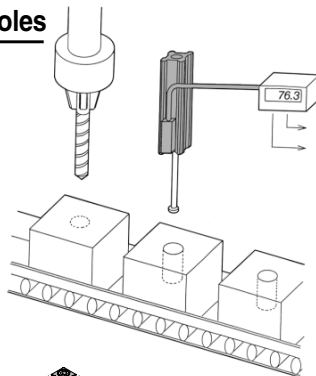
### Detection of lifter position

Can continuously monitor a lifter's stroke.



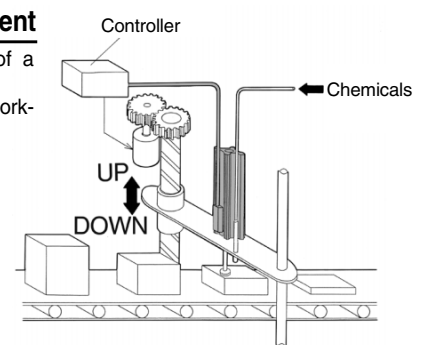
### Inspection of machined holes

Can detect machined hole depth, burrs and foreign matter, etc.



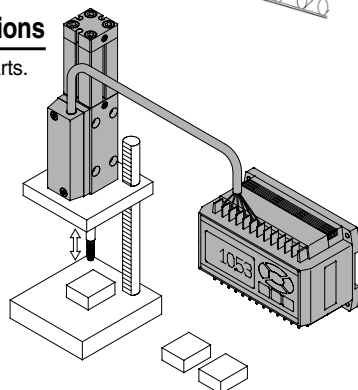
### Nozzle height adjustment

Maintains a certain height of a workpiece and a nozzle by measuring the height of a workpiece.



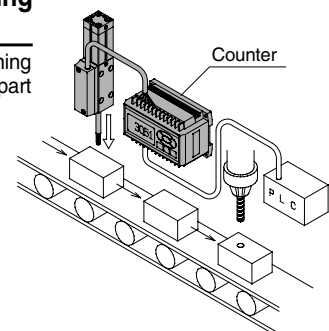
### Measurement of dimensions

Can measure dimensions of parts.



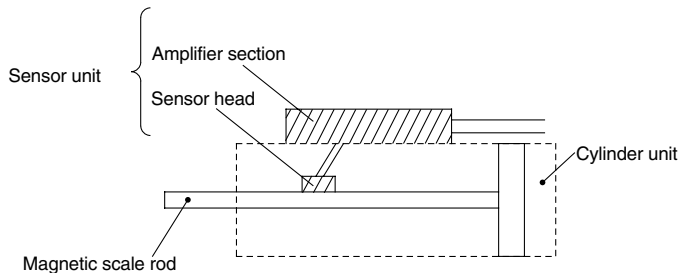
### Measurement of machining dimensions

Performs adjustment of machining depth, etc. by measuring the part dimensions before machining.

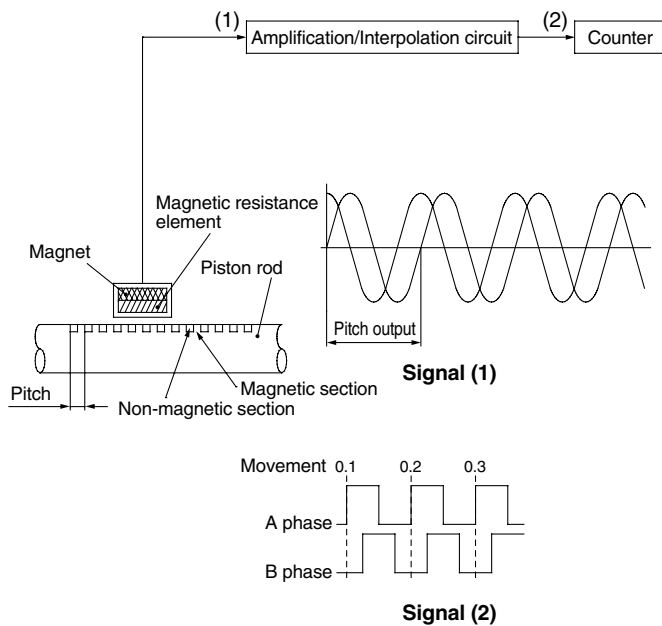


## Measurement Principle

The amount of rod movement in the stroke reading cylinder is detected using an MR element (magnetic resistance element) whose resistance value changes due to magnetic force. The detection unit containing this MR element is called the sensor head. An amplifying circuit and a dividing circuit are required to produce output which can be read by the counter, and these are attached to the cylinder case. The sensor head and amplifier section together are referred to as the sensor unit.



The stroke reading cylinder is equipped with the capability of outputting the piston stroke movement as a pulse signal. The measurement principle is as shown in the drawing below.

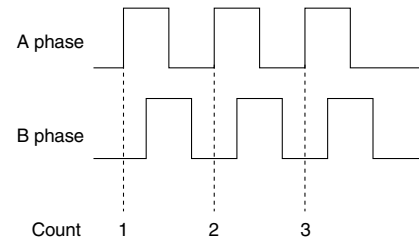


1. Scales of magnetic layers and non-magnetic layers are etched at a certain pitch on the piston rod.
2. With movement of the piston rod, a sin, cos 2-phase signal (Signal (1)) is received by the magnetic resistance element. For this wave form, 1 pitch (0.8 mm) becomes exactly 1 cycle.
3. This is amplified and divided into 1/8 parts. As a result, a 90° phase difference pulse signal of 0.1 mm/pulse (Signal (2)) is output.
4. By measuring this pulse signal with the counter, it is possible to detect the piston position with a resolution of 0.1 mm.
5. In the case of the high precision stroke reading cylinder, the sin, cos 2-phase signal obtained in 2 is amplified and divided into 1/20 parts. As a result, a 90° phase difference pulse signal of 0.04 mm/pulse (Signal (2)) is output.
6. By multiplying this pulse signal by 4 with the counter, it is possible to detect the piston position with a resolution of 0.01 mm.

## A/B Phase Difference Output (90° phase difference output)

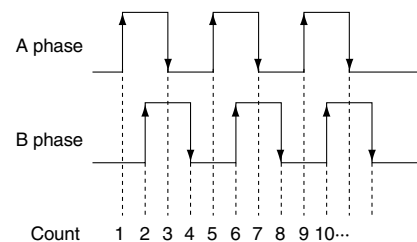
When movement is expressed by a single line of pulses, it is impossible to accurately identify the current position, because pulse waves appear in both upward and downward directions. Accordingly, in A/B phase difference output, two lines of pulses are provided, wherein one line detects the movement and the other distinguishes the direction.

The CE1 also employs this system.



## 4 Times Multiplication Function

This function increases resolution 4 times by counting 4 for each cycle of pulses, instead of counting 1 for each cycle as is normally the case. In principle, this function counts each time there is a rise or fall in either of the A or B phase pulses.



## Counting Speed (kHz, kcps)

Counting speed indicates the number of pulses that can be counted per second. If the stroke reading cylinder is operated at high speeds, pulse waves are output in shorter cycles. The counting speed of the counter must be higher than the pulse speed for the maximum piston speed when operating. Since the stroke reading cylinder outputs one pulse for each 0.1 mm of movement, 5,000 pulses will be output for each 500 mm of movement. Therefore, a speed of 500 mm/s is equivalent to 5 kcps (kHz), but a counting speed 2 to 3 times greater is recommended for actual operation.

## Repeatability

The accuracy is the difference between the dimensions based upon the signals of the stroke reading cylinder and the absolute dimensions.

The maximum display error that will appear on the counter's digital display is equal to twice ( $\pm 1$  count) the resolution when the home position is reset and when dimensions are measured.

RE<sub>B</sub><sup>A</sup>

REC

C□X

C□Y

MQ<sub>M</sub><sup>Q</sup>

RHC

MK(2)

RS<sub>G</sub><sup>Q</sup>RS<sub>A</sub><sup>H</sup>

RZQ

MI<sub>S</sub><sup>W</sup>

CEP1

CE1

CE2

ML2B

C<sub>5</sub><sup>1/5</sup>-S

CV

MVGQ

CC

RB

J

D-

-X

20-

Data





## Series CE

# Specific Product Precautions

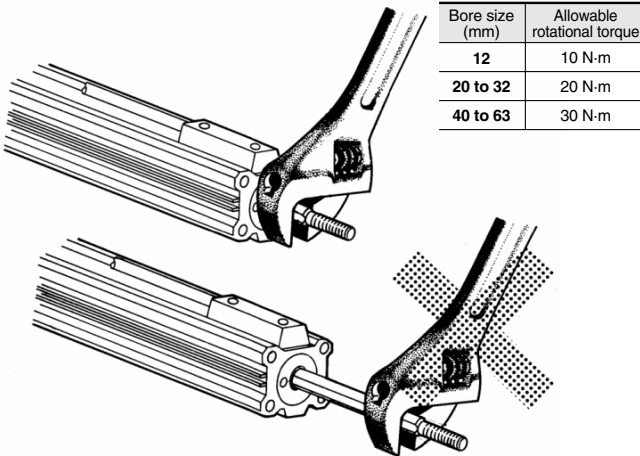
Be sure to read before handling.

### Mounting

#### ⚠ Caution

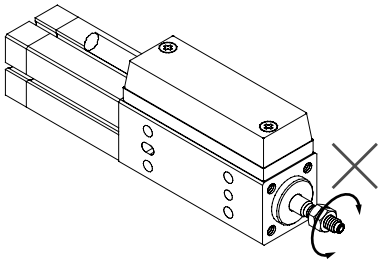
- When screwing a nut or fitting, etc. onto the threaded section at the end of the piston rod, return the piston rod to its fully retracted position, and grasp the exposed portion of the rod across two parallel sides with a wrench. In the case of the high precision stroke reading cylinder, there are no parallel sides. Secure the workpiece with a double nut.

Note) Do not apply rotational torque to the piston rod.



Bore size (mm)	Allowable rotational torque
12	10 N·m
20 to 32	20 N·m
40 to 63	30 N·m

- Operate the cylinder in such a way that the load is always applied in the axial direction.
  - In case the load is applied in a direction other than the axial direction of the cylinder, provide a guide to constrain the load itself.
  - When mounting a cylinder, centering should be done carefully.
- Avoid using the air cylinder in such a way that rotational torque would be applied to the piston rod.



- Be careful to avoid scratches or dents, etc. on the sliding sections of the piston rod.

### Sensor Unit

- The sensor unit is adjusted to an appropriate position at the time of shipment. Therefore, never detach the sensor unit from the body.
- The cylinder should be protected from contact with liquids such as coolants or coolant water. (CE1)
- The sensor cable should not be pulled with a strong force.
- Since the sensor for stroke reading cylinder adopts the magnetic method, it may result in malfunction if there is a strong magnetic field around the sensor. Use it under the external magnetic field with 14.5 mT or less.

This is equivalent to a magnetic field of approximately 18 cm in radius from a welding area using a welding amperage 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.

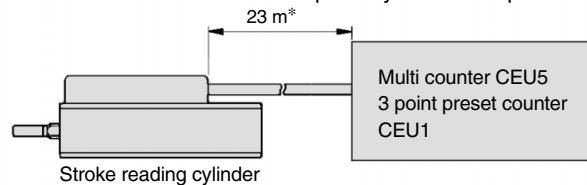
- Switches or relays, etc. should not be installed in the power supply line (12 to 24 VDC).

### Effects of Noise

#### ⚠ Caution

When the stroke reading cylinder is used near a motor, welding machine or other source of noise generation, there is a possibility of miscounting. In this case, noise should be suppressed as much as possible and the following countermeasure should be taken.

- Connect the shield wire to FG (frame ground).
- The maximum transmission distance for the stroke reading cylinder is 23 m, but since the output signal is a pulse output, the sensor cable should be wired separately from other power lines.

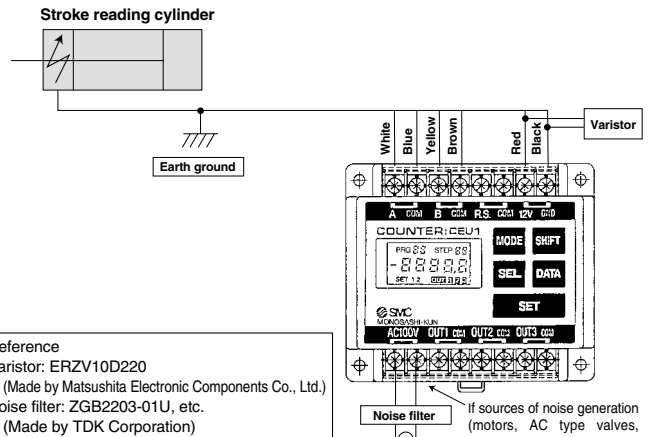


\* When using SMC extension cable and counter.

### Noise Counter Measures

Methods of dealing with noise are given below.

- Connect only the shield wire to FG (frame ground).
- Use a power source separate from large motors and AC valves, etc.
- Run the stroke reading cylinder's cable away from other power lines.
- Install a noise filter in the 100 VAC power line, and install a varistor in the DC power supply of the sensor cable.



Reference  
 Varistor: ERZV10D220  
 (Made by Matsushita Electronic Components Co., Ltd.)  
 Noise filter: ZGB2203-01U, etc.  
 (Made by TDK Corporation)

If sources of noise generation (motors, AC type valves, relays, etc.) are connected on the secondary side of the noise filter, the filter will have no effect.

#### <Counting speed of counter>

When the speed of the stroke reading cylinder is greater than the counting speed of the counter, the counter will miscount.

For CE1 (when measuring to 0.1 mm), a counter should be used with a counting speed of 10 kHz (kcps) or more.

And for CEP1 (when measuring to 0.01 mm), use a counter with a counting speed of 50 kHz (kcps) or more when 4 times multiplication is input.

#### <Malfunction due to lurching and bounding>

When lurching or bounding occurs at the beginning or end of stroke reading cylinder, or due to other causes, the cylinder speed momentarily increases, and there is a possibility of exceeding the counting speed of the counter or the response speed of the sensor, thereby causing a miscount.

### Handling of Technical Material

The instruction manuals should be read before using the Series CEP1 high precision stroke reading cylinder, CEU5 multi counter, CE1 scale cylinder and CEU1 3 point preset counter.



# High Precision Stroke Reading Cylinder Non-rotating Piston Type Series CEP1 ø12, ø20

CE, CAD, For details about certified products conforming to international standards, visit us at [www.smcworld.com](http://www.smcworld.com).

## How to Order

**CEP1** **B** **12** **50** **F9BW**

**Mounting style**

<b>B</b>	Direct mounting rod side tapped
<b>L</b>	Foot style
<b>F</b>	Rod side flange style

**Bore size**

<b>12</b>	12 mm equivalent
<b>20</b>	20 mm equivalent

**Standard cylinder stroke (mm)**  
Refer to "Standard Stroke" on page 10-12-9.

**Connector**

<b>Nil</b>	With connector
<b>Z</b>	Without connector

**Sensor cable length**

<b>Nil</b>	0.5 m
<b>L</b>	3 m

**Number of auto switches**

<b>Nil</b>	2 pcs.
<b>S</b>	1 pc.
<b>n</b>	"n" pcs.

**Auto switch**

<b>Nil</b>	Without auto switch
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\* For the applicable auto switch model, refer to the table below.  
\* Auto switches are shipped together, (but not assembled).

**Applicable counter**  
Series CEU5

<Made-to-order>  
Fluoro rubber seals: -XC22  
(Example) CEP1B12-100-M9N-XC22

<Option>  
Extension cable CE1-R **05**

**Cable length**

<b>05</b>	5 m
<b>10</b>	10 m
<b>15</b>	15 m
<b>20</b>	20 m

**Suffix**

<b>Nil</b>	Extension cable
<b>C</b>	Extension cable & connector

**Mounting Bracket Part No.**

Cylinder part no.	Foot	Rod side flange
<b>CEP1□12</b>	CEP1-L12	CEP1-F12
<b>CEP1□20</b>	CEP1-L20	CEP1-F20

**Applicable Auto Switch**/Refer to page 10-20-1 for further information on auto switches.

Type	Special function	Electrical entry	indicator/light	Wiring (Output)	Load voltage			Auto switch model		Lead wire length (m)			Pre-wire connector	Applicable load	
					DC	AC		Perpendicular	In-line	0.5 (Nil)	3 (L)	5 (Z)			
Reed switch	—	Grommet	Yes	3-wire (NPN equivalent)	—	5 V	—	<b>A96V</b>	<b>A96</b>	●	●	—	—	IC circuit	—
				2-wire	24 V	12 V	100 V	<b>A93V</b>	<b>A93</b>	●	●	—	—	—	Relay, PLC
Solid state switch	—	Grommet	Yes	3-wire (NPN)	24 V	5 V, 12 V	—	<b>M9NV</b>	<b>M9N</b>	●	●	○	○	IC circuit	Relay, PLC
				3-wire (PNP)				<b>M9PV</b>	<b>M9P</b>	●	●	○	○		
				2-wire				<b>M9BV</b>	<b>M9B</b>	●	●	○	○		
	Diagnostic indication (2-color indication)			3-wire (NPN)	24 V	5 V, 12 V	—	<b>F9NWV</b>	<b>F9NW</b>	●	●	○	○	IC circuit	
				3-wire (PNP)				<b>F9PWV</b>	<b>F9PW</b>	●	●	○	○		
	Water resistant (2-color indication)			2-wire	24 V	12 V	—	<b>F9BWV</b>	<b>F9BW</b>	●	●	○	○	—	
				—				<b>F9BA</b>	—	●	○	○			

\* Lead wire length symbols: 0.5 m..... Nil (Example) M9N  
3 m..... L (Example) M9NL  
5 m..... Z (Example) M9NZ

\* Solid state switches marked with "○" are produced upon receipt of order.

- Refer to page 10-12-16 for details on other applicable auto switches than listed above.
- For details about auto switches with pre-wire connector, refer to page 10-20-66.

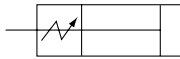
# High Precision Stroke Reading Cylinder Non-rotating Piston Type **Series CEP1**

## Cylinder Specifications



Action	Double acting, Single rod (Non-rotating piston)	
Fluid	Air	
Proof pressure	1.5 MPa	
Maximum operating pressure	1.0 MPa	
Minimum operating pressure	ø12	ø20
	0.15 MPa	0.1 MPa
Piston speed	50 to 300 mm/s	
Ambient and fluid temperature	0 to 60°C (No freezing)	
Lubrication	Non-lube	
Stroke length tolerance range	0 to 1.0 mm	
Cushion	Without	
Rod non-rotating accuracy	ø12	ø20
	±2°	±3°
Mounting	Direct mounting rod side tapped (Standard), Foot style, Rod side flange style	
Thread tolerance	JIS Class 2	

### JIS Symbol



**Made to Order Specifications**  
(For details, refer to page 10-21-1.)

Symbol	Specifications
-XC22	Fluoro rubber seals

## Sensor Specifications

Cable	ø7, 6 core twisted pair shielded wire (Oil, Heat & Flame resistant)
Maximum transmission distance	23 m (when using SMC cable and counter)
Position detection method	Magnetic scale rod, sensor head <Incremental type>
Magnetic field resistance	14.5 mT
Power supply	10.8 to 26.4 VDC (Power supply ripple: 1% or less)
Current consumption	50 mA
Resolution	0.01 mm (With 4 times multiplication)
Accuracy	±0.02 mm <sup>(1)</sup> (at 20°C)
Output type	Open collector (24 VDC, 40 mA)
Output signal	A/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, Y directions 4 hrs. in Z direction based upon JIS D 1601
Impact resistance	30 G 3 times each in X, Y, Z directions
Enclosure	IP-67 (IEC Standard) <sup>(2)</sup>
Extension Cable (Option)	CE1-R* 5 m, 10 m, 15 m, 20 m

Note 1) This includes the digital display error of the counter (CEU5).

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

Note 2) Except for the connector, the cylinder section is the equivalent of an SMC water resistant cylinder.

## Cylinder Stroke

Model	Standard stroke (mm)				Manufacturable stroke range
	25	50	75	100	
<b>CEP1B12</b>	●	●	●	●	0 to 150
<b>CEP1B20</b>	●	●	●	●	0 to 300

But, as for stroke over 100 mm, its accuracy will be ±0.05 mm. (at 20°C)

RE<sub>A</sub>  
B

REC

C□X

C□Y

MQ<sub>M</sub><sup>Q</sup>

RHC

MK(2)

RS<sub>G</sub><sup>Q</sup>RS<sub>A</sub><sup>H</sup>

RZQ

MI<sub>S</sub><sup>W</sup>

CEP1

CE1

CE2

ML2B

C<sub>G</sub><sup>1</sup>/<sub>5</sub>-S

CV

MVGQ

CC

RB

J

D-

-X

20-

Data



# Series CEP1

## Weight (Without mounting bracket/connector)

Bore size (mm)	Cylinder stroke (mm)				(kg)
	25	50	75	100	
12	0.29	0.33	0.37	0.41	
20	0.62	0.68	0.74	0.80	

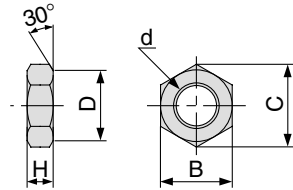
## Proper Auto Switch Mounting Position

Regarding dimensions for the proper auto switch mounting position (at stroke end), refer to page 10-12-16.

## Rod End Nut Dimensions

(2 pcs. are attached as standard.)

Material  $\phi 12, 20$ : Steel

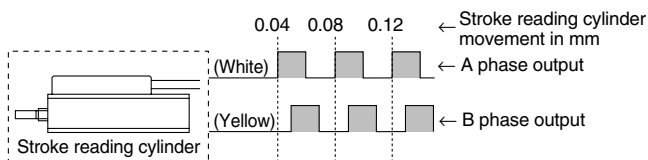


Applicable bore size (mm)	d	H	B	C	D
12	M5 x 0.8	3	8	9.2	7.8
20	M8 x 1.25	5	13	15.0	12.5

## Electrical Wiring

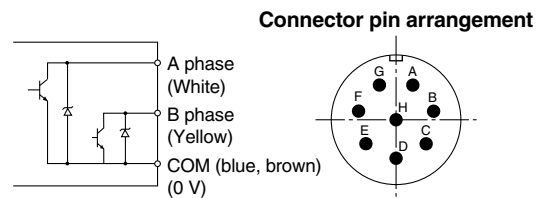
### Output type

The output signal of the high precision stroke reading cylinder is A/B phase difference output (open collector output) as shown in the figure below. The relation between the movement distance and the signal output of the high precision stroke reading cylinder is that for each 0.04 mm of movement a one pulse signal is output to both output terminals A and B. In order to measure with a discrimination of 0.01 mm, a counter with a 4 times multiplication function (CEU5) is required.



### Input/Output

The input/output of the stroke reading cylinder is performed by a  $\phi 7$  shielded twisted pair wire from the sensor section plus a connector.



Output circuit of stroke reading cylinder

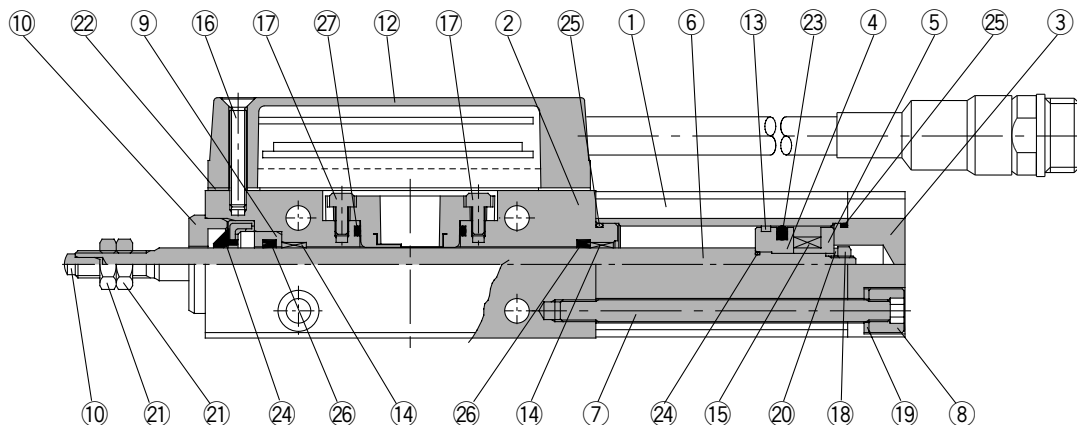
### Signal

Contact signal	Wire color	Signal name
A	White	A phase
B	Yellow	B phase
C	Brown	COM (0 V)
D	Blue	COM (0 V)
E	Red	+12 to 24 V
F	Black	0 V
G	—	Shield

# High Precision Stroke Reading Cylinder Non-rotating Piston Type Series CEP1

## Construction

ø12, ø20



## Component Parts

No.	Description	Material	Note
①	Cylinder tube	Aluminum alloy	Hard anodized
②	Rod cover	Aluminum alloy	Hard chrome plated
③	Head cover	Aluminum alloy	Hard anodized
④	Piston A	Aluminum alloy	Hard anodized
⑤	Piston B	Aluminum alloy	Hard anodized
⑥	Piston rod	Carbon steel	Hard chrome plated
⑦	Tie-rod	Carbon steel	Chromated
⑧	Tie-rod nut	Carbon steel	Nickel plated
⑨	Seal ring	Aluminum alloy	White anodized
⑩	Centering location ring	Aluminum alloy	White anodized
⑪	Rod end pin	Stainless steel	Quenched
⑫	Sensor unit	—	With or without connector
⑬	Wear ring	Special resin	
⑭	Bushing	Cast iron	

No.	Description	Material	Note
⑮	Magnet	Rare earth	
⑯	Cross recessed countersunk head screw	Chromium molybdenum steel	Nickel plated
⑰	Hexagon socket head cap screw	Stainless steel	
⑱	Hexagon nut	Carbon steel	Nickel plated
⑲	Spring washer	Steel wire	Nickel plated
⑳	Spring washer	Steel wire	Nickel plated
㉑	Hexagon nut	Carbon steel	Rod end nut
㉒	Sensor case gasket	NBR	
㉓	Piston seal	NBR	
㉔	Scraper	NBR	
㉕	Tube gasket	NBR	
㉖	Rod seal	NBR	
㉗	O-ring	NBR	
㉘	O-ring	NBR	

\* Since there is a possibility of improper operation, please contact SMC regarding the replacement of seals.

RE<sub>B</sub><sup>A</sup>

REC

C□X

C□Y

MQ<sub>M</sub><sup>Q</sup>

RHC

MK(2)

RS<sub>G</sub><sup>Q</sup>RS<sub>A</sub><sup>H</sup>

RZQ

MI<sub>S</sub><sup>W</sup>

CEP1

CE1

CE2

ML2B

C<sub>6</sub><sup>1</sup>/5-S

CV

MVGQ

CC

RB

J

D-

-X

20-

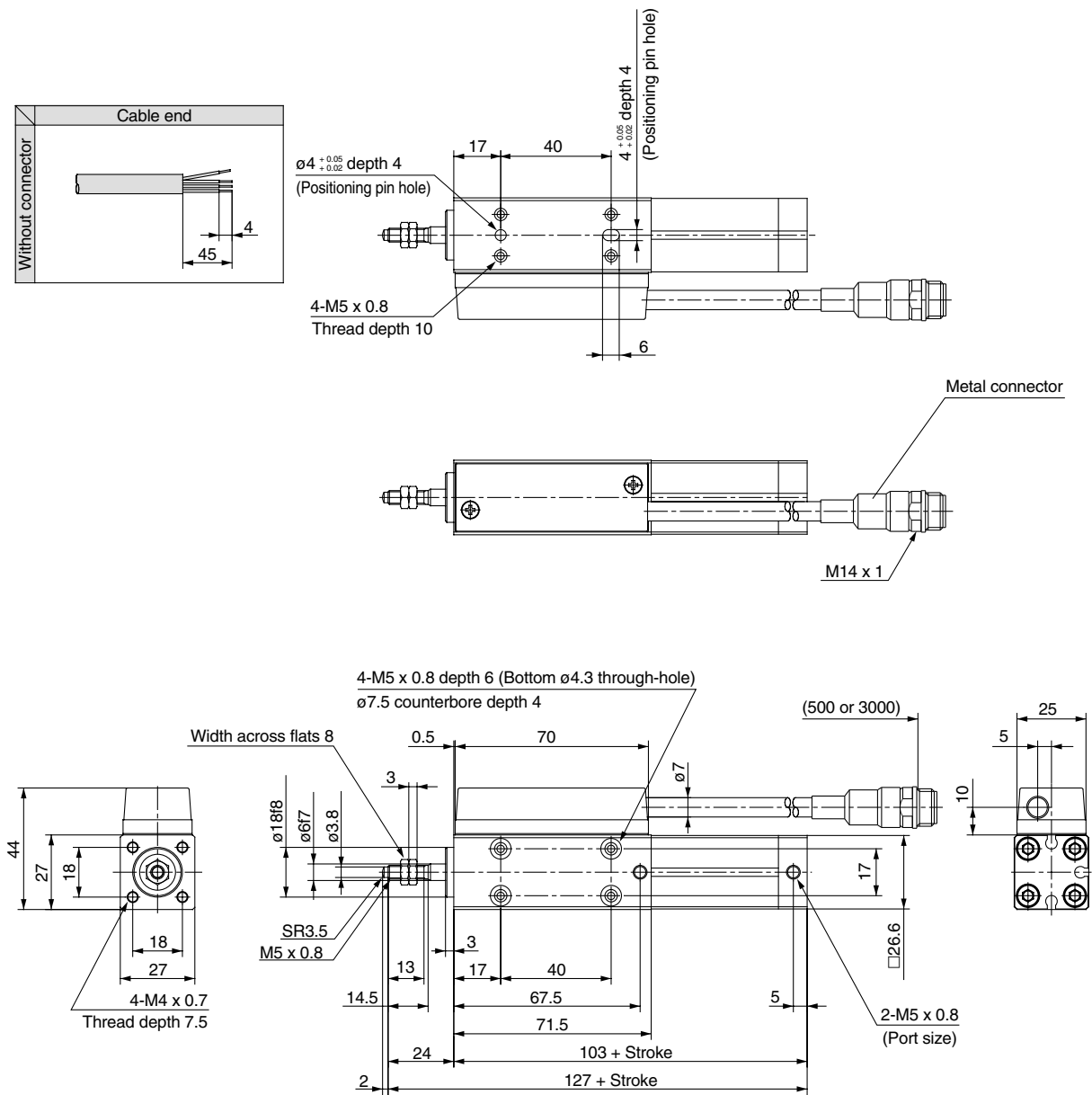
Data

# Series CEP1

Dimensions:  $\phi 12$

Direct mounting, rod side tapped style:

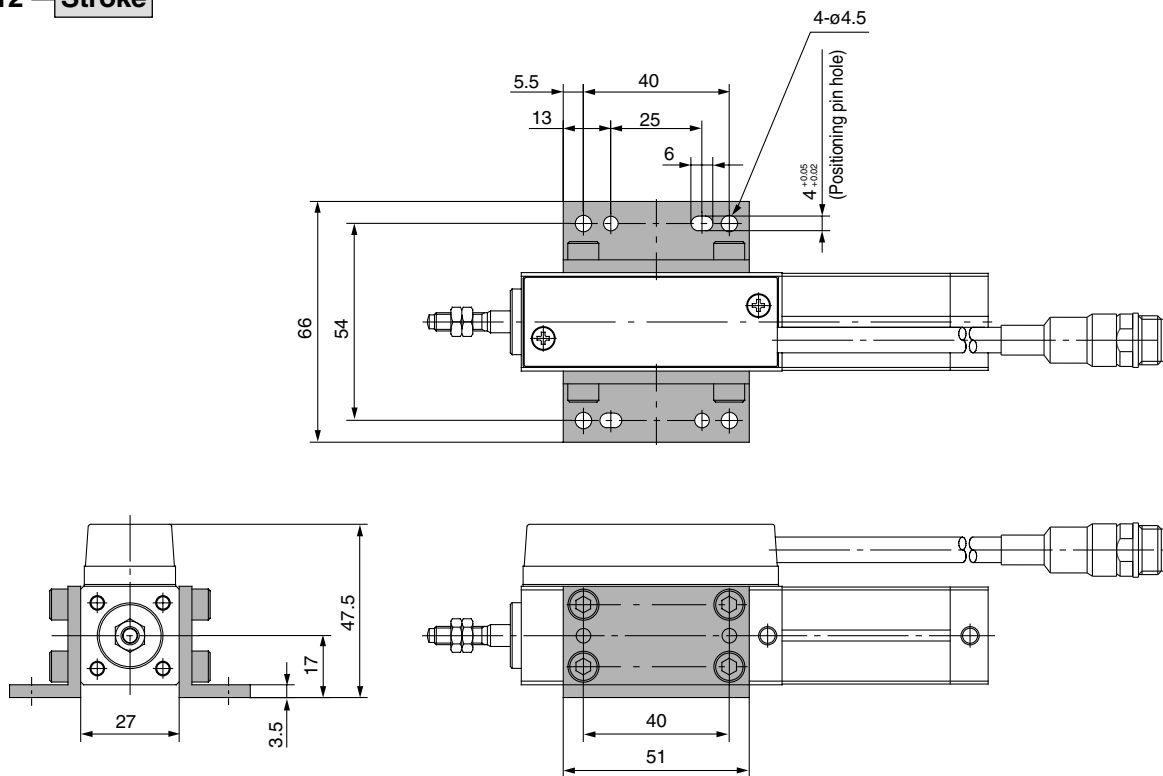
CEP1B12 — Stroke



# High Precision Stroke Reading Cylinder Non-rotating Piston Type **Series CEP1**

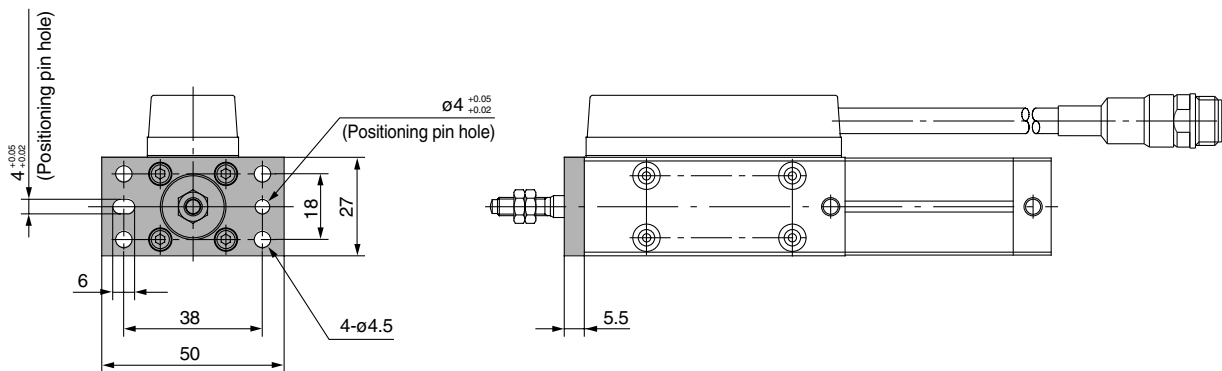
Foot style:

CEP1L12 — **Stroke**



Rod side flange style:

CEP1F12 — **Stroke**



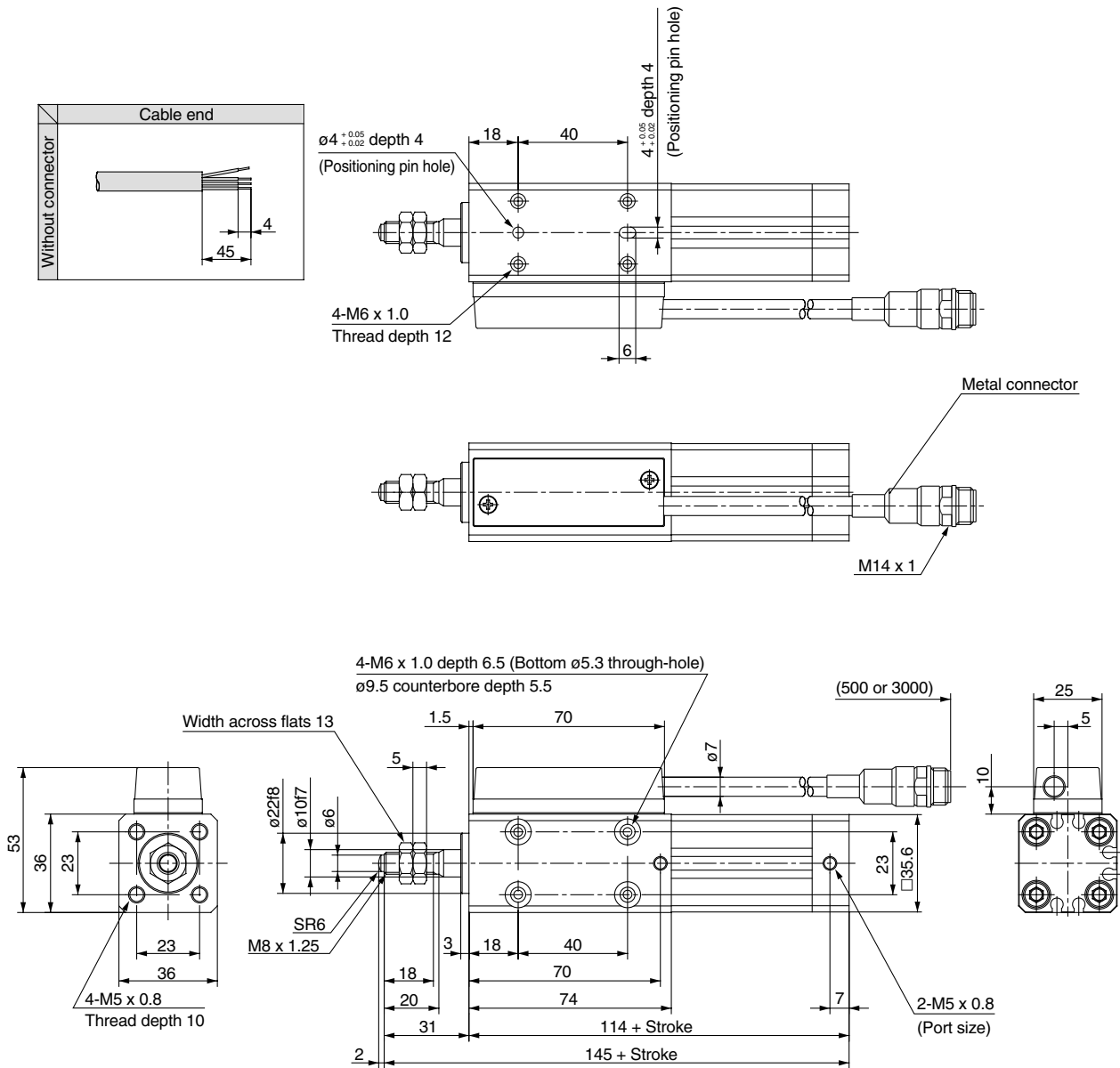
RE <sup>A</sup> <sub>B</sub>
REC
C□X
C□Y
MQ <sup>Q</sup> <sub>M</sub>
RHC
MK(2)
RS <sup>Q</sup> <sub>G</sub>
RS <sup>H</sup> <sub>A</sub>
RZQ
MI <sup>W</sup> <sub>S</sub>
<b>CEP1</b>
CE1
CE2
ML2B
C <sup>1</sup> / <sub>6</sub> 5-S
CV
MVGQ
CC
RB
J
D-
-X
20-
Data

# Series CEP1

Dimensions:  $\phi 20$

Direct mounting, rod side tapped style:

CEP1B20 — Stroke

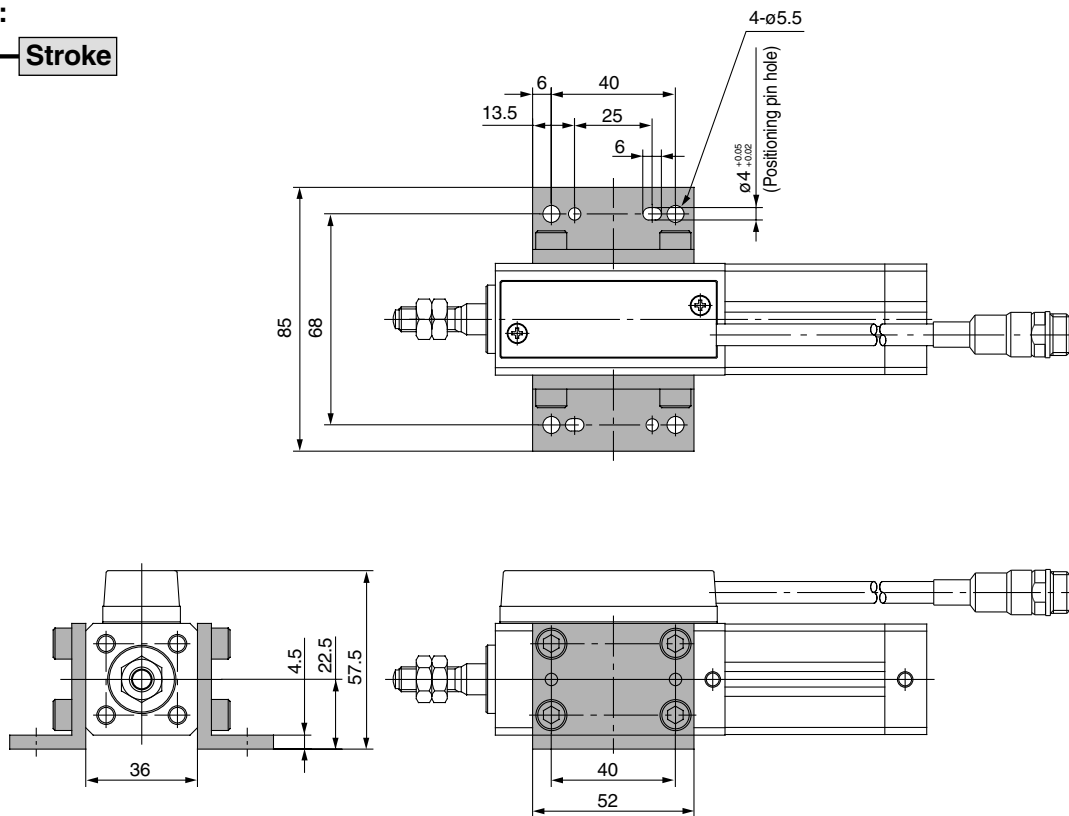




# High Precision Stroke Reading Cylinder Non-rotating Piston Type **Series CEP1**

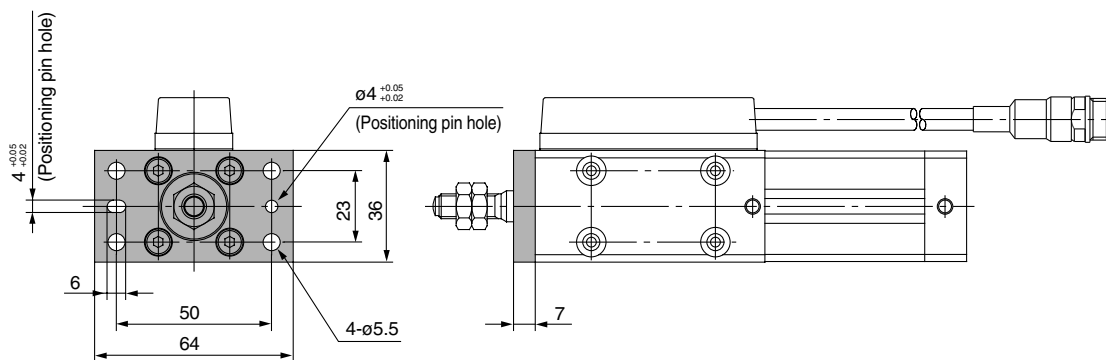
Foot style:

CEP1L20 — **Stroke**



Rod side flange style:

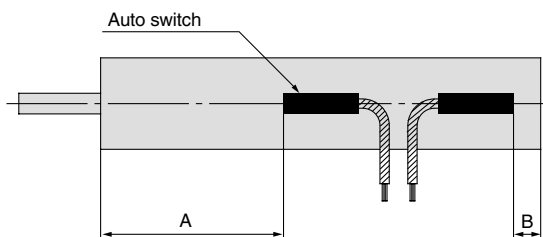
CEP1F20 — **Stroke**



- RE<sup>A</sup><sub>B</sub>
- REC
- C□X
- C□Y
- MQ<sup>Q</sup><sub>M</sub>
- RHC
- MK(2)
- RS<sup>Q</sup><sub>G</sub>
- RS<sup>H</sup><sub>A</sub>
- RZQ
- MI<sup>W</sup><sub>S</sub>
- CEP1**
- CE1
- CE2
- ML2B
- C<sup>1</sup>/<sub>5</sub>-S
- CV
- MVGQ
- CC
- RB
- J
- D-
- X
- 20-
- Data

# Series CEP1

## Proper Auto Switch Mounting Position (Detection at stroke end) and Its Mounting Height



### Proper Auto Switch Mounting Position

Auto switch model	D-A9□ D-A9□V		D-M9□ D-M9□V D-F9□W D-F9□WV		D-F9BAL	
	A	B	A	B	A	B
Bore size (mm) 12	75	8	79	12	78	11
20	82	12	86	16	85	15

### Operating Range

Auto switch model	Bore size (mm)	
	12	20
D-A9□/A9□V	6	10
D-M9□/M9□V	2.5	3
D-F9□W/F9□WV D-F9BAL	3	5

\* Since this is a guideline including hysteresis, not meant to be guaranteed. (Assuming approximately  $\pm 30\%$  dispersion)  
There may be the case it will vary substantially depending on an ambient environment.

Other than the models listed in "How to Order", the following auto switches are applicable.  
For detailed specifications, refer to page 10-20-1.

Type	Model	Electrical entry	Features
Reed switch	D-A90	Grommet (In-line)	Without indicator light
	D-A90V	Grommet (Perpendicular)	

\* Normally closed (NC = b contact), solid state switch (D-F9G/F9H type) are also available.  
For details, refer to page 10-20-40.



# Stroke Reading Cylinder

## Series CE1

ø12, ø20, ø32, ø40, ø50, ø63

### How to Order

**CE1 L 32 200 J79W**

**Mounting style**

B	Both ends tapped style (Standard)
L	Foot style
F	Rod side flange style
G	Head side flange style
D	Double clevis style

**Bore size**

12	12 mm
20	20 mm
32	32 mm
40	40 mm
50	50 mm
63	63 mm

**Standard cylinder stroke (mm)**  
Refer to "Standard Stroke" on page 10-12-19.

**Auto switch**

Nil	Without auto switch
-----	---------------------

\* For the applicable auto switch model, refer to the table below.  
\* Auto switches are shipped together, (but not assembled).

**Number of auto switches**

Nil	2 pcs.
S	1 pc.
3	3 pcs.
n	"n" pcs.

**Cable length**

Nil	0.5 m
L	3 m

**Connector**

Nil	With connector
Z	Without connector

**Suffix for cylinder**  
(Applicable bore size ø40 to ø63)

Nil	With cushion on both ends
N	Without cushion
R	With cushion on rod end
H	With cushion on head end

\* ø12, ø20, ø32: Without cushion only.  
But, symbol N is not necessary.

**Applicable counter**

Series CEU1
Series CEU5

**<Option>**

**Extension cable CE1-R 05**

**Cable length**

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

**Suffix**

Nil	Extension cable
C	Extension cable & connector

### Applicable Auto Switch/Refer to page 10-20-1 for further information on auto switches.

Type	Special function	Electrical entry	Indicator/light	Wiring (Output)	Load voltage		Rail mounting		Direct mounting		Lead wire length (m)*				Pre-wire connector	Applicable load			
					DC	AC	ø12 to ø63		ø32 to ø63		0.5 (Nil)	3 (L)	5 (Z)	None (N)		IC circuit	Relay, PLC		
							Perpendicular	In-line	Perpendicular	In-line									
Reed switch	—	Grommet	Yes	3-wire (NPN equivalent)	5 V	—	—	A76H	A96V	A96	●	●	—	—	—	—	—		
				—	—	200 V	A72	A72H	—	—	●	●	—	—	—	—	—		
		Connector		24 V	12 V	100 V	—	—	A73H	—	—	—	●	●	●	—	—	—	
							—	—	A93V	A93	●	●	—	—	—	—	—	—	
Diagnostic indication (2-color indication)	Grommet	—	—	—	—	—	A73C	—	—	—	●	●	●	●	—	—			
							A79W	—	—	—	●	●	—	—	—	—	—		
Solid state switch	—	Grommet	Yes	3-wire (NPN)	5 V, 12 V	—	F7NV	F79	M9NV	M9N	●	●	○	—	○	—	—		
				3-wire (PNP)			F7PV	F7P	M9PV	M9P	●	●	○	—	○	—	—		
		Connector		24 V	12 V	—	F7BV	J79	M9BV	M9B	●	●	○	—	○	—	—	—	
						—	J79C	—	—	—	●	●	●	●	—	—	—		
	Diagnostic indication (2-color indication)	Grommet		—	—	24 V	5 V, 12 V	—	F7N WV	F79W	F9N WV	F9N W	●	●	○	—	○	—	—
									—	F7PW	F9P WV	F9P W	●	●	○	—	○	—	—
									F7B WV	J79W	F9B WV	F9B W	●	●	○	—	○	—	—
									—	F7BAV	—	—	—	—	●	●	○	—	○
Water resistant (2-color indication)	Grommet	—	—	12 V	—	—	—	F7BA	—	F9BA	—	●	○	—	○	—			
							—	F7BAV	—	—	—	—	●	●	○	—	○	—	
Diagnostic indication (2-color indication)	Grommet	—	—	4-wire (NPN)	5 V, 12 V	—	—	F79F	—	—	—	●	●	○	—	○			
							—	—	—	—	—	—	—	—	—	—	—		

\* Lead wire length symbols: 0.5 m..... Nil (Example) F73C  
 3 m..... L (Example) F73CL  
 5 m..... Z (Example) F73CZ  
 None..... N (Example) A73CN

\* Solid state switches marked with "○" are produced upon receipt of order.

- Refer to page 10-12-26 for details on other applicable auto switches than listed above.
- For details about auto switches with pre-wire connector, refer to page 10-20-66.

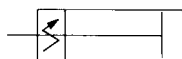
# Stroke Reading Cylinder Series CE1

## Cylinder Specifications



Fluid	Air		
Proof pressure	1.5 MPa		
Maximum operating pressure	1.0 MPa		
Minimum operating pressure	ø12	ø20 to ø63	
	0.07 MPa	0.05 MPa	
Piston speed	70 to 500 mm/s		
Ambient and fluid temperature	0 to 60°C (No freezing)		
Humidity	25 to 85% RH (No condensation)		
Lubrication	Non-lube		
Stroke length tolerance range	ø12, ø20: $+1.0_0$	ø32, ø40, ø50, ø63: $+1.6_0$	
	With Air cushion	ø12, ø20, ø32...None	ø40, ø50, ø63...With
Thread tolerance	JIS Class 2		
Rod non-rotating accuracy	ø12	ø20	ø32, ø40, ø50, ø63
	$\pm 2^\circ$	$\pm 1^\circ$	$\pm 0.8^\circ$
Mounting	Both ends tapped (Standard), Foot style, Flange style, Double clevis style		
Auto switch	Reed type, Solid state type		

### JIS Symbol



## Mounting Bracket Part No.

Bore size (mm)	Foot *	Flange	Double clevis
12	CQ-L012	CQ-F012	CQ-D012
20	CQ-L020	CQ-F020	CQ-D020
32	CQ-L032	CQ-F032	CQ-D032
40	CQ-L040	CQ-F040	CQ-D040
50	CQ-L050	CQ-F050	CQ-D050
63	CQ-L063	CQ-F063	CQ-D063

Note 1) When ordering the foot bracket., order 2 pcs. per cylinder.

Note 2) Parts belonging to each bracket are as follows.

Foot, Flange/Body mounting bolts  
Double clevis/Clevis pin, type C snap ring for shaft, Body mounting bolts

## Auto Switch Mounting Bracket Part No.

Bore size (mm)	Mounting bracket part no.	Note	Applicable auto switch
12 20	BQ-1	• Switch mounting screw (M3 x 0.5 x 8ℓ) • Square nut	D-A7□/A80 D-A7□H/A80H D-A73C/A80C D-A79W D-F7□V
32 40 50 63	BQ-2	• Switch mounting screw (M3 x 0.5 x 10ℓ) • Switch spacer • Switch mounting nut	D-F7□/J79 D-J79C D-F7□WV D-F7□W/J79W D-F7BAL/F7BAVL D-F79F/F7NTL

## Sensor Specifications

Cable	ø7, 6 core twisted pair shielded wire (Oil, Heat & Flame resistant cable)	
Maximum transmission distance	23 m (when using SMC cable and counter)	
Position detection method	Magnetic scale rod <Non-rotating>	Sensor head <Incremental type>
	14.5 mT	
Magnetic field resistance	14.5 mT	
Power supply	10.8 to 26.4 VDC (Power supply ripple: 1% or less)	
Current consumption	40 mA	
Resolution	0.1 mm/pulse	
Accuracy	$\pm 0.2$ mm (at 20°C) (1)	
Output type	Open collector (24 VDC, 40 mA)	
Output signal	A/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, Y directions 4 hrs. in Z direction based upon JIS D 1601	
Impact resistance	30 G 3 times each in X, Y, Z directions	
Enclosure	IP65 (IEC Standard) (2) Except connector tor part	
Extension cable (Option)	5 m, 10 m, 15 m, 20 m	

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

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

Note 2) The cylinder section does not have a water resistant enclosure.

## Standard Stroke

Bore size (mm)	Stroke (mm)											Manufacturable stroke range	
	25	50	75	100	125	150	175	200	250	300	400		500
12	●	●	●	●	●	●	—	—	—	—	—	—	25 to 150
20	●	●	●	●	●	●	●	●	—	—	—	—	25 to 300
32	—	●	●	●	●	●	●	●	●	●	—	—	25 to 400
40	—	—	—	●	●	●	●	●	●	●	●	●	25 to 600
50	—	—	—	—	—	—	—	●	—	●	—	●	25 to 600
63	—	—	—	—	—	—	—	●	—	●	—	●	25 to 600

\* Please contact SMC regarding non-standard strokes.

When the bore size is 12 mm and the stroke length is 100 mm or more, particular care should be taken regarding an offset load on the rod.

RE<sup>A</sup><sub>B</sub>

REC

C□X

C□Y

MQ<sup>Q</sup><sub>M</sub>

RHC

MK(2)

RS<sup>Q</sup><sub>G</sub>RS<sup>H</sup><sub>A</sub>

RZQ

MI<sup>W</sup><sub>S</sub>

CEP1

CE1

CE2

ML2B

C<sup>1</sup>/<sub>5</sub>-S

CV

MVGQ

CC

RB

J

D-

-X

20-

Data



# Series CE1

## Weight (Without mounting bracket/connector)

Bore size (mm)	Cylinder stroke (mm)												(kg)
	25	50	75	100	125	150	175	200	250	300	400	500	
12	0.29	0.33	0.36	0.4	0.43	0.47	—	—	—	—	—	—	—
20	0.51	0.58	0.65	0.72	0.79	0.86	0.93	1.0	—	—	—	—	—
32	—	0.94	1.05	1.15	1.26	1.36	1.47	1.58	1.79	2.0	—	—	—
40	—	—	—	1.7	1.83	1.95	2.08	2.2	2.45	2.7	3.2	3.7	—
50	—	—	—	—	—	—	—	3.4	—	4.1	—	5.5	—
63	—	—	—	—	—	—	—	4.2	—	5.0	—	6.6	—

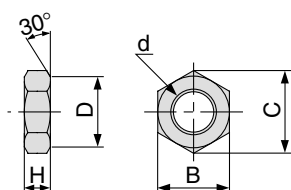
## Proper Auto Switch Mounting Position

Regarding dimensions for the proper auto switch mounting position (at stroke end), refer to page 10-12-26.

## Rod End Nut Dimensions

(1 pc. is attached as standard.)

Material  $\phi 12, 20$ : Steel  
 $\phi 32$  to  $\phi 63$ : Rolled steel



Part no.	Applicable bore size (mm)	d	H	B	C	D
NTJ-015A	12	M5 x 0.8	4	8	9.2	7.8
NT-02	20	M8 x 1.25	5	13	15.0	12.5
NT-04	32, 40	M14 x 1.5	8	22	25.4	21.0
NT-05	50, 63	M18 x 1.5	11	27	31.2	26

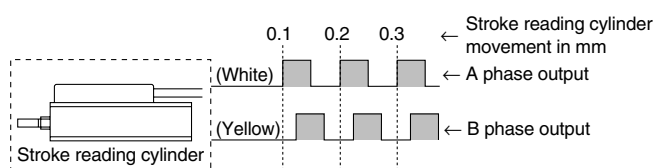
## Electrical Wiring

### Output type

The output signal of the stroke reading cylinder is A/B phase difference output (open collector output) as shown in the figure below.

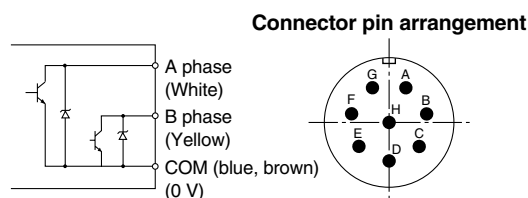
The relation between the movement distance and the signal output of the stroke reading cylinder is that for each 0.1 mm of movement a one pulse signal is output to both output terminals A and B.

Furthermore, the maximum response speed of the sensor for the stroke reading cylinder is at a maximum cylinder speed of 1500 mm/s (15 kcps).



### Input/Output

The input/output of the stroke reading cylinder is performed by a  $\phi 7$  shielded twisted pair wire from the sensor section plus a connector.



Output circuit of stroke reading cylinder

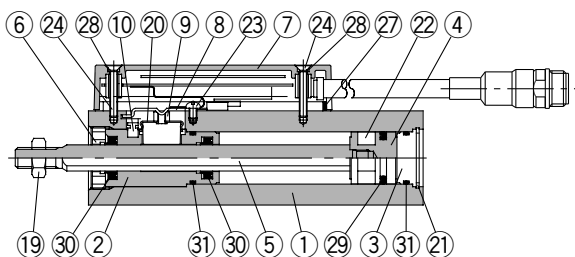
### Signal

Contact signal	Wire color	Signal name
A	White	A phase
B	Yellow	B phase
C	Brown	COM (0 V)
D	Blue	COM (0 V)
E	Red	+12 to 24 V
F	Black	0 V
G	—	Shield

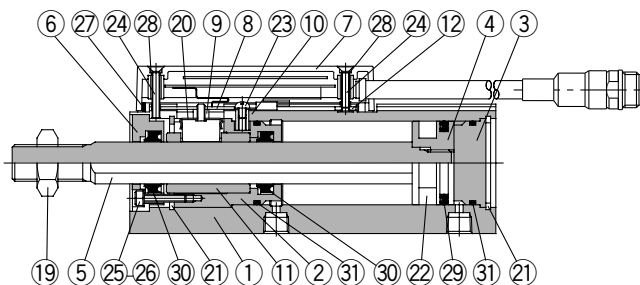
# Stroke Reading Cylinder Series CE1

## Construction

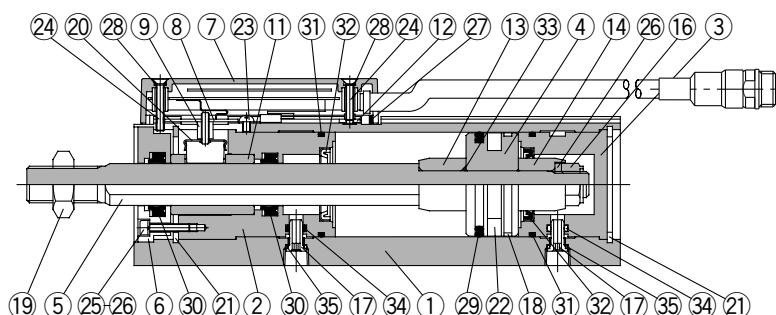
ø12, ø20



ø32



ø40 to ø63



### Component Parts

No.	Description	Material	Note
①	Cylinder body	Aluminum alloy	
②	Rod cover	Brass	ø12 to ø20
		Aluminum alloy	ø32 to ø63
③	Head cover	Aluminum alloy	
④	Piston	Magnetic material	ø12
		Aluminum alloy	ø20 to ø63 (Built-in magnet)
⑤	Piston rod	Stainless steel	
⑥	Rod cover disk	Aluminum alloy	
⑦	Sensor unit	—	
⑧	Sensor setting bracket	Stainless steel	
⑨	Sensor setting piece assembly	—	ø20 to ø63
⑩	Pin	Stainless steel	ø12 to ø32
⑪	Sensor guide	Lead-bronze casted	ø32 to ø63
⑫	Case setting nut	Carbon steel	ø32 to ø63
⑬	Cushion ring A	Rolled steel	ø40 to ø63
⑭	Cushion ring B	Rolled steel	ø40 to ø63
⑮	Cushion valve	—	ø40 to ø63
⑯	Piston nut	Rolled steel	ø40 to ø63
⑰	Port joint	Stainless steel	ø40 to ø63

No.	Description	Material	Note
⑱	Wear ring	Resin	ø40 to ø63
⑲	Rod end nut	Carbon steel	
⑳	Sensor setting plate	Cold rolled special steel strip	
㉑	Type C snap ring	Carbon steel	
㉒	Magnet	—	
㉓	Round head Phillips screw	Carbon steel wire	
㉔	Cross recessed countersunk head screw	Carbon steel wire	
㉕	Hexagon socket head cap screw	Chromium molybdenum steel	
㉖	Spring washer	Steel wire	
㉗	Case gasket	NBR	
㉘	Case screw gasket	NBR	
㉙	Piston seal	NBR	
㉚	Rod seal	NBR	
㉛	Gasket	NBR	
㉜	Cushion seal	NBR	
㉝	Piston gasket	NBR	
㉞	Port seal	NBR	
㉟	Joint seal	NBR	
㊱	Valve seal	NBR	
㊲	Valve retainer seal	NBR	

\* Since there is a possibility of improper operation, please contact SMC regarding the replacement of seals.

RE<sub>B</sub><sup>A</sup>

REC

C□X

C□Y

MQ<sub>M</sub><sup>Q</sup>

RHC

MK(2)

RS<sub>G</sub><sup>Q</sup>RS<sub>A</sub><sup>H</sup>

RZQ

MI<sub>S</sub><sup>W</sup>

CEP1

CE1

CE2

ML2B

C<sub>G</sub><sup>1</sup>5-S

CV

MVGQ

CC

RB

J

D-

-X

20-

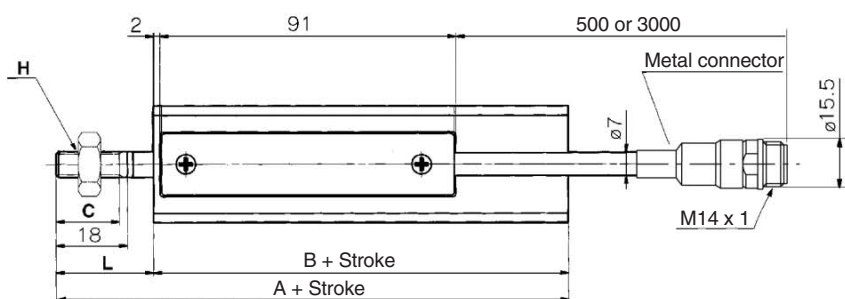
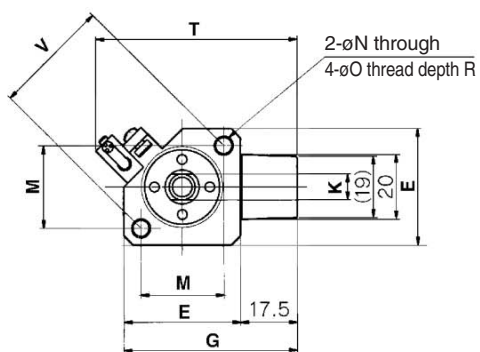
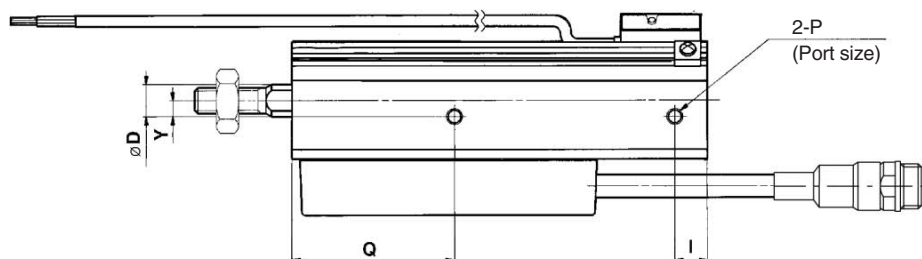
Data

# Series CE1

Dimensions:  $\phi 12$ ,  $\phi 20$

Both ends tapped style:

CE1B Bore size — Stroke



Bore size (mm)	Standard stroke	A	B	C	D	E	G	H	I	K	L	M
12	25, 50, 75, 100, 125, 150	94	69	15	6	25	42.5	M5 x 0.8	16	5.2	25	15.5
20	25, 50, 75, 100, 125, 150, 175, 200	106	78	15.5	10	36	53.5	M8 x 1.25	10	8	28	25.5

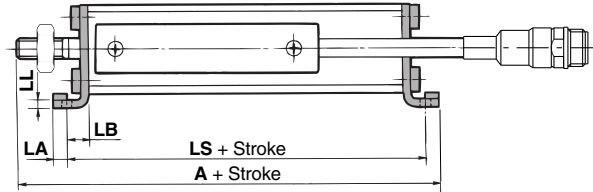
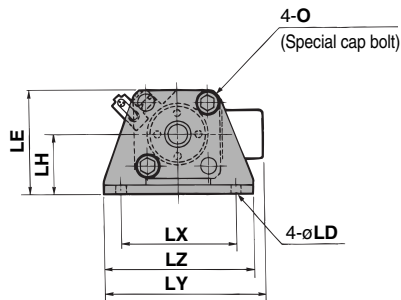
Bore size (mm)	N	O	P	Q	R	T*	V	Y
12	—	M4 x 0.7	M5 x 0.8	47	7	53.5	22	7
20	5.5	M6 x 1	M5 x 0.8	50	15	62.5	36	5

\* For rod nut and accessory bracket, refer to page 10-12-20. \* Dimensions for auto switch model D-F79W.

# Stroke Reading Cylinder Series CE1

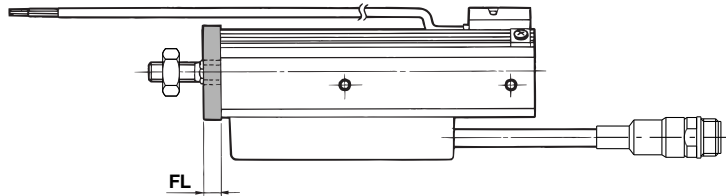
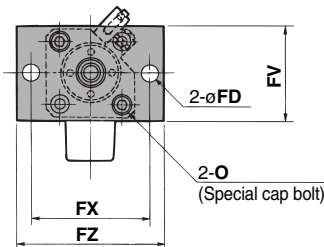
## Foot style:

CE1L Bore size — Stroke



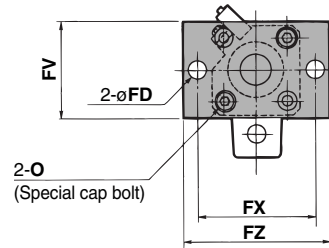
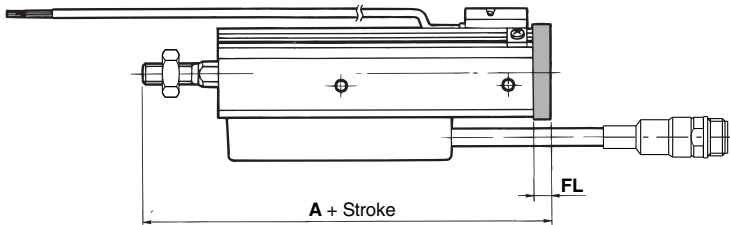
## Rod side flange style:

CE1F Bore size — Stroke



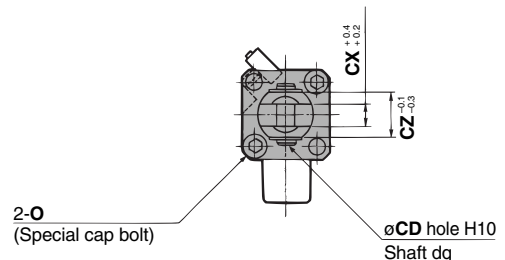
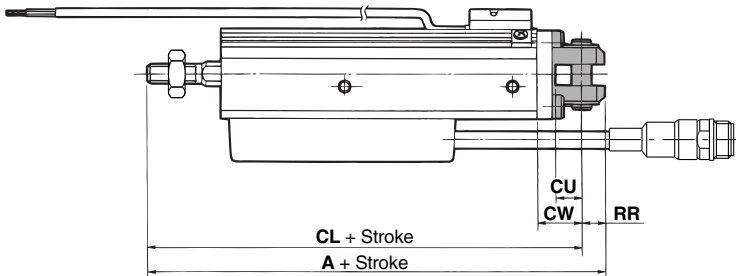
## Head side flange style:

CE1G Bore size — Stroke



## Double clevis style:

CE1D Bore size — Stroke



RE<sup>A</sup><sub>B</sub>

REC

C□X

C□Y

MQ<sup>Q</sup><sub>M</sub>

RHC

MK(2)

RS<sup>Q</sup><sub>G</sub>

RS<sup>H</sup><sub>A</sub>

RZQ

MI<sup>W</sup><sub>S</sub>

CEP1

**CE1**

CE2

ML2B

C<sub>G</sub>5-S

CV

MVGQ

CC

RB

J

D-

-X

20-

Data

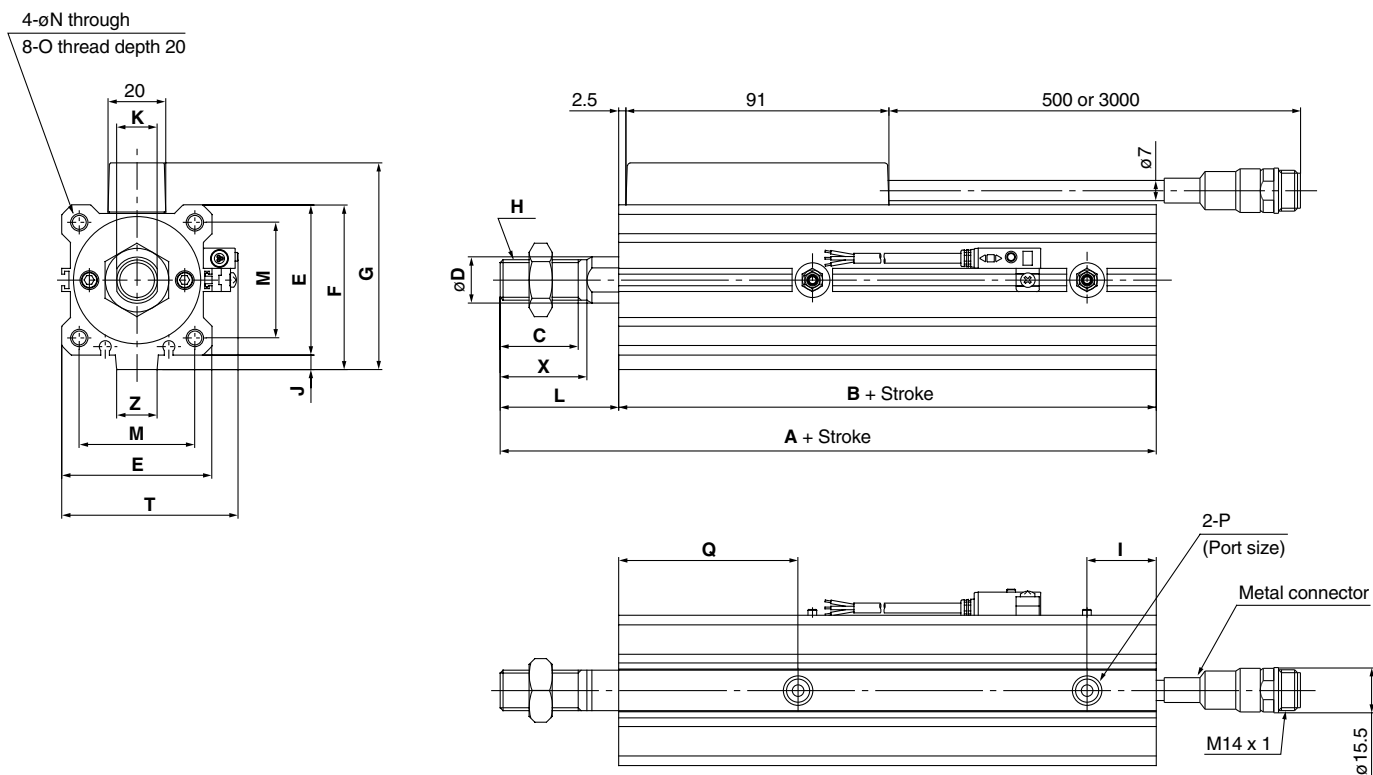
Bore size (mm)	Foot style												Rod side flange, Head side flange					Head side flange	Double clevis style							
	A	LA	LB	LD	LE	LH	LL	LS	LX	LY	LZ	FG	FL	FV	FX	FZ	A	A	CD	CL	CU	CW	CX	CZ	RR	
12	106.5	4.5	8	4.5	29.5	17	2	85	34	52	44	4.5	5.5	25	45	55	99.5	114	5	108	7	14	5	10	6	
20	121	5.8	9.2	6.6	42	24	3.2	96.4	48	66.5	62	6.6	8	39	48	60	114	133	8	124	12	18	8	16	9	

# Series CE1

Dimensions:  $\varnothing 32$ ,  $\varnothing 40$ ,  $\varnothing 50$ ,  $\varnothing 63$

Both ends tapped style:

CE1B Bore size — Stroke



Bore size (mm)	Standard stroke	A	B	C	D	E	F	G	H	I	J	K
32	50, 75, 100, 125, 150, 175, 200, 250, 300	131	90	27	16	45	49.5	64	M14 x 1.5	14	4.5	14
40	100, 125, 150, 175, 200, 250, 300, 400, 500	177	136	27	16	52	57	71.5	M14 x 1.5	24	5	14
50	200, 300, 500	193	144	32	20	64	71	85.5	M18 x 1.5	25.5	7	18
63	200, 300, 500	194	145	32	20	77	84	98.5	M18 x 1.5	21	7	18

Bore size (mm)	L	M	N	O	P	Q	T*	X	Z
32	41	34	5.5	M6 x 1	Rc 1/8	56	57.5	30	14
40	41	40	5.5	M6 x 1	Rc 1/8	62	64.5	30	14
50	49	50	6.6	M8 x 1.25	Rc 1/4	61.5	76.5	35	19
63	49	60	9	M10 x 1.5	Rc 1/4	64	89.5	35	19

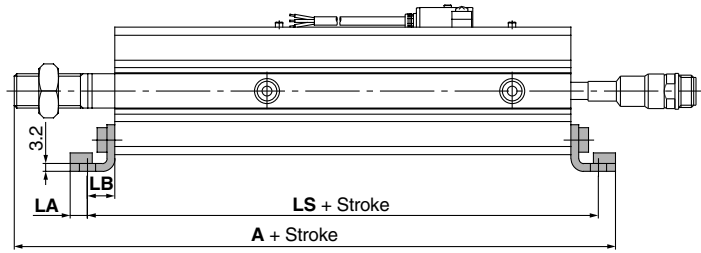
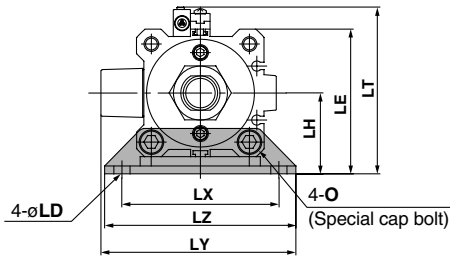
\* For rod nut and accessory bracket, refer to page 10-12-20. \* Dimensions for auto switch model D-F79W.



# Stroke Reading Cylinder Series CE1

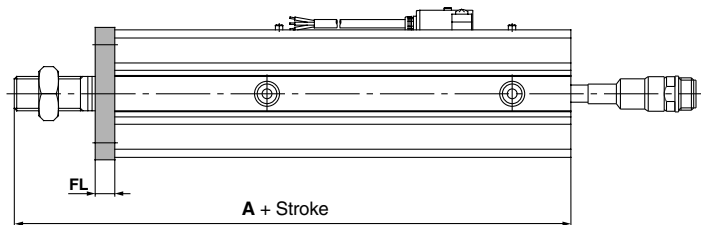
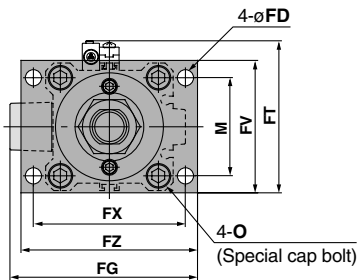
**Foot style:**

CE1L **Bore size** — **Stroke**



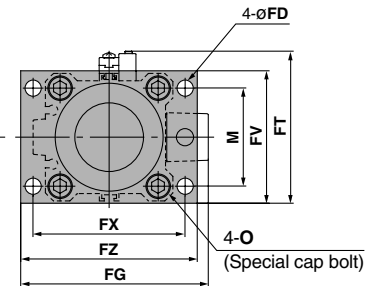
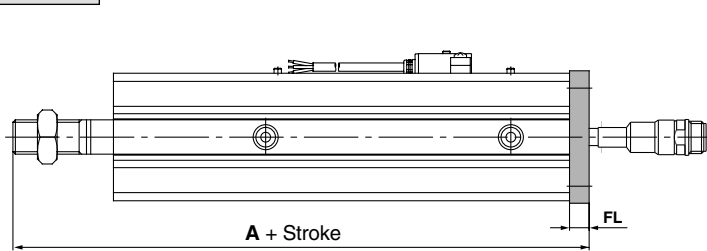
**Rod side flange style:**

CE1F **Bore size** — **Stroke**



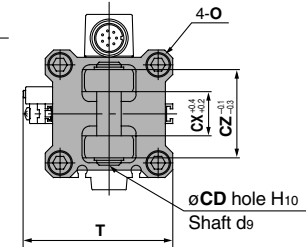
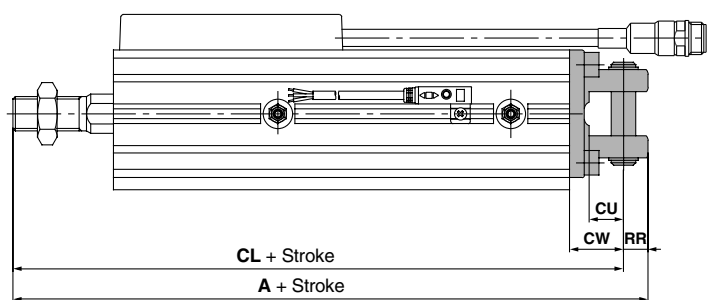
**Head side flange style:**

CE1G **Bore size** — **Stroke**



**Double clevis style:**

CE1D **Bore size** — **Stroke**



Bore size (mm)	Foot style											Rod side flange, Head side flange							Head side flange	Double clevis style									
	A	LA	LB	LD	LE	LH	LS	LT*	LX	LY	LZ	FD	FG	FL	FT*	FV	FX	FZ		M	A	A	CD	CL	CU	CW	CX	CZ	RR
32	148	5.8	11.2	6.6	52.5	30	112.4	65	57	72.5	71	5.5	69.5	8	59	48	56	65	34	139	161	10	151	14	20	18	36	10	57.5
40	195.2	7	11.2	6.6	59	33	158.4	71.5	64	79.5	78	5.5	76.5	8	65.5	54	62	72	40	185	209	10	199	14	22	18	36	10	64.5
50	215.7	8	14.7	9	71	39	173.4	83.5	79	94	95	6.6	91	9	78	67	76	89	50	202	235	14	221	20	28	22	44	14	76.5
63	219.2	9	16.2	11	84.5	46	177.4	97	95	109.5	113	9	107	9	91	80	92	108	60	203	238	14	224	20	30	22	44	14	89.5

\* Dimensions for auto switch model D-F79W.

RE<sup>A</sup><sub>B</sub>

REC

C□X

C□Y

MQ<sup>Q</sup><sub>M</sub>

RHC

MK(2)

RS<sup>Q</sup><sub>G</sub>

RS<sup>H</sup><sub>A</sub>

RZQ

MI<sup>W</sup><sub>S</sub>

CEP1

**CE1**

CE2

ML2B

C<sup>1</sup>/<sub>5</sub>-S

CV

MVGQ

CC

RB

J

D-

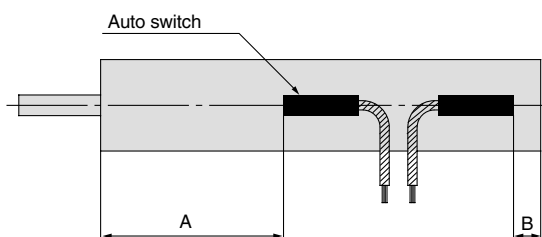
-X

20-

Data

# Series CE1

## Proper Auto Switch Mounting Position (Detection at stroke end)



## Proper Auto Switch Mounting Position

Auto switch model Bore size (mm)	D-A7□ D-A80		D-A7□H/A80H D-A73C/A80C D-F7□/J79 D-F7□V/J79C D-F7□W/J79W D-F7□WV D-F7BAL D-F7BAVL/F79F		D-A79W		D-F7NTL		D-A9□ D-A9□V		D-M9□ D-M9□V D-F9□W D-F9□WV		D-F9BAL	
	A	B	A	B	A	B	A	B	A	B	A	B	A	B
12	40.5	4	41	4.5	38	2	46	9.5	39.5	3	43.5	7	42.5	6
20	47	13	47.5	13.5	44.5	10.5	52.5	18.5	46	12	50	16	49	15
32	55	17	5.5	17.5	52.5	14.5	60.5	22.5	54	16	58	20	57	19
40	79	39	79.5	39.5	76.5	36.5	84.5	44.5	78	38	82	42	81	41
50	82	44	82.5	44.5	79.5	41.5	87.5	49.5	81	43	85	47	84	46
63	85.5	41.5	86	42	83	39	91	47	84.5	40.5	88.5	44.5	87.5	43.5

## Operating Range

Auto switch model	Bore size (mm)					
	12	20	32	40	50	63
D-A7□/A80 D-A7H/A80H D-A73C/A80C	10	12	12	11	10	12
D-A79W	13	13	13	14	14	16
D-A9□/A9□V	—	—	9.5	9.5	9.5	11.5
D-F7□/J79 D-F7□V/J79C D-F7□W/F7□WV D-J79W/F7NNTL D-F7BAL/F7BAVL/F79F	5.5	5.5	6	6	6	6.5
D-M9□/M9□V D-F9□W/F9□WV D-F9BAL	—	—	4.5	4.5	4.5	4.5
	—	—	5.5	5.5	5.5	6

\* Since this is a guideline including hysteresis, not meant to be guaranteed. (Assuming approximately  $\pm 30\%$  dispersion)

There may be the case it will vary substantially depending on an ambient environment.

Other than the applicable auto switches listed in "How to Order", the following auto switches can be mounted. For detailed specifications, refer to page 10-20-1.

Type	Model	Electrical entry (Fetching direction)	Features	Applicable bore size (mm)
Reed switch	D-A80	Grommet (Perpendicular)	Without indicator light	12 to 63
	D-A80H	Grommet (In-line)		
	D-A80C	Connector (Perpendicular)		
	D-A90	Grommet (In-line)		32 to 63
	D-A90V	Grommet (Perpendicular)		
Solid state switch	D-F7NTL	Grommet (In-line)	With timer	12 to 63

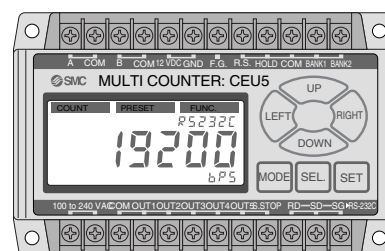
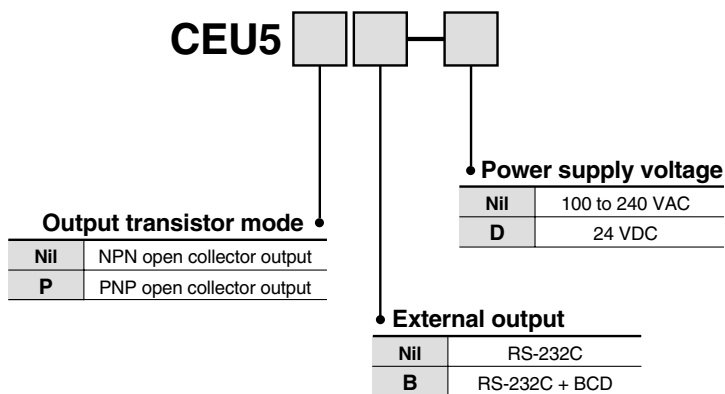
\* With pre-wire connector is available for D-F7NTL type, too. For details, refer to page 10-20-66.

\* Normally closed (NC = b contact), solid state switch (D-F9G/F9H type) are also available. For details, refer to page 10-20-40.

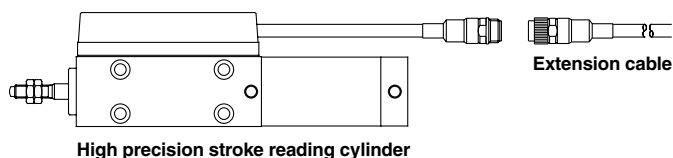
# Series CEU/Series CE Counter/Extension Cable

## Multi-counter

### How to Order



## Connection Method



If the distance between high precision stroke reading cylinder and multi-counter is over 23 meter, use transmission box. (CE1-H0374)

#### BCD Connector Specifications

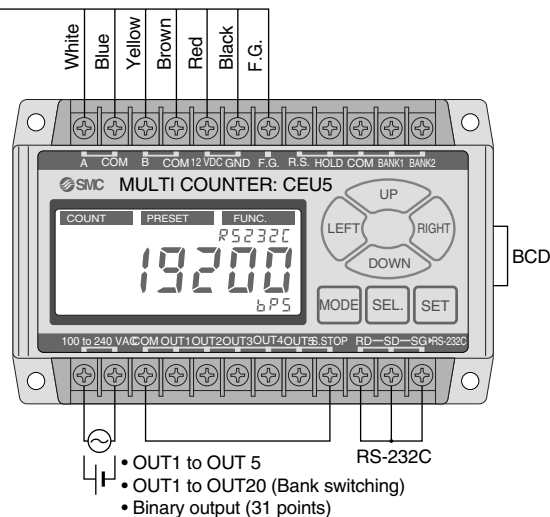
Model (counter side):

DX10M-36S (made by Hirose Electric Co., Ltd.)

Connector model:

DX30AM-36P (made by Hirose Electric Co., Ltd.)

Please consult with SMC separately for a BCD cable with connector.

RE<sub>A</sub>  
B

REC

C□X

C□Y

MQ<sup>Q</sup><sub>M</sub>

RHC

MK(2)

RS<sup>Q</sup><sub>G</sub>RS<sup>H</sup><sub>A</sub>

RZQ

MI<sup>W</sup><sub>S</sub>

CEP1

CE1

CE2

ML2B

C<sub>6</sub><sup>1</sup>/5-S

CV

MVGQ

CC

RB

J

D-

-X

20-

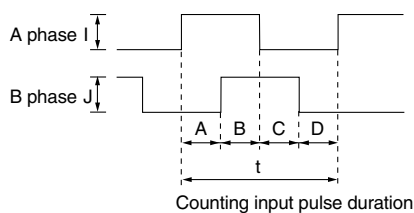
Data

# Series CEU5

## Multi-counter/Specifications

Model	CEU5	CEU5-D	CEU5P	CEU5P-D	CEU5B	CEU5B-D	CEU5PB	CEU5PB-D
Type	Multi-counter							
Mounting	Surface mounting (DIN rail or Screw stop)							
Operating system	Adding - subtracting type							
Operation mode	Operating mode, Data setting mode, Function setting mode							
Reset system	External reset terminal							
Display system	LCD (With back light)							
Number of digits	6 digits							
Memory holding (Storage medium)	Setting value (always held), Count value (Hold/Non-hold switching), {E <sup>2</sup> ROM (Warning display after writing approx. 800,000 times: E2FUL)}							
Input signal type	Count input, Control signal input (Reset, Hold, Bank selection)							
Count input	No-voltage pulse input							
Pulse signal system	90° phase difference input *1/ UP/DOWN separate input *2							
Counting speed	100 kHz *1							
Control signal input	Voltage input (12 VDC or 24 VDC)							
Sensor power supply	10.8 to 13.2 VDC, 60 mA							
Output signal type	Preset output, Cylinder stop output				Preset output, Cylinder stop output, BCD output			
Preset output configuration	Compare/Hold/One-shot (100 ms fixed pulse)							
Output type	Separate 5 point output/Binary code output							
Output delay time	5 ms or less (for normal output)							
Communication system	RS-232C							
Output transistor mode	NPN open collector Max 30 VDC, 50 mA		PNP open collector Max 30 VDC, 50 mA		NPN open collector Max 30 VDC, 50 mA *3		PNP open collector Max 30 VDC, 50 mA *3	
Power supply voltage	90 to 264 VAC	21.6 to 26.4 VDC	90 to 264 VAC	21.6 to 26.4 VDC	90 to 264 VAC	21.6 to 26.4 VDC	90 to 264 VAC	21.6 to 26.4 VDC
Power consumption	20 VA or less	10 W or less	20 VA or less	10 W or less	20 VA or less	10 W or less	20 VA or less	10 W or less
Withstand voltage	Between case and AC line: 1500 VAC for 1 min. Between case and signal ground: 500 VAC for 1 min.							
Insulation resistance	Between case and AC line: 500 VDC, 50 MΩ or more							
Ambient temperature	0 to 50°C (No freezing)							
Ambient humidity	35 to 85% RH (No condensation)							
Noise resistance	Square wave noise from a noise simulator (pulse duration 1 μs) between power supply terminals ±2000 V, I/O line ±600 V							
Shock resistance	Endurance 10 to 55 Hz; Amplitude 0.75 mm; X, Y, Z for 2 hours each							
Impact resistance	Endurance 10 G; X, Y, Z directions, 3 times each							
Weight	350 g or less							

\*1) 90° phase difference input



A:  
B:  
C:  
D:

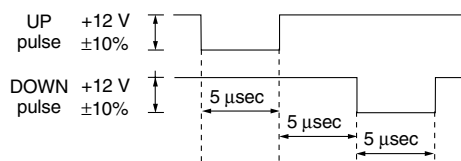
2.5 μsec or more required

t : 10 μsec or more required

$$\text{Counting speed } f = \frac{1}{t} = \frac{1}{10 \times 10^{-6}} = 100000 \text{ Hz} \approx 100 \text{ kHz}$$

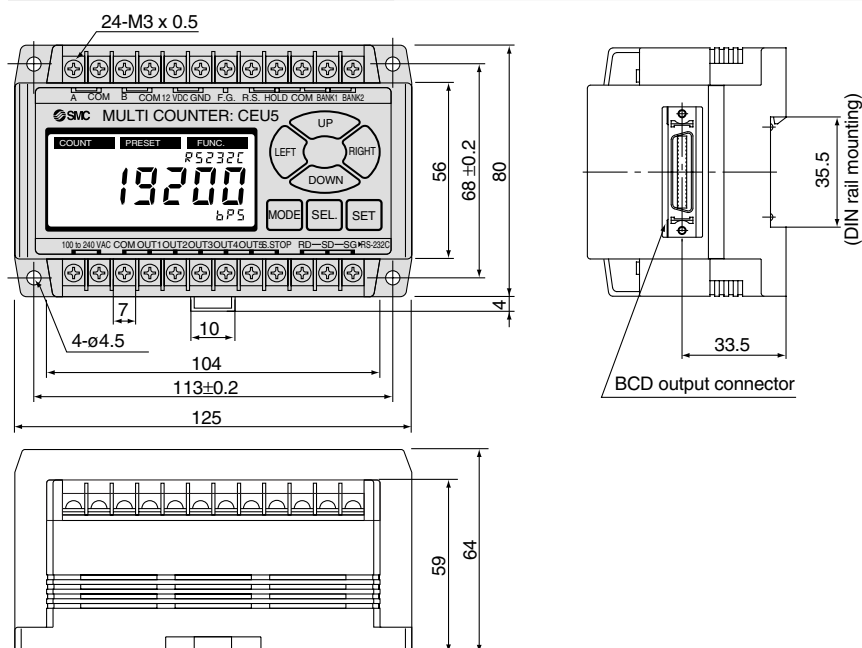
\*2) UP/DOWN input

Input wave form conditions: At a maximum of 100 kHz, the UP/DOWN wave form should be as shown below.



\*3) 15 mA when BCD is output.

## Multi-counter/Dimensions



## Wiring with External Equipment

### <Wiring with multi counter CEU5>

#### 1. Wiring of power source for driving counter

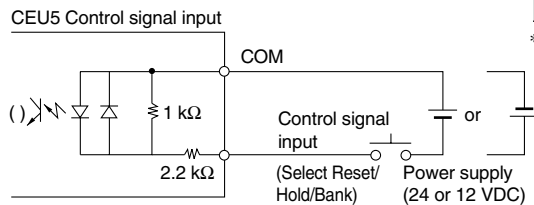
For power source for driving counter, use the one with 90 to 264 VAC, 50/60 Hz or 21.6 to 264 VDC, 0.4 A or more.

#### 2. Wiring for control signal input

##### (Selection among Reset, Hold, Bank)

Make each control signal to be the transistor which can run more than 15 mA or the contact output. Input time for reset signal should be more than 10 ms. Bank selection and hold will function only when the input signal is applied.

COM is common to each signal input. Applicable to NPN and PNP input. Use 24 VDC or 12 VDC for the power source of COM. Connect DC- when PNP is applied, and DC+ when NPN is applied.



#### 3. Output circuit

There are two outputs, the NPN open collector and the PNP open collector.

The maximum rating is 30 VDC, 50 mA. Operating the controller by exceeding this voltage and amperage could damage the electric circuit.

Therefore, the equipment to be connected must be below this rating.

Model	CEU5□-□	CEU5P□-□
Connection method	<p>NPN transistor output</p>	<p>PNP transistor output</p>

\* However, the COM of the input circuit and the COM of the output circuit are electrically insulated from each other.

RE<sub>B</sub><sup>A</sup>

REC

C□X

C□Y

MQ<sub>M</sub><sup>Q</sup>

RHC

MK(2)

RS<sub>G</sub><sup>Q</sup>RS<sub>A</sub><sup>H</sup>

RZQ

MI<sub>S</sub><sup>W</sup>

CEP1

CE1

CE2

ML2B

C<sub>G</sub><sup>1</sup>5-S

CV

MVGQ

CC

RB

J

D-

-X

20-

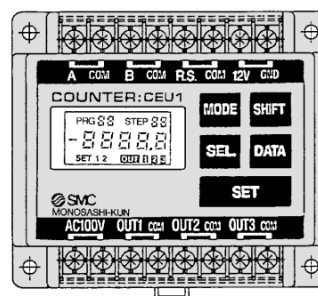
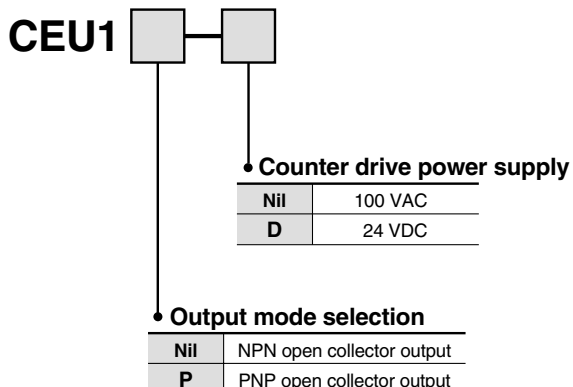
Data



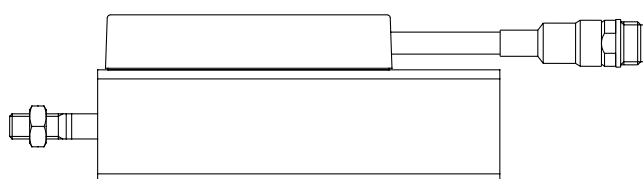
# Series CEU1

## ■ 3-point Preset Counter

### How to Order



### Connection Method

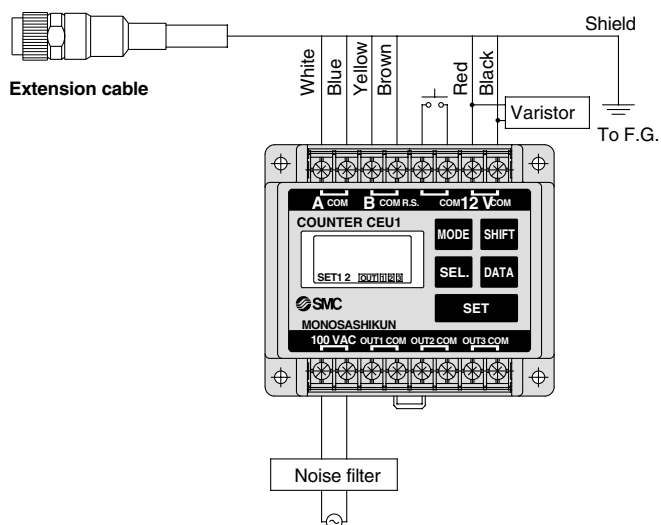


Stroke reading cylinder

Anti-noise performance will be improved by placing varistor, noise filter as a figure at right.

Shielding should be connected to FG (frame ground).  
If sources of noise generation (motors, AC type valves, relays, etc.) are connected on the secondary side of the noise filter, the filter will have no effect.

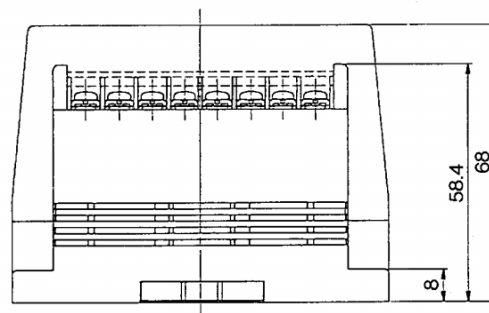
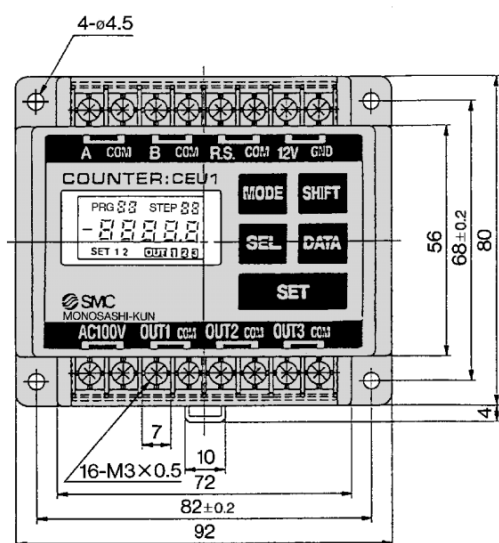
When the distance between stroke reading cylinder and counter is over 23 m, use a transmission box (CE1-H0374).



### 3-point Preset Counter/Specifications

Model	CEU1	CEU1P	CEU1-D	CEU1P-D
Type	3-point preset counter			
Mounting	Surface mounting (DIN rail or Screw stop)			
Operating system	Adding - subtracting type			
Operation modes	Operating mode, Data setting mode			
Reset system	External reset terminal			
Display system	LCD (With back light)			
Number of digits	5 digits display (-9999.9 to 9999.9)			
Memory holding {Storage medium}	Preset data (always held) (E <sup>2</sup> ROM (Warning display after writing approx. 65,000 times: $F_L$ ))			
Input signal type	Count input, Reset input			
Count input	No-voltage pulse input			
Pulse signal system	90° phase difference input			
Counting speed	20 kHz			
Reset input	R.S. and COM terminals are shorted for 10 ms or more (Pulse input)			
Sensor power supply	10.8 to 13.2 VDC, 60 mA			
Output signal type	Preset output			
Preset output configuration	Compare/Hold/One-shot (100 ms fixed pulse)			
Output delay time	5 ms or less			
Output transistor mode	NPN open collector Max. 30 VDC, 50 mA	PNP open collector Max. 30 VDC, 50 mA	NPN open collector Max. 30 VDC, 50 mA	PNP open collector Max. 30 VDC, 50 mA
Power supply voltage	80 to 120 VAC 50/60 Hz		21.6 to 26.4 VDC	
Power consumption	10 VA or less		5 W or less	
Withstand voltage	Between case and AC line: 1500 VAC for 1 min. Between case and signal ground: 500 VAC for 1 min.			
Insulation resistance	Between case and AC line: 500 VDC, 50 MΩ or more			
Ambient temperature	0 to 50°C (without freezing)			
Ambient humidity	35 to 85% RH (No condensation)			
Noise resistance	Square wave noise from a noise simulator (pulse duration 1 μs) between power supply terminals ±1500 V, I/O line ±600 V			
Shock resistance	Endurance 10 to 55 Hz; Amplitude 0.75 mm; X, Y, Z for 2 hours each			
Impact resistance	Endurance 10 G; X, Y, Z directions, 3 times each			
Weight	250 g or less			

### 3-point Preset Counter/Dimensions

RE<sub>B</sub><sup>A</sup>

REC

C□X

C□Y

MQ<sub>M</sub><sup>Q</sup>

RHC

MK(2)

RS<sub>G</sub><sup>Q</sup>RS<sub>A</sub><sup>H</sup>

RZQ

MI<sub>S</sub><sup>W</sup>

CEP1

CE1

CE2

ML2B

C<sub>G</sub><sup>1</sup>5-S

CV

MVGQ

CC

RB

J

D-

-X

20-

Data

# Series CEU

## ■ Extension Cable

### How to Order

CE1-R

• Cable length

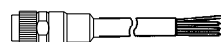
05	5 m
10	10 m
15	15 m
20	20 m

• Suffix

Nil	Extension cable
C	Extension cable & connector

Extension cable

CE1-R



Stroke reading cylinder side connector (unit)

CE1-R00C



R04-J8M7.3  
(Made by Tajimi Electronics Co., Ltd.)

CE1-R  C



## Operating Condition of each Output Mode

### One-shot Output

Without allowable values	With allowable values
<p>When the counter value passes the preset value, output is turned ON for 100 ms.</p>	<p>When the counter value passes the sum of the preset value + the allowed value, output is turned ON for 100 ms.</p>

### Hold Output

Without allowable values	With allowable values
<p>When the counter value passes the preset value, output is turned ON and that state is maintained. Output is cancelled when the power is turned off, the reset signal is input or when the setting value is changed.</p>	<p>When the counter value passes the sum of the preset value + the allowed value, output is turned ON. Output is cancelled when the power is turned off, the reset signal is input or when the setting value is changed.</p>

### Compare Output

Without allowable values	With allowable values
<p>Output is turned ON only when the counter value coincides with the preset value.</p>	<p>When the counter value passes the sum of the preset value + the allowed value, output is turned ON.</p>

RE<sup>A</sup><sub>B</sub>

REC

C<sup>□</sup>X

C<sup>□</sup>Y

MQ<sup>Q</sup><sub>M</sub>

RHC

MK(2)

RS<sup>Q</sup><sub>G</sub>

RS<sup>H</sup><sub>A</sub>

RZQ

MI<sup>W</sup><sub>S</sub>

CEP1

CE1

CE2

ML2B

C<sup>1</sup><sub>5-S</sub>

CV

MVGQ

CC

RB

J

D-

-X

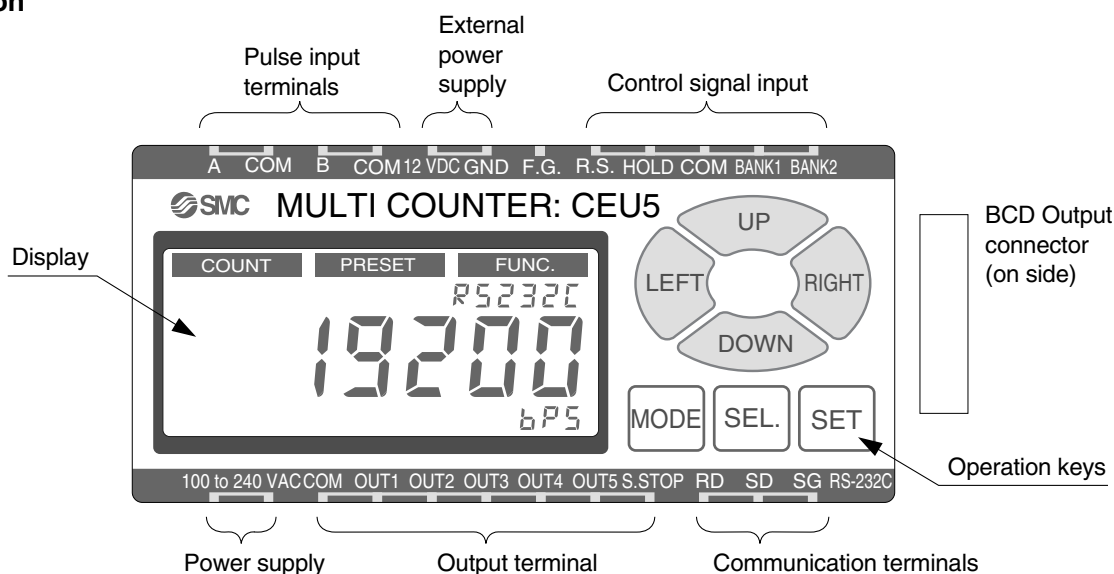
20-

Data

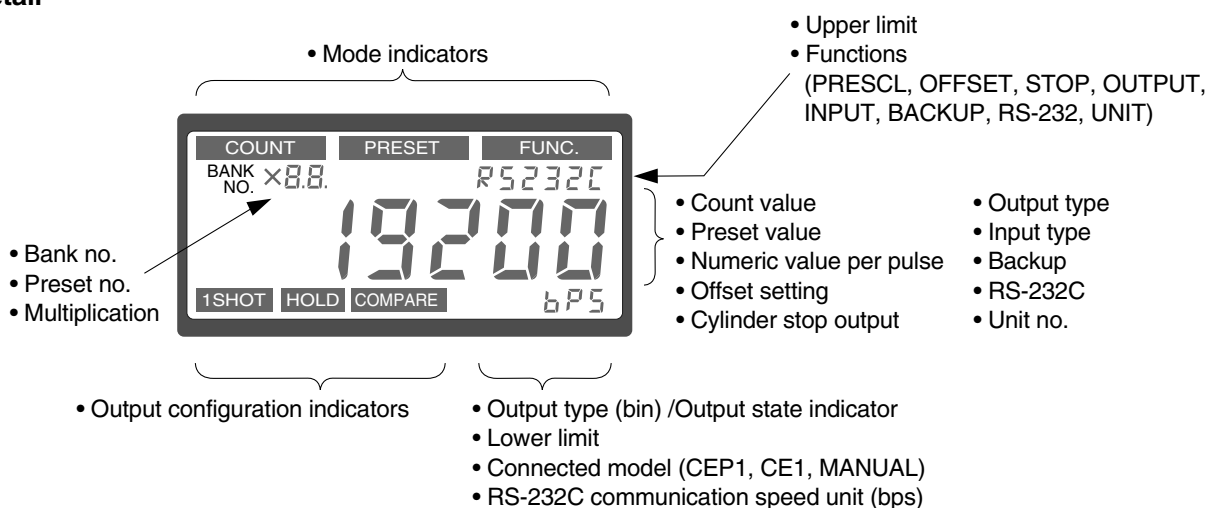
# Series CEU

## CEU5 Operation

### Parts description



### Display detail

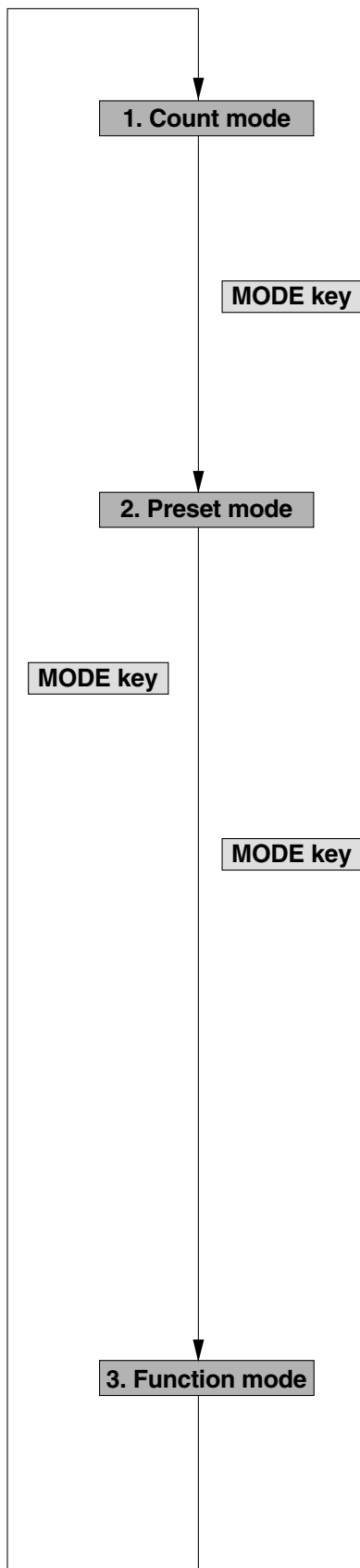


### Key and Functions

Key	Functions
MODE	Changes the mode. In any given condition, it shifts to the next mode. Does not write data.
SEL.	Shifts the cursor to the next item. Does not write data.
SET	Writes displayed data into the memory when setting.
RIGHT	Shifts the cursor to the right when setting numerical values.
LEFT	Shifts the cursor to the left when setting numerical values.
UP	Changes the contents of a setting. Increases the value when setting numerical values.
DOWN	Changes the contents of a setting. Decreases the value when setting numerical values.

In the explanations of the operating method, references to "Direction keys" indicate the 4 keys RIGHT, LEFT, UP and DOWN.

Mode cycle using mode key

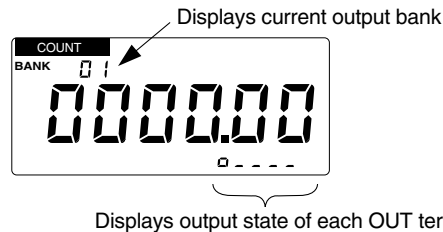


**Basic Operation**

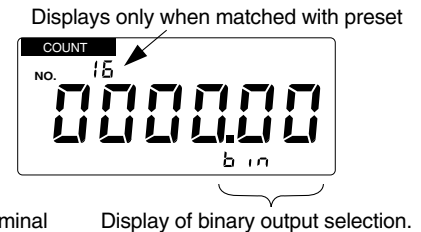
- **SET key** : In any of the conditions (1) through (5), this writes the display data into the memory and shifts to (1).
- **SEL. key** : Shifts to the next item, but does not write data.
- **MODE key** : In any given condition, this shifts to the next mode, but does not write data.
- **Direction keys** : LEFT/RIGHT keys shift the digits, and UP/DOWN keys increase or decrease numerical values.

**1. Explanation of display in count mode**

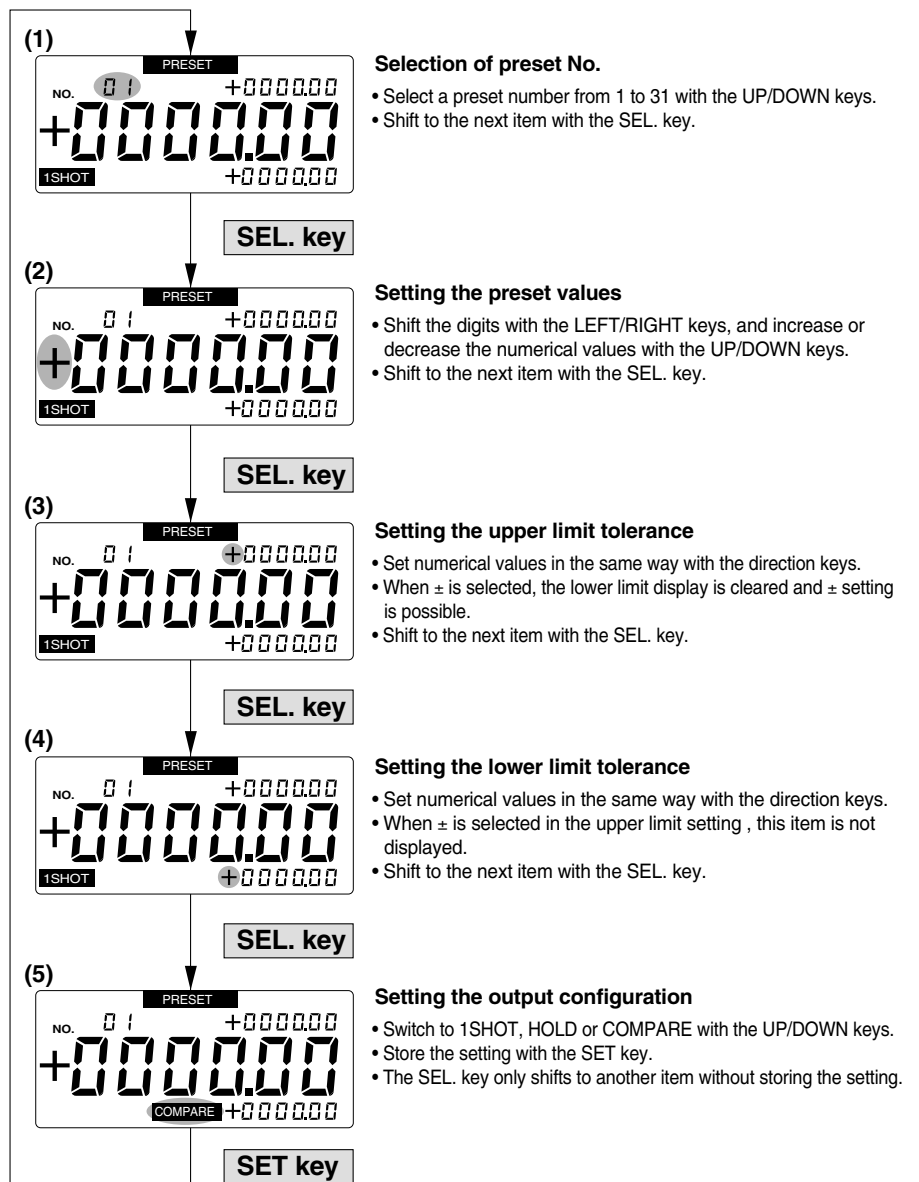
**Normal output display**



**Binary output display**



**2. Setting of preset mode**



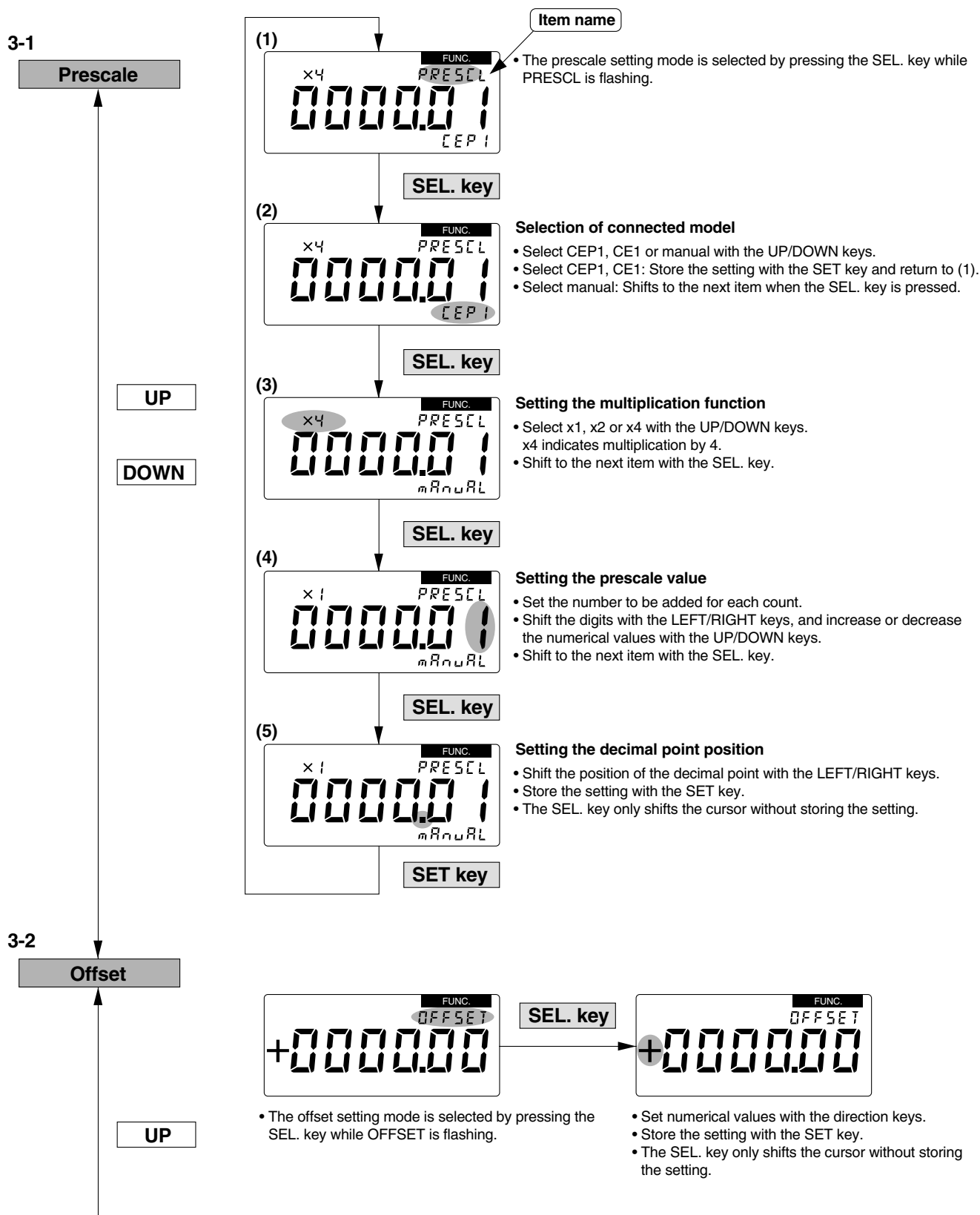
- RE<sub>B</sub><sup>A</sup>
- REC
- C□X
- C□Y
- MQ<sub>M</sub><sup>Q</sup>
- RHC
- MK(2)
- RS<sub>G</sub><sup>Q</sup>
- RS<sub>A</sub><sup>H</sup>
- RZQ
- MI<sub>S</sub><sup>W</sup>
- CEP1
- CE1
- CE2
- ML2B
- C<sub>5-S</sub><sup>1</sup>
- CV
- MVGQ
- CC
- RB
- J
- D-
- X
- 20-
- Data

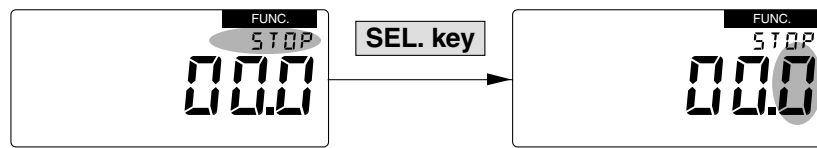
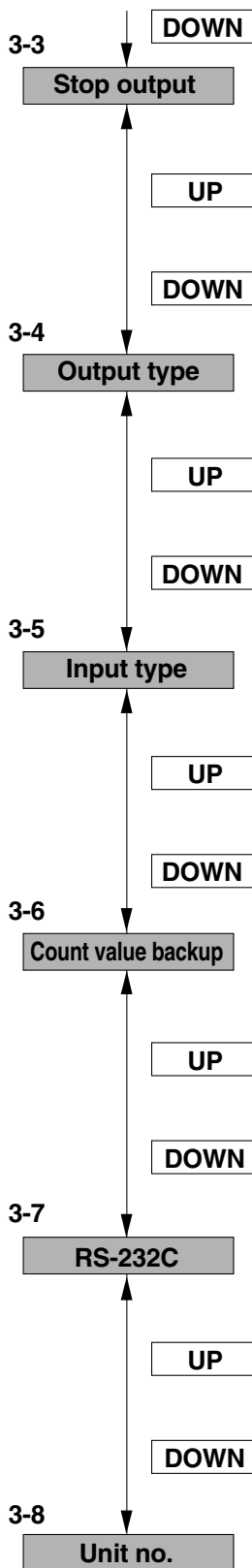
# Series CEU

## CEU5 Operation

### 3. Explanation of settings in the function mode

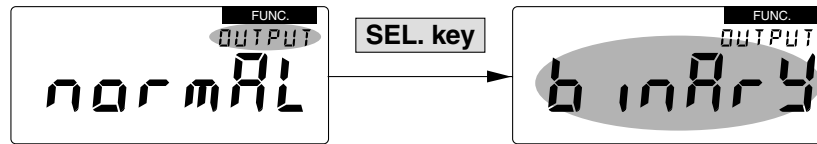
If the UP/DOWN keys are pressed when an item name is flashing, it shifts to another setting item. When the SEL. key is pressed, the cursor shifts and it is possible to change the content of the setting for the item which is being displayed.





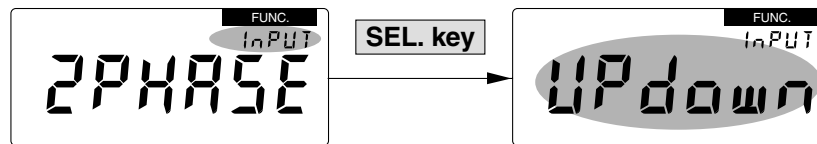
• The setting mode for stand-by time until stop output is commanded is selected by pressing the SEL. key while STOP is flashing.

- Set numerical values with the direction keys.
- The unit is 0.1 sec.
- Store the setting with the SET key.
- The SEL. key only shifts the cursor without storing the setting.



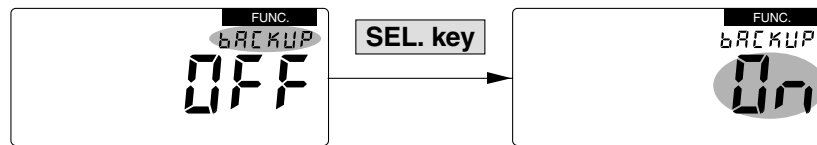
• The output system setting mode is selected by pressing the SEL. key while OUTPUT is flashing.

- Select normal output or binary output with the UP/DOWN keys.
- Store the setting with the SET key.
- The SEL. key only shifts the cursor without storing the setting.



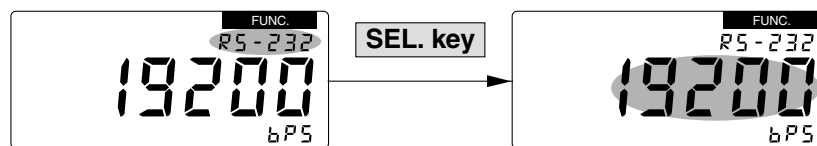
• The input type setting mode is selected by pressing the SEL. key while INPUT is flashing.

- Select phase difference input with the UP/DOWN keys. (2PHASE) or separate input (UP/DOWN) with the UP/DOWN keys.
- Store the setting with the SET key.
- The SEL. key only shifts the cursor without storing the setting.



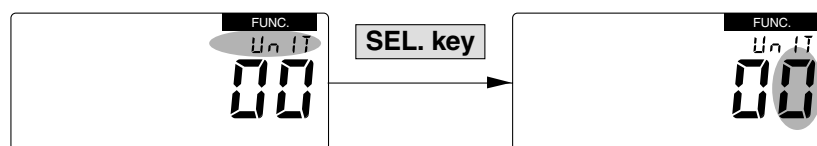
• The count value backup setting mode is selected by pressing the SEL. key while BACKUP is flashing.

- Select ON or OFF with the UP/DOWN keys.
- Store the setting with the SET key.
- The SEL. key only shifts the cursor without storing the setting.



• The RS-232C communication speed setting mode is selected by pressing the SEL. key while RS-232 is flashing.

- Select the communication speed from 1200, 2400, 4800, 9600 or 19200 with the UP/DOWN keys.
- Store the setting with the SET key.
- The SEL. key only shifts the cursor without storing the setting.



• The unit number registration mode is selected by pressing the SEL. key while UNIT is flashing.

- Set numerical values with the direction keys.
- Settings can be made from 00 to 99.
- Store the setting with the SET key.

RE<sub>A</sub><sub>B</sub>

REC

C<sub>0</sub>X

C<sub>0</sub>Y

MQ<sub>M</sub><sup>Q</sup>

RHC

MK(2)

RS<sub>G</sub><sup>Q</sup>

RS<sub>A</sub><sup>H</sup>

RZQ

MI<sub>S</sub><sup>W</sup>

CEP1

CE1

CE2

ML2B

C<sub>0</sub>5-S

CV

MVGQ

CC

RB

J

D-

-X

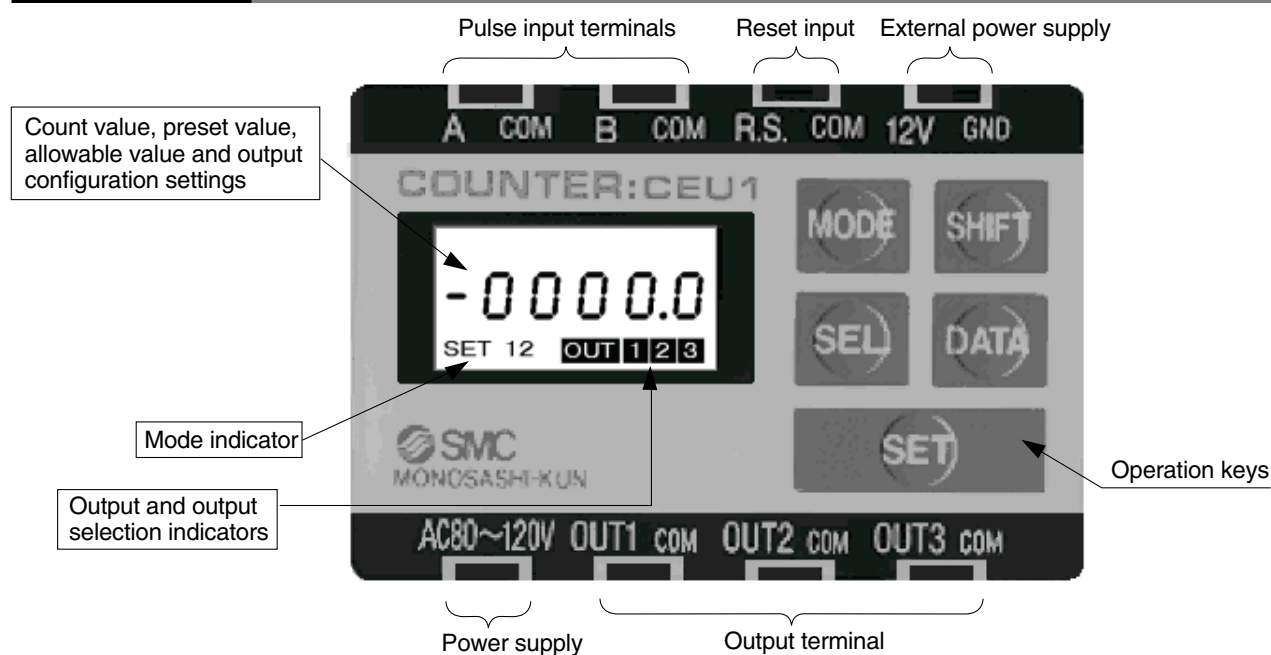
20-

Data



# Series CEU

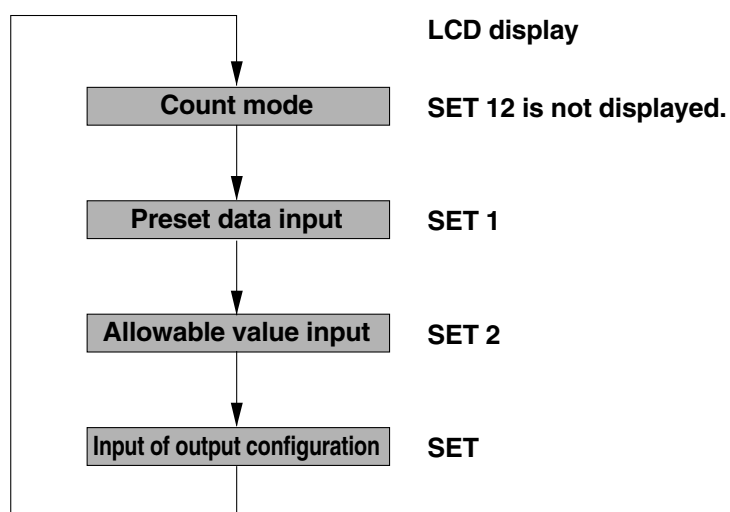
## CEU1 Operation

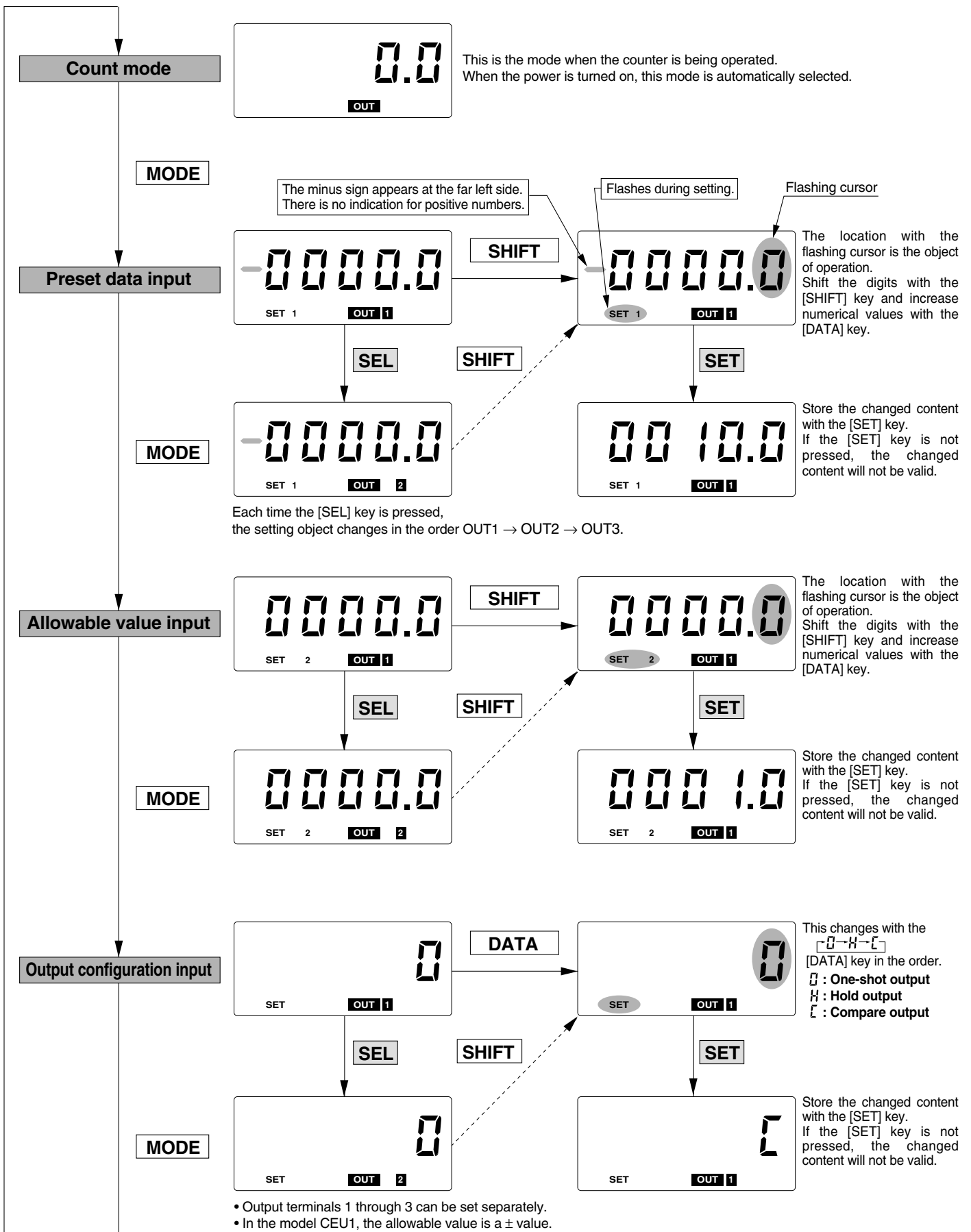


### Key and Functions

Key	Functions
MODE	Switches between the count mode and the setting mode.
SHIFT	Switches digits for preset data input and allowable value input. Shifts the flashing cursor to the left each time it is pressed.
SEL	In the setting mode, this switches the output terminal number which is to be set. Switches in the order OUT1 → OUT2 → OUT3 each time it is pressed.
DATA	In the setting mode, this changes numerical values, or codes and symbols. Numerical values increase by 1 each time it is pressed. For positive and negative codes, a minus sign turns on or off.
SET	Registers the setting contents in the setting mode. Press this key to perform registration after making setting changes. The setting will not be registered if the screen is changed by pressing the [MODE] or [SEL] keys without pressing the [SET] key.

The counter mode changes in the order shown below each time the [MODE] key is pressed.





- Output terminals 1 through 3 can be set separately.
- In the model CEU1, the allowable value is a ± value. (Only the model CEU5 is equipped with a function to set different values for the upper and lower limits.)

RE <sup>A</sup> <sub>B</sub>
REC
C□X
C□Y
MQ <sup>Q</sup> <sub>M</sub>
RHC
MK(2)
RS <sup>Q</sup> <sub>G</sub>
RS <sup>H</sup> <sub>A</sub>
RZQ
MI <sup>W</sup> <sub>S</sub>
CEP1
CE1
CE2
ML2B
C <sup>1</sup> / <sub>5</sub> -S
CV
MVGQ
CC
RB
J
D-
-X
20-
Data

## Series CE

# Glossary (Functions of CEU5)

### BCD Output

This is a system which expresses one digit of a decimal number with a 4 digit binary number.

The count value is expressed by the ON/OFF state of each BCD output terminal. In the case of 6 digits, 24 terminals are required.

The relation between decimal numbers and BCD codes is shown in the table below.

Decimal no.	0	1	2	3	4	5	6	7	8	9
BCD	0000	0001	0010	0011	0100	0101	0110	0111	1000	1001

Ex.) 1294.53 is expressed as follows.

0001 0010 1001 0100 0101 0011

### RS-232C

This is the interface standard for the serial transmission method, which is standard equipment on a personal computer.

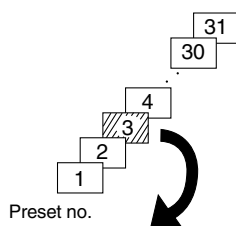
### Prescale Function

This function allows free setting of how many millimeters will indicate one pulse.

### Binary Output

31 point preset output is possible without bank switching, by means of binary system output from a 5 point output terminal. Cylinder stop output is used as the readout release signal.

When the count value coincides with preset no. 3.

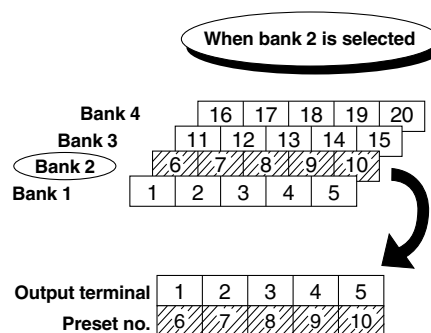


Output terminal	1	2	3	4	5
Pattern indicating no. 3	On	On	Off	Off	Off

The coincident preset number is expressed as a 5 digit binary number.

### Bank Function

5 points of preset output are possible simultaneously, however, a maximum of 20 types of work discrimination, etc. can be performed by using the 5 points of preset values as one of a maximum of four quadrats, and switching its use during operation.



Output terminal	1	2	3	4	5
Preset no.	6	7	8	9	10

For example, when bank 2 is selected, presets 6 through 10 are valid and when the count value coincides with the setting value of 6 through 10, the respective output terminals 1 through 5 are turned ON.

### Bank Switching Correspondence

Input terminal	BANK2	BANK1
Bank no. 1	OFF	OFF
2	OFF	ON
3	ON	OFF
4	ON	ON

## Series CE

# Glossary (Functions of CEU5)

### Display Offset Function

Normally the count value returns to "0" after resetting, but with this function, the initial value can be set to any desired value.

### Hold Function

When "hold" is input, the counter holds the current count value in memory. Next, when the count value is read into a PLC which uses serial or BCD output, etc., the count value that was held can be read in, even if there is a time lag.

### Setting the Tolerances of Preset Values

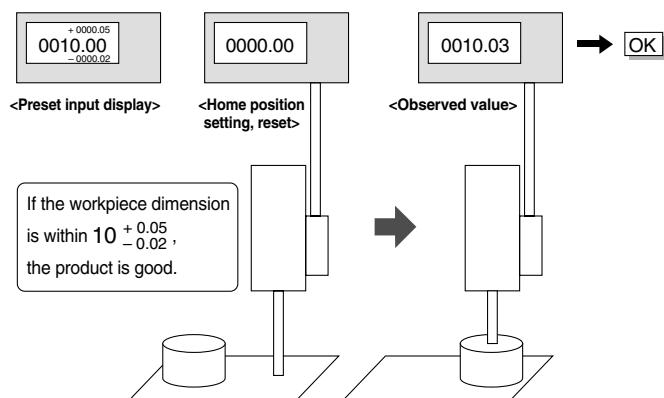
In the current model CEU1, the preset value tolerances could only be set as  $\pm$ , but now it has become possible to set an upper and lower limit of  $+ \bigcirc$  mm and  $- \triangle$  mm.

By including preset tolerance setting, superior performance is exhibited in parts inspections, etc. In a workpiece to be measured, there are tolerances which assure a good product. For example, in the case of  $10^{+0.05}_{-0.02}$ , the CEU5 allows these tolerances to be input as they stand. If the workpiece is within tolerances the OK signal is sent.

On the other hand, in ordinary counters, no. 1 is set to 9.98 and no. 2 is set to 10.06, and if no. 1 is ON and no. 2 is OFF, an acceptance decision is made. 2 points of output are used in order to check whether or not the product is within dimension tolerances. In this example, one preset of the CEU5 performs the same function as two presets of an ordinary counter.

<Simple input as per drawing dimensions>  
Tolerances can be set with the preset value.

OK/NG signal is output by the counter.  
Labor savings can be realized in parts inspections.



### Count Value Protection

In the past, the count value returned to "0" when the power supply was cut off, but this function holds the previous value even after a power failure. This function can be switched between active and inactive settings.

### Cylinder Stop Output

When workpiece discrimination is performed using a preset counter, it has been common to estimate the amount of time from the cylinder's start of operation until it touches the workpiece and stops, using a timer to read the output after a fixed amount of time. Since cylinder stop output is now output when there is no cylinder movement for a fixed amount of time, timing of preset output and external output, etc. is simplified.

RE<sub>B</sub><sup>A</sup>

REC

C□X

C□Y

MQ<sub>M</sub><sup>Q</sup>

RHC

MK(2)

RS<sub>G</sub><sup>Q</sup>RS<sub>A</sub><sup>H</sup>

RZQ

MI<sub>S</sub><sup>W</sup>

CEP1

CE1

CE2

ML2B

C<sub>G</sub><sup>1</sup>5-S

CV

MVGQ

CC

RB

J

D-

-X

20-

Data