OPERATION MANUAL

PRODUCT NAME: **HYRODLESS MONOSASHI-KUN**

MODEL   :   ML2B Series

- READ THIS OPERATION MANUAL CAREFULLY BEFORE USE IT.

- NEVER INSTALL THE PRODUCT UNTIL FINISH READING THIS

- KEEP THIS MANUAL ALL THE TIME FOR YOUR REFERENCE.

SMC CORPORATION

Contents

Specifications are subject to change without prior notice

Chapter 1: Read before Use

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

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

＊1) ISO 4414: Pneumatic fluid power - General rules relating to systems

ISO 10218-1: 2006: Robots for industrial environments - Safety requirements - Part 1: Robot

IEC 60204-1: Safety of machinery - Electrical equipment of machines - Part 1:General requirements

JIS B 8370: General Rules for Pneumatic systems

JIS B 9960-1: Safety of machinery - Electrical equipment of machines - Part 1: General requirements

JIS B 8433-1:2007: Robots for industrial environments - Safety requirements - Part 1: Robot

＊2) Labor Safety and Sanitation Law etc.

⚠Warning

1. The compatibility of pneumatic equipment is the responsibility of the person who designs the pneumatic system or decides its specifications.

   Since the products specified here are used in various operating conditions, their compatibility for the specific pneumatic system must be based on specifications or after analysis and/or tests to meet your specific requirements. Ensuring the initial performance and safety are the responsibility of the person who decides the compatibility of the pneumatic system. Pneumatic systems should be constructed after full review of the details of the products other than specifications and possibilities of failures by checking the latest product information.

2. Only trained personnel should operate poneumaticallly operated machinery and equipment.

   Assembly, handling, or repair of pneumatic systems should be performed by trained and experienced operators.

3. Do not service machinery/equipment or attempt to remove component until safety is confirmed.
   a. Inspection and maintenance of machinery/equipment should only be performed after confirmation of safe locked-out control positions.
   b. When equipment is to be removed, confirm the safety process as mentioned above. Cut the supply pressure for this equipment and exhaust all residual compressed air in the system.
   c. Before machinery/equipment is re-started, take measure to prevent shooting-out of cylinder piston rod etc.

4. Contact SMC and take necessary safety measures if the products are to be used in any of the following conditions:
   a. Conditions and environments beyond the given specifications, or if products are used outdoors.
   b. Installation on equipment in conjunction with atomic energy, railway, air navigation, vehicles, medical equipment, food and beverages, recreation equipment, emergency stop circuits, press applications, or safety equipment.
   c. An application which has the possibility of having negative effects on people, property, or animals, requiring special safety analysis.
   d. When used in an interlock circuit, dual interlock such as mechanical protection is necessary in case of accident. Periodical inspection is also necessary to confirm proper operation.

Operating and Storage Environments

⚠Warning

1. Envioments to avoid

Avoid using or storing the products in the following environments which may cause failures.

If the products need to be used or stored in those environments, take necessary measures.

a. Place where ambient temperature exceeds the range of 5℃ to 60℃.

b. Place where ambient humidity exceeds the range of 35% to 85% RH.

c. Place where condensation occurs due to sudden temperature change.

d. Place where atmosphere containing corrosive gas, flammable gas or organic solvent.

e. Place where atmosphere containing con-ductive powder such as dust and iron chips, oil mist, salt, or organic solvent, or splashing cutting chips, dust and cutting oil (water , liquid) over the products.

f. Place where the products are exposed to direct sunlight or radiated heat.

g. Place where strong electromagnetic noise is generated (place where strong electric field, strong magnetic field or surge is generated).

h. Place where static electricity is discharged or condition that the products have electrostatic discharge.

i. Place where strong high frequency is gene-rated.

j. Place where damages of thunder are expected.

k. Place where vibration or impact is directly given to the products.

l. Condition that the products are deformed by force or weight applied.

2. Do not close any objects which are affected by magnets.

Since magnets are built in cylinders, do not close magnetic disks, magnetic cards or magnetic tapes. The data may be destroyed.

Precaution on Design

⚠Warning

1. There is a possibility of dangerous sudden action by cylinders if sliding parts of machi-nery are twisted due to external forces, etc.

In such cases, human injury may occur; e. g., by catching hands or feet in the machinery, or damage to the machinery itself may occur.

2. Provide a cover to minimize the risk of human injury.

When a driven object or moving parts of a cylinder may cause the risk of human injury, design a structure to avoid contact with human body.

3. Securely tighten all stationary parts and connected parts of cylinders so that they will not become loose.

Tighten cylinders securely especially when they are used in high frequency or in locations where direct vibration or impact shock, etc. will be applied to the body of the cylinder.

4. Deceleration circuits or shock absorbers are needed in some cases.

If a driven object travels at a high speed or is heavy, impact will not be sufficiently absorbed only with the cylinder cushion. In such cases, use a circuit to decelerate the cylinder speed before the cushion becomes effective or use external shock absorbers to reduce impact. At this time, take the rigidity of machinery into account.

5. Consider possible drop of pressure in circuit due to power outage.

For cylinders used in clamping mechanism, a work may become loose due to less clamping force by pressure drop in circuit at the time of power outage. Install safety devices to prevent human injury and machinery damage. Measures should be taken to prevent drop of hanging or lifing equipment.

6. Consider possible loss of power sources.

Measures should be taken to protect against human injury and machinery damage in the event that there is a loss of air pressure, electricity or hydraulic power.

7. Design circuit to prevent shooting out of a driven object.

A driven object is quickly shot out when pressure is supplied from one side of the piston after air in the cylinder is exhausted in such cases that cylinder is actuated by exhaust center type of directional control valve or started after residual air is exhausted from the circuit. At this time, human injury may occur; e.g., by catching hands or feet in the machinery, or damage to the machinery itself may occur. Therefore, the machine should be designed and constructed to prevent shooting out.

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

9. Consider actions when operation is restarted after an emergency stop or abnormal stop.
Design the machinery so that human injury or equipment damage will not occur upon restart of operation. When the cylinder is required to return to the initial position, provide the equipment with a safe override.

10. Construct the machinery so that moving objects and the moving parts of the cylinder with brake do not come into direct contact with the human body.

11. Use a balanced circuit in which lurching of the cylinder is prevented. When operation is locked in specified intermediate positions of the stroke, and air pressure is applied to only one side of the cylinder, the piston will lurch when the lock is released. This might cause injury or damage to machinery.

Selection

⚠Warning

1. Confirm the specifications.
The product in this manual is designed to be used only in industrial compressed air system. The product should not be used with pressures or temperatures outside the range of the specifications, as this may cause damage or malfunction, etc.

2. Intermediate stop
When cylinder piston is stopped intermediately by 3-position closed center type of directional control valve, intermediate stop positions may not be as precise and exact as hydraulic operation due to compressibility of air. Valves and cylinders are not guaranteed for zero air leakage, and stop position may not be held in a long period of time. Consult SMC for long term holding of stop positions.

3. When a cylinder is in a no-load and locked state, the holding force (maximum static load) is the lock's ability to hold a static load that does not involve vibrations or shocks. To ensure braking force, the maximum load must be set as described below.

①For constant static loads, such as for drop prevention:

35% or less of holding force (Maximum static load)

Note) For applications such as drop prevention, consider situations in which the air source is shut off, and make selections based on the holding force of the spring locked state. Do not use the pneumatic lock for drop prevention purposes.

②When kinetic energy acts upon the cylinder, such as when effecting an intermediate stop, there are constraints in terms of the allowable kinetic energy that can be applied to the cylinder in a locked state. Refer to the allowable kinetic energy of the respective series. Furthermore, during locking, the mechanism must sustain the thrust of the cylinder itself, in addition to absorbing the kinetic energy. Therefore, even within a given allowable kinetic energy level, there is an upper limit to the amount of the load that can be sustained.

- Maximum load for horizontal mounting: 70% or less of the holding force (Maximum static load) for spring lock

- Maximum load for vertical mounting: 35% or less of the holding force (Maximum static load) for spring lock

③In a locked state, do not apply impact, strong vibrations or rotational forces. Any impact, strong vibrations or rotational forces from external sources could damage or shorten the life of the lock unit.

④Although the cylinder can be locked in both directions.

⚠Caution

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

Air Supply

⚠Warning

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

①Operating pressure:

Actuating part: 0.1 – 1.0MPa

Braking part: 0.3 – 0.5MPa

②Fluid & ambient temperature: 5 to 60°C

2. Use clean air.

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

⚠Caution

1. Install air filter.

Install air filter before and in vicinity of valve. The filter should be able to collect particles of 5 microns or smaller. A large quantity of drain may cause malfunction of pneumatic components.

2. Install after cooler, air dryer, auto drain, etc.

Compressed air that includes excessive condensate may cause malfunction of valve and other pneumatic equipment. To prevent this, install after cooler, air dryer, auto drain, etc.

Pneumatic circuit

⚠Warning

1. Be certain to use a pneumatic circuit which will apply balanced pressure to both sides of the piston when in a locked stop. (Refer to Chapter 6 for recommended pneumatic circuit.)

In order to prevent the cylinder lurching after a locked stop, use a circuit which applies balanced pressure to both sides of the piston when restarting or when manually releasing the lock, thereby canceling the force generated by the load in the direction of piston movement.

2. Use a solenoid valve for unlocking which has a larger effective area, as a rule 50% or more of the effective area of the cylinder drive solenoid valve.

(Refer to Chapter 6 for recommended pneumatic components.)

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

3. Place the solenoid for unlocking close to the cylinder, and no farther than the cylinder drive solenoid valve.

The shorter the distance from the cylinder, the shorter the overrun amount will be, and stopping accuracy will be improved.

4. Allow at least 0.5 seconds from a locked stop (intermediate stop of the cylinder) until release of the lock.

When the locked stop time is too short, the piston rod may lurch at a speed greater than the control speed of the speed controller.

5. When restarting, control the switching signal for the unlocking solenoid valve so that it acts before or at the same time as the cylinder drive solenoid valve.

If the signal is delayed, the piston rod may lurch at a speed greater than the control speed of the speed controller.

Installation

⚠Warning

1. Connect the slider end and the load with the lock released.

2. Ensure that the equipment operates properly before the use.

3. Operation manual

Do not install the products unless the safety instruction have been read and understood.

Keep this operation manual on file for future reference.

⚠Caution

1. Maintenance space

When installing the products, allow space for maintenance.

2. Do not give strong impact and/or excessive moment when work is mounted.

External force other than allowable moment may cause rattle at guide part and/or increase in sliding resistance.

5. Be careful to avoid scratches or dents, etc. on the sliding sections of the slider.

Wiring

⚠ Warning

1. **Preparation for wiring**
   Shut off the power before wiring (including insertion and removal of connectors). Mount a protective cover on the terminal block after wiring.

2. **Check the power**
   Make sure the power has sufficient capacity and voltages are within the specified range before wiring.

3. **Grounding**
   Ground terminal block F.G. (Frame Ground). Do not ground it with devices generating strong electromagnetic noise.

4. **Check wiring**
   Incorrect wiring may cause damage or malfunction of the products. Make sure the wiring is correct before operation.

⚠ Caution

1. **Separation of signal wires from power wire**
   Avoid common or parallel wiring of signal and power wires to prevent malfunction due to noise.

2. **Wiring arrangement and fixation**
   Avoid bending cables sharply at connector part or electrical entry in wiring arrangement.
   Inproper arrangement may cause disconnection which in turn causes malfunction. Fix cables close enough not to give excessive force to the connector.

Piping

⚠ Caution

1. **Before piping**
   Remove cutting chips, cutting oil, dust, etc. in piping by flushing or cleaning before piping. Care should be taken especially that any cutting chips, cutting oil, dust, etc. do not exist after a filter.

2. **At piping**
   ①Foreign matter should not enter. Entering of foreign matter will cause malfunction.
   ②Cutting chips and sealing materials at piping threads should not enter valves when piping and fittings are screwed in. Leave 1.5 to 2 threads when seal tape is used.

Lubrication

⚠ Caution

1. **Lubrication of cylinder**
   ①This cylinder is pre-lubricated and can be used without lubrication.
   ②In case of lubrication, use a equivalent of the turbine oil type 1 ISO VG32. Once lubrication is performed, it should be continued since the initial lubricant flows out causing malfunction.

Adjustment

⚠ Caution

1. The locks are manually disengaged when the cylinder is shipped from the factory. Be sure to change them to the locked state before using the cylinder.

2. Adjust the cylinder's air balance. In the state in which a load is attached to the cylinder, disengage the lock and adjust the air pressure on the rod side and the head side of the cylinder to obtain a load balance. By maintaining a proper air balance, the piston rod can be prevented from lurching when the lock is disengaged.

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

Sensor unit

⚠ Caution

1. Do not remove the sensor unit.
   The position and sensitivity of the sensor is adjusted properly before shipment.
   Removing or replacing the sensor may cause malfunction.

2. Operate the system with an external magnetic field of 14.5mT or less.
   Strong magnetic field in the vicinity may cause malfunction, since ML2 sensor is magnetic type.
   This is equivalent to a magnetic field of approximately 18cm in radius from a welding area using a welding current of almost 15,000 amperes. To use the system in a magnetic field that exceeds this value, use a magnetic material to shield the sensor unit

Welding machine

18cm

18cm   18cm

Operating range

3. Do not pull sensor cable strongly.
Such action may cause failure.

4. Water shall be kept away from the sensor unit to avoid failure.

5. Power supply line
Do not mount any switch or relay to power supply line (12 VDC).

Measurement

⚠Caution

SMC products are not intended for use as instruments for legal metrology.

Measurement instruments that SMC manufactures or sells have not been qualified by type approval tests relevant to the metrology (measurement) laws of each country. Therefore, SMC products cannot be used for business or certification ordained by the metrology (measurement) laws of each country.

Maintenance and Check

⚠Warning

1. **Performing regular check**
Check regularly that the products do not operate with failures unsolved. Check should be done by trained and experienced operators.

2. **Dismantling of product and supply/exhaust of compressed air.**
Before dismantling, ensure that drop preventing and runaway preventing treatments are properly provided, shut the power source of air supplied, and exhausts compressed air in the system. When starting operation again, operate the product with care after ensuring that a treatment for preventing extrusion is properly provided.

3. **Prohibition of disassembly and modification**
To prevent accidents such as failures and electric shocks, do not remove the cover to perform disassembly or modification. If the cover has to be removed, shut off the power before removal.

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

Chapter 2: General Description / Features

2-1 General Description

Positioning with high reproducibility has been realized by Hyrodless Monosashi-kun, which brake and stroke sensor are installed in mechanical joint type rodless cylinder (MY1B Series). (Stopping accuracy is ±0.5mm when specified controller. CEU2, is used.)

2-2 Features

Brake Structure

- Adoption of integrated pneumatic and spring

  Slider stops instant due to quick response of brake. Also the current position is hold by spring lock when the air pressure is lowered or the compressed air is stopped.

- Lock is possible for both directions

  Lock is possible for reciprocation of cylinder stroke.

- Easy maintenance

  Brake can be replaced and disassembled, and can be opened manually for its unit structure.

- Brake structure which does not give a load on cylinder

  Slider can be stopped without losing its performance since brake does not give a load on cylinder for its structure, which spring acts on brake shoe directly to put between upper and lower brake plates.

Scale

- Minimum measuring unit : 0.1mm

  This is measured by scale plate and detection head built-in body.

Chapter 3: System Configuration

3-1 System Configuration

HYRODLESS MONOSASHI-KUN (ML2 Series) can be used for measurement or to prevent falling besides positioning application.

	Model type	Function		Connected equipment	Application			
		Brake	Scale		Keeping	Intermediate stop	Measurement	Positioning
①	ML2B※	○	○	CEU1	○	○	○	
②	ML2B※	○	○	CEU2				○
③	ML2B※S		○	CEU1			○	
④	ML2B※B	○		Sequence, etc.	○	○		

3-2 Example of system Configuration

■For Keeping

Hyrodless Monosashi-kun + Counter

3 points preset counter : CEU1 Series

External equipment (Sequence controller, etc.)

Counter (CEU1)

COUNTER : CEU.＊-＊

MONOSASHI‐KUN

Brake valve

Solenoid valve

Hyrodless Monosashi-kun (ML2※)

Extension cable (CE1-R□□)
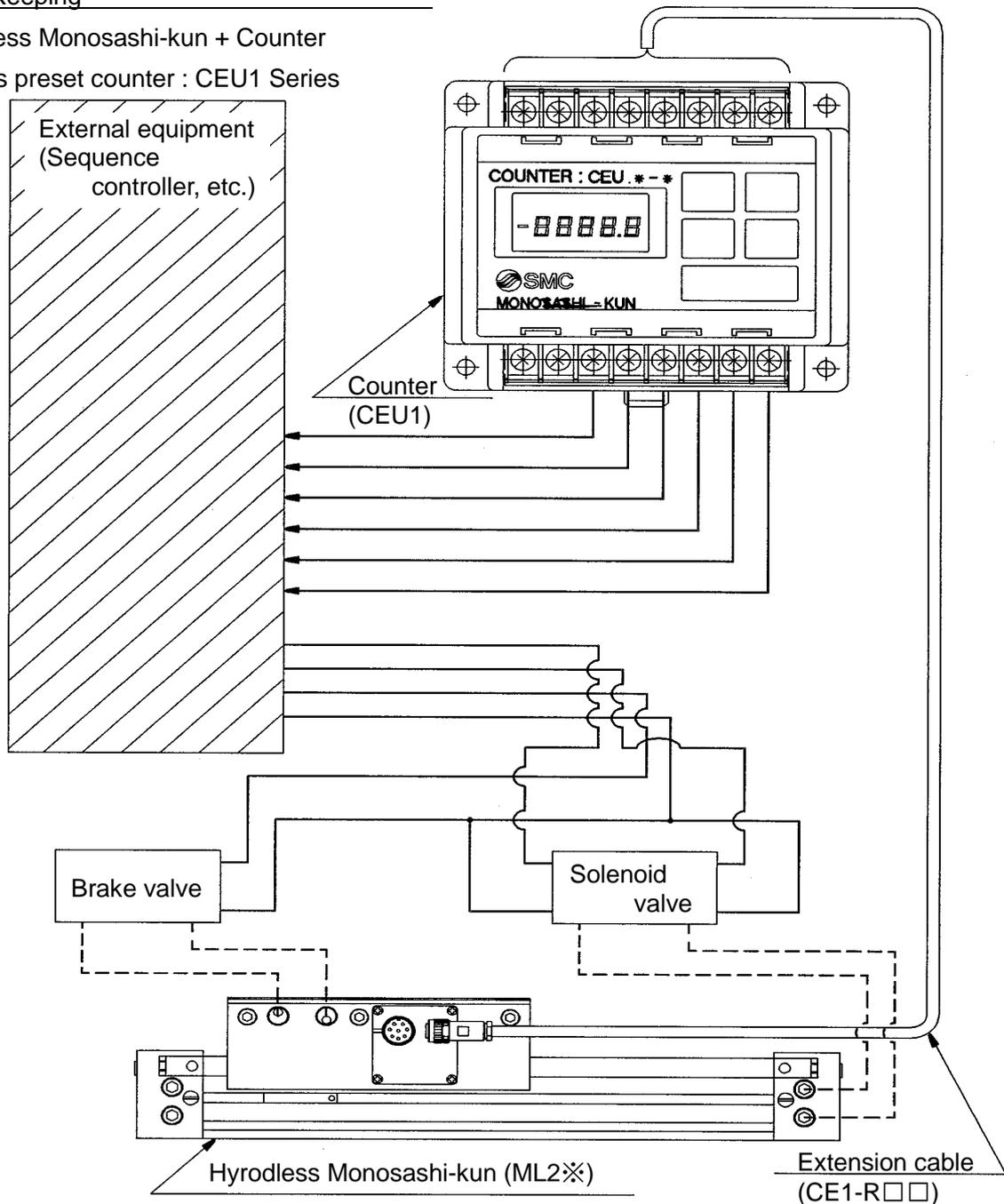
■For precise positioning (Stopping accuracy ±0.5mm)

Hyrodless Monosashi-kun + Controller

Controller : CEU2 Series

External equipment (Sequence controller, etc.)

Controller
(CEU2)

Brake valve

Solenoid
valve

Hyrodless Monosashi-kun (ML2※)

Extension cable
(CE1-R□□)

3-3 Pneumatic Circuit

Horizontal Mounting

Vertical Mounting

<Air Circuit Diagram>
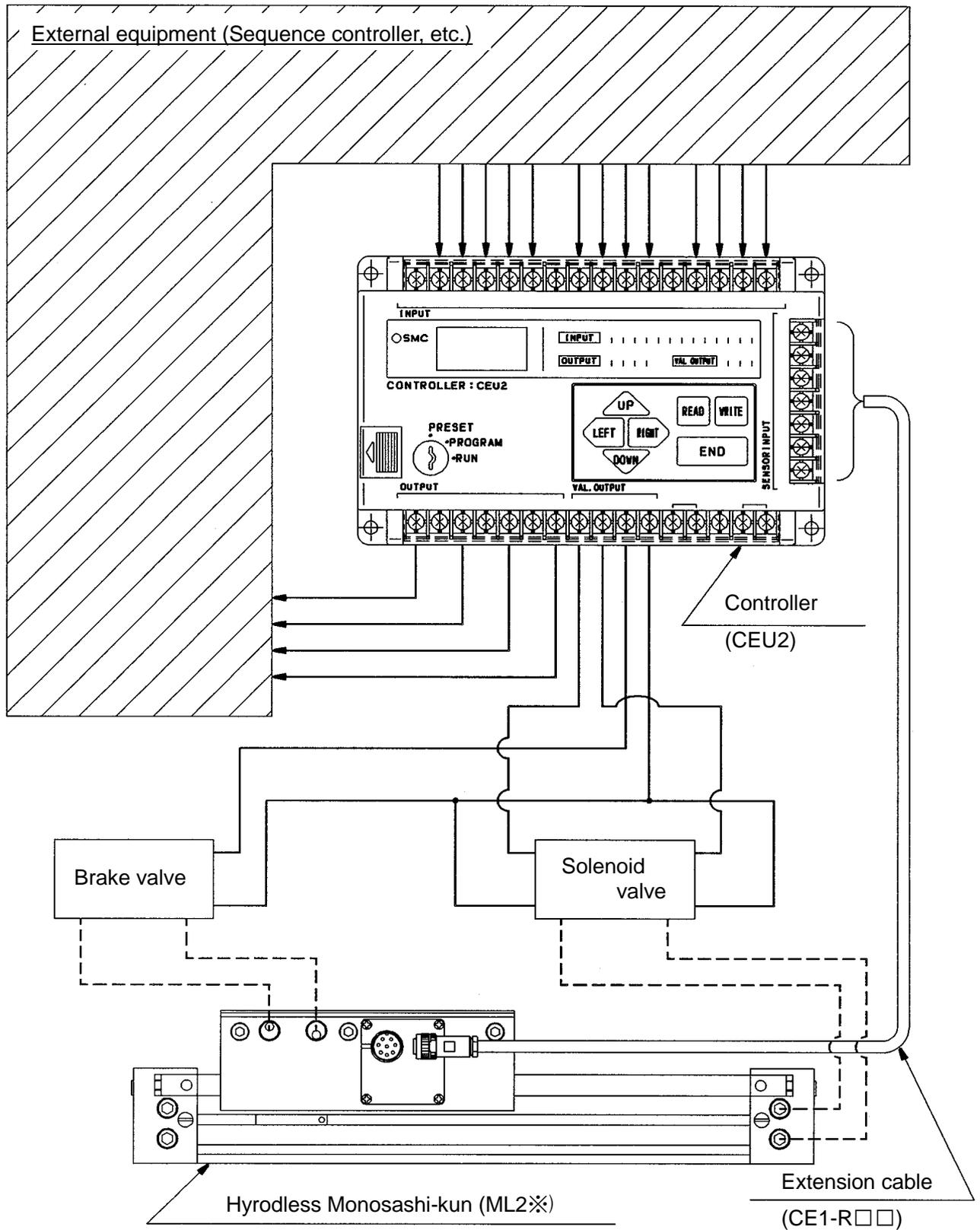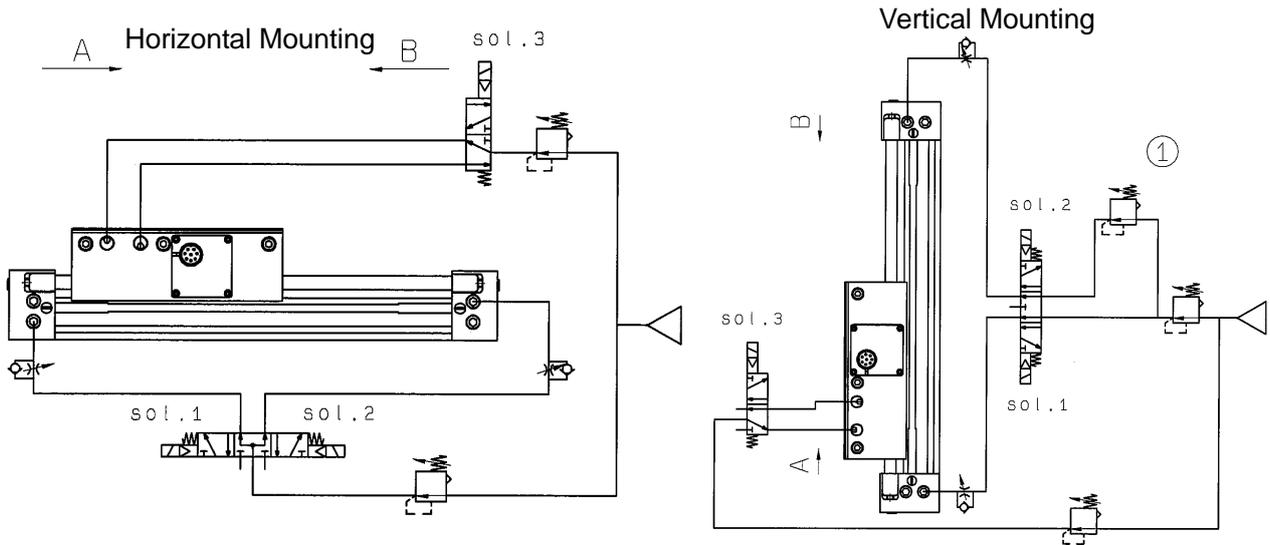
	Sol.1	Sol.2	Sol.3
A	ON	OFF	ON
B	OFF	ON	ON
Stop	OFF	OFF	OFF

Pneumatic Equipment

Bore Size	Directional Valve		Brake Valve	Regulator
	Horizontal Mounting	Vertical Mounting		
25	VFS25□0	VFS24□0R	VFS21□0	AR425
32	VFS25□0	VFS24□0R	VFS21□0	AR425
40	VFS25□0	VFS24□0R	VFS21□0	AR425

• Air Balance

  • With the above circuit, maintaining the slider at center by balancing both sides (left & right) supply pressure to achieve air balance state.
  • At the situation of vertical mounting, maintain the slider at the center and reduce the upper portion's supply pressure accordingly to counter for the weight due to gravity. If air balance is not achieved, motion after center positioning will be either accelerating abnormally or false movement. Hence, the accuracy of positioning will be affected.

• Tubing

  • Use larger diameter's tube and reduce the tubing length between solenoid valve and cylinder, so as to increase position determination's precision.
  • Connect brake valve near to slider. If tubing between brake valve and slider is long, its motion response time will be slower. Moreover, it may rush vigorously when brake is released.
  • During installation, connected tubing should be flushed thoroughly, and prevent dust and chips from entering into cylinder.

• Supply Pressure

  • Set brake release port's supply pressure as 0.3~0.5MPa. With supply pressure of below 0.3MPa, brake's release will not be activated. While with pressure of above 0.5MPa, brake's life span will be shortened.
  • Direct pressure supply from pressure line will cause pressure variation problem and thus, affect cylinder performance. Hence, it is advisable to connect regulator before driving and brake solenoid valve. Besides that, if there is a lot of cylinder activated and moving at the same time, use regulator with larger flow characteristic and install air tank.
  • Connect head cover tubing wisely with consideration of surrounding conditions.

The most suitable tubing can be selected according to the situation when tubing head cover.

Driving Direction

Left ◀ ▶ Right

<Back>　　　<Side>　　　　　　<Front>　　　　　　<Side>　　　<Back>

Ⓜ Ⓝ

Ⓐ　　　　　　　　　Ⓖ
Ⓑ　　　　　　　　　Ⓗ
Ⓓ Ⓒ　　　　　　　Ⓙ Ⓘ

Brake Operating Port　　Brake Release Port

Ⓕ　　　　　　　　Ⓛ
Ⓔ　　　　　　　　Ⓚ

Head　Cover-WL　　　　　　　　　　　Head　Cover-WR
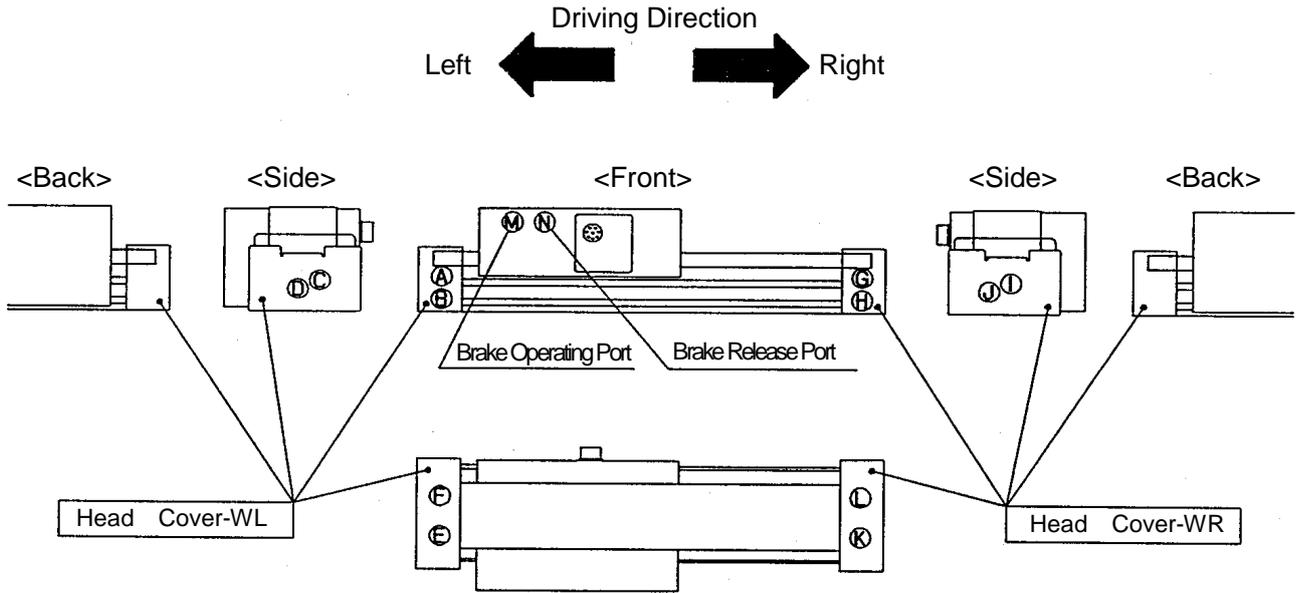
Tube face No.		1	2	3	4	5	6
Type of head cover		Head Cover-WL			Head Cover-WR		
Tubing face		Front	Side	Bottom	Front	Side	Bottom
Operating direction	Left	A	C	E	G	I	K
	Right	B	D	F	H	J	L

Note: 1)Tubing should be group according to the grouping in the table
　　　　　above, 6 on each sides.
　　　2)SMC's one-touch speed controller can be mounted directly on
　　　　　tubing No.1,2,4 and 5.

Installating dimension of bottom face

Head cover

O-ring

ϕA

Rz12.5

Fixing plate

	ϕ25, ϕ32	ϕ40
O-ring	C9	C11.2
ϕA	ϕ6	ϕ8

Speed
controller
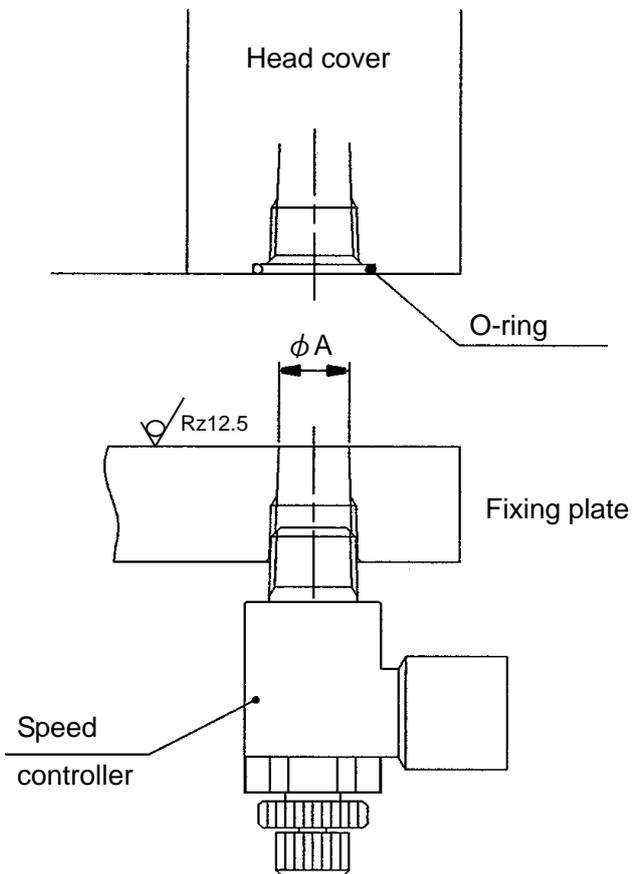
Chapter 4: Operating Principle

4-1 Operating principle of brake
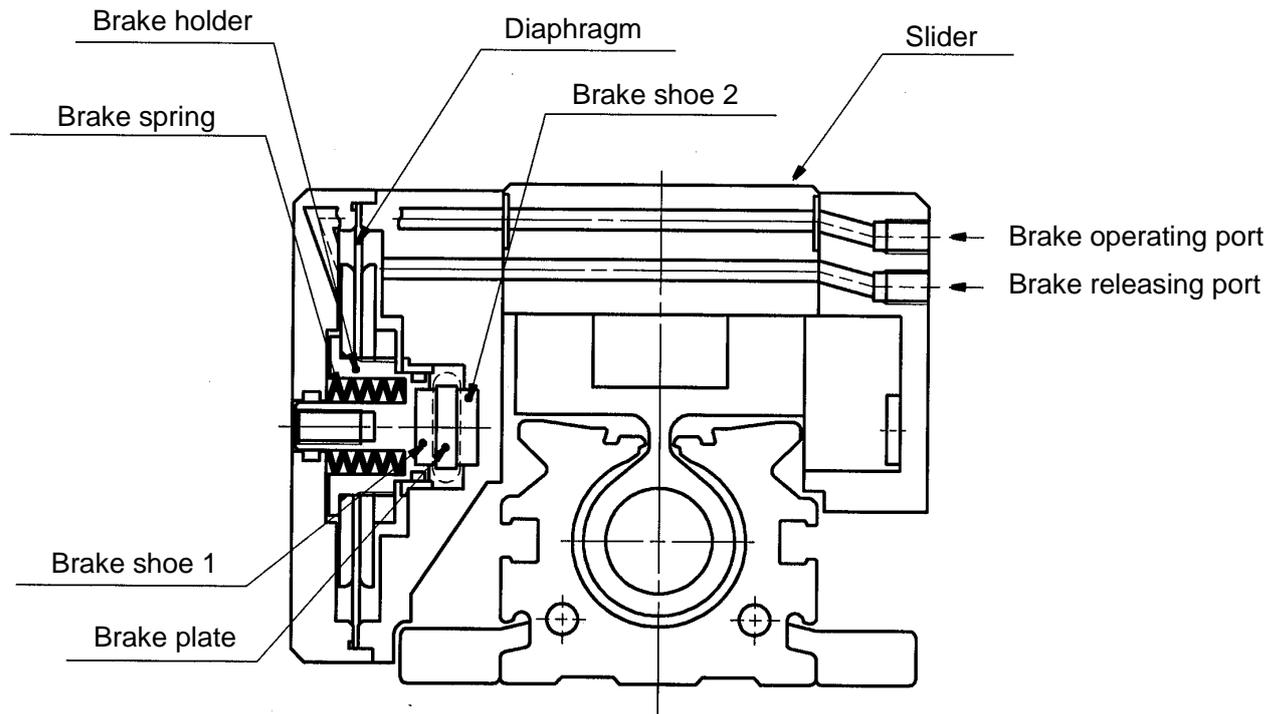
Brake operation

    Spring force caused by brake spring and the air pressure supplied from brake operating port work on brake shoe 1 fixed with brake holder, bend brake plate fixed on head cover on both sides, and stop slider by putting brake plate between brake shoe 1 and brake shoe 2 fixed on the slider side.

Brake release

    The air pressure supplied from brake releasing port work on diaphragm, decline brake spring, and cancel brake.

Chapter 5: Selecting Procedure

5-1 Precaution

Be sure to check with the procedure below before using Hyrodless Monosashi-kun. For positioning with CEU2, check with the procedure of "Operation Manual of Brake Positioning System (Rodless type)".

```
┌─────────────────────────┐
│          Start          │
└─────────────────────────┘
              │
              ▼
┌─────────────────────────┐         ┌─────────────────────────┐
│ Is the total of moment  │   NO    │ Select cylinder size so │
│ of each direction to    │───────▶ │ that load factor will   │
│ cylinder and load factor│         │ become less than "1"?   │
│ of movable load within  │         │                         │
│ "1"?                    │         │ Select cylinder size so │
│ (in the case of without │         │ that kinetic energy will│
│ guide)                  │         │ become within allowable │
│                         │         │ kinetic energy.         │
│ Is kinetic energy within│         │                         │
│ allowable kinetic energy│         │                         │
│ (in the case of with    │         │                         │
│ guide)                  │         │                         │
└─────────────────────────┘         └─────────────────────────┘
              │ YES
              ▼
┌─────────────────────────┐  YES    ┌─────────────────────────┐  NO   ┌─────────────────────────┐
│ 1. Is there any         │───────▶ │ Is it possible to use at│─────▶ │ Do not use it since it  │
│ influence by magneteic  │         │ less than 14.5mT?       │       │ will cause miscount and │
│ field?                  │         │                         │       │ insufficient control.   │
└─────────────────────────┘         └─────────────────────────┘       └─────────────────────────┘
              │ NO      ◀──────────────────── YES
              ▼
┌─────────────────────────┐  YES    ┌─────────────────────────┐  NO   ┌─────────────────────────┐
│ 2. Is cylinder exposed  │───────▶ │ Can the cylinder be     │─────▶ │ Do not use it since it  │
│ to coolant, oil, water  │         │ protected with a cover, │       │ will cause brekage of   │
│ and power, etc?         │         │ etc?                    │       │ sensor or degradation of│
└─────────────────────────┘         └─────────────────────────┘       └─────────────────────────┘
              │ NO      ◀──────────────────── YES
              ▼
┌─────────────────────────┐         ┌─────────────────────────┐
│ Can the cable of        │   NO    │ Do not use it since it  │
│ Hyrodless Monosashi-kun │───────▶ │ is easily affected by   │
│ be wired separate from  │         │ noise due to pulse      │
│ the other power cable?  │         │ output, which will cause│
└─────────────────────────┘         │ maloperation.           │
              │ YES                 └─────────────────────────┘
              ▼
┌─────────────────────────┐
│ No particular problems  │
│ for operation.          │
└─────────────────────────┘
```
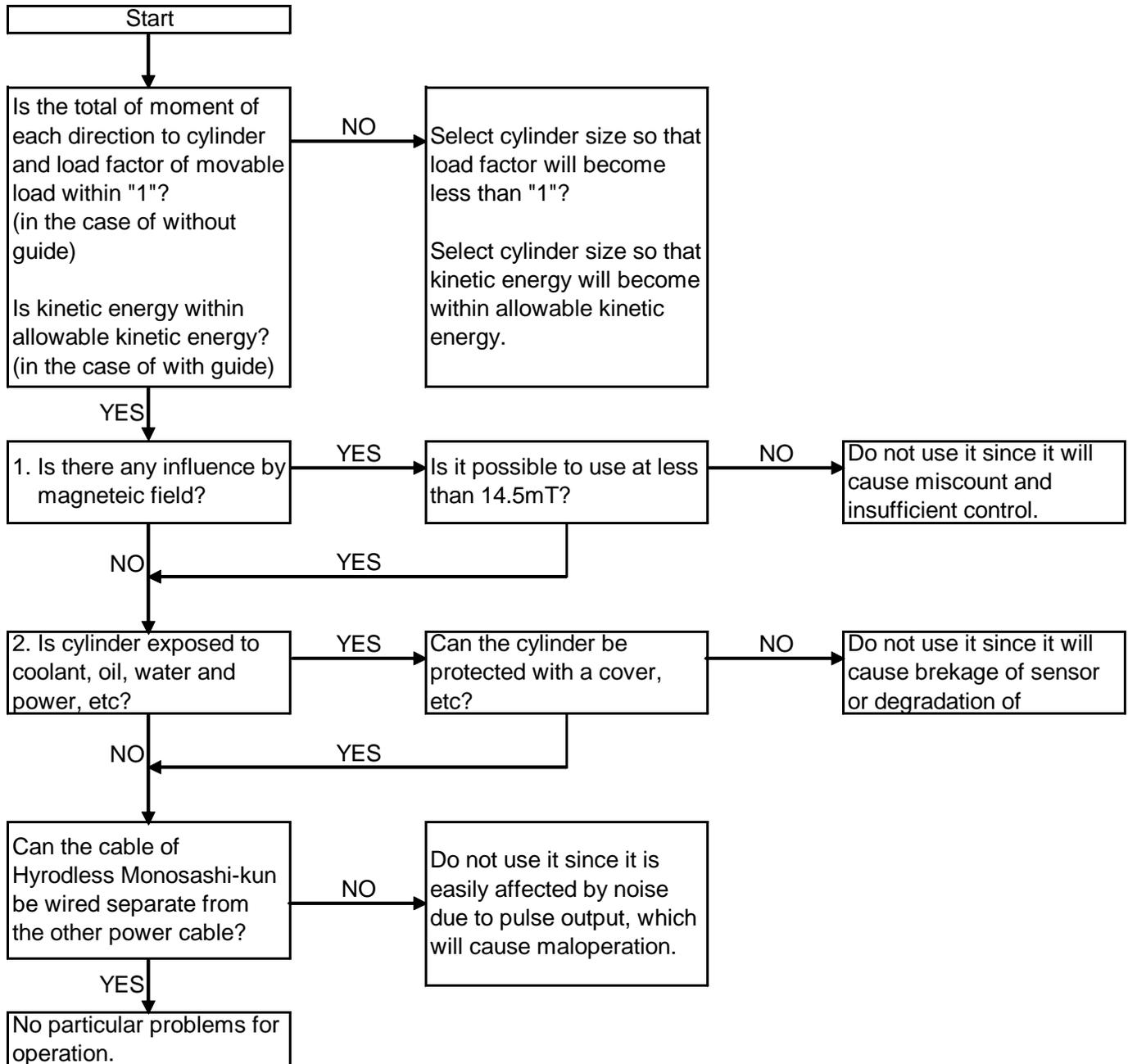
5-2 Selecting Procedure

Follow the procedure below to select the most suitable ML2 series.
As allowable moment, maximum movable load, and allowable kinetic energy vary with the conditions, such as mounting position, piston speed, and with / without guide, ①maximum movable load, ②static moment, ③dynamic moment (during impact with stopper and locking), and ④allowable kinetic energy should be considered so that the total amount of load factor will not exceed 1 (∑an≦1) when calculating allowable load. (In the case of ∑an＞1, select a cylinder with larger bore size.)
When positioning is necessary, maximum speed should be not more than 500mm/s.

Operating Condition

W : Load (N)   Mounting Direction :
Va : Average Speed (mm/s)   Guide :
P   : Operating Pressure (Mpa)   Impact Absorption :
                                          Autoswitch :

Predetermined Cylinder Bore Size

With / Without Guide

Without Guide

With Guide

Calculate Load,
W≦Wmax

Calculate Kinetic Energy
E≦Emax   NG

Calculate Momentum
∑an≦1

NG

OK

OK

Selection of Shock Absorption Unit

Air Cushion   NG   Stroke Adjustment Unit

OK   OK

Selection of Autoswitch

Determination of Model

17

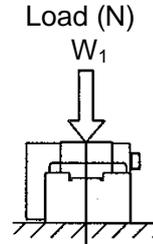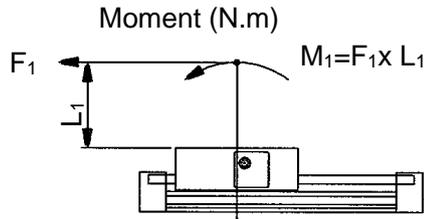## 5-3 Selection Information

W   (N)   : Load
We (N)   : Impact loading (during locking or knocking of stopper)
V   (m/s) : Impact speed (during locking or knocking of stopper)
Va (m/s) : Average speed
L   (m)   : Distance from C.G. of load
M   (Nm) : Maximum moment
E   (J)   : Kinetic energy of load
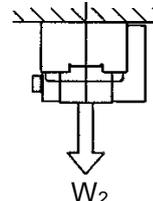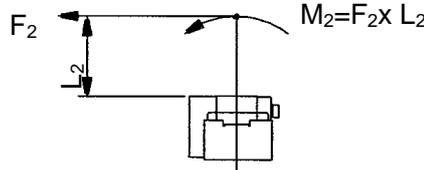g   (m/s) : Gravity acceleration ($9.8 m/s^2$)

<Piston speed>

$$V = 1.4 \times Va$$

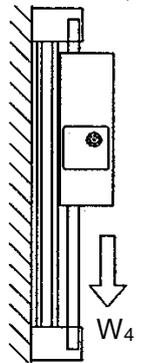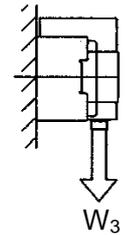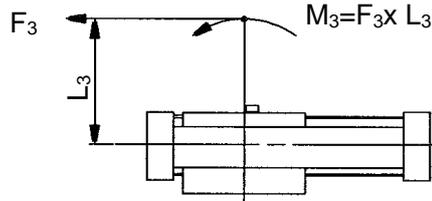<Maximum load>

$$We = 1.4 \times Va \times W \times 10$$

<Maximum allowable moment>

$$M = \frac{We \times L}{3} = 5 \times Va \times W \times L$$

<Load factor>

$$an = \frac{F}{Fmax}$$

F ^   : Calculated load

Fmax   : Maximum allowable load under the condition of allowable speed

       (value obtained from graph)

<Allowable kinetic energy>

$$Ek = \frac{W}{2g} V^2$$

Moment (N.m)

$M_1 = F_1 \times L_1$

$M_2 = F_2 \times L_2$

$M_3 = F_3 \times L_3$

Load (N)

W_1

W_2

W_3

W_4

• Allowable moment and maximum load

Model	Allowable moment N.m			Maximum load N			
	M1	M2	M3	W1	W2	W3	W4
ML2B25	10.0	1.2	3.0	200.0	58.0	65.0	100.0
ML2B32	20.0	2.4	6.0	300.0	80.0	96.0	150.0
ML2B40	40.0	4.8	12.0	500.0	106.0	140.0	250.0

• Allowable kinetic energy

	ML2B25	ML2B32	ML2B40
Allowable kinetic energy J	0.43	0.68	1.21

Max. Allowable Momentum

Select cylinder accordingly with refer to the graph below. Its momentum should not over the specified range. However, selected cylinder may have larger loading value than specified max. load. Counter check with loading condition.
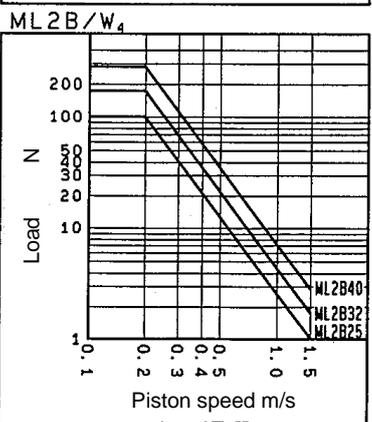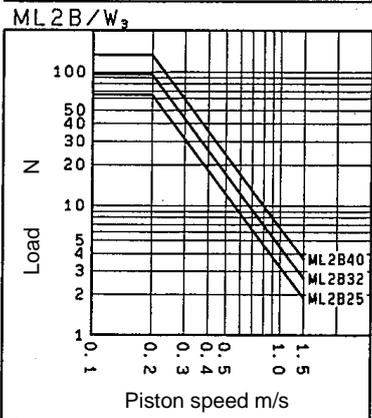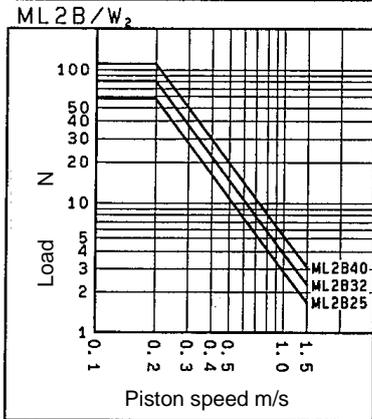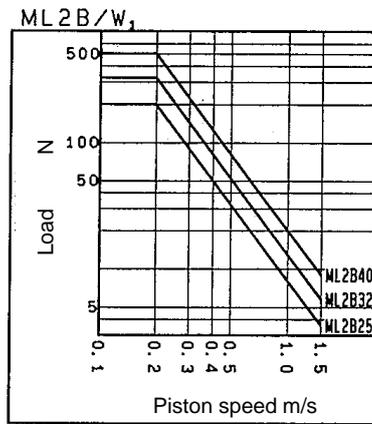
ML2B/M₁

ML2B/M₂

ML2B/M₃
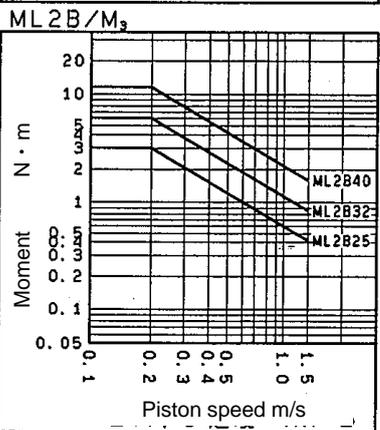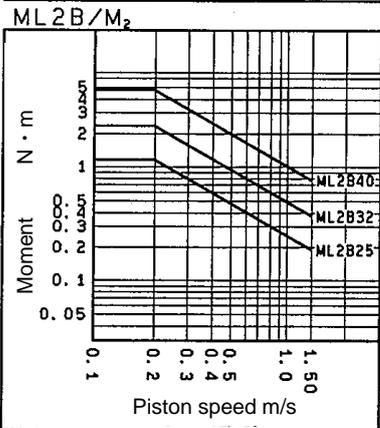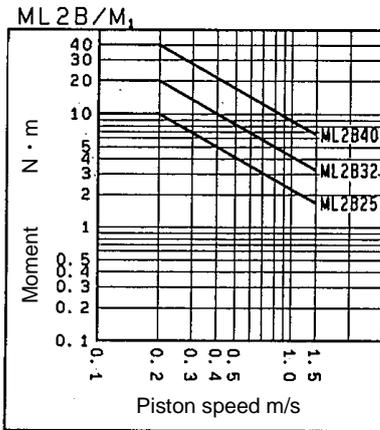
Allowable kinetic energy
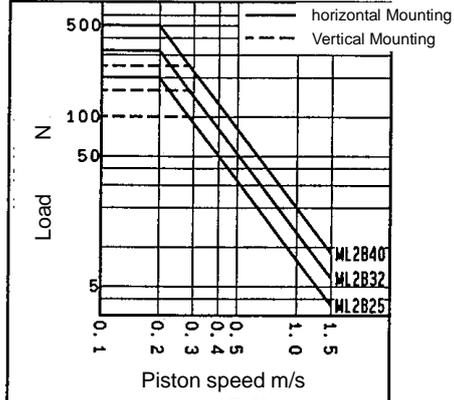
Max. Load

Select cylinder accordingly with refer to the graph below. Its load should not over than specified range. However, selected cylinder may have larger momentum value than specified max. momentum. Counter check with momentum condition.
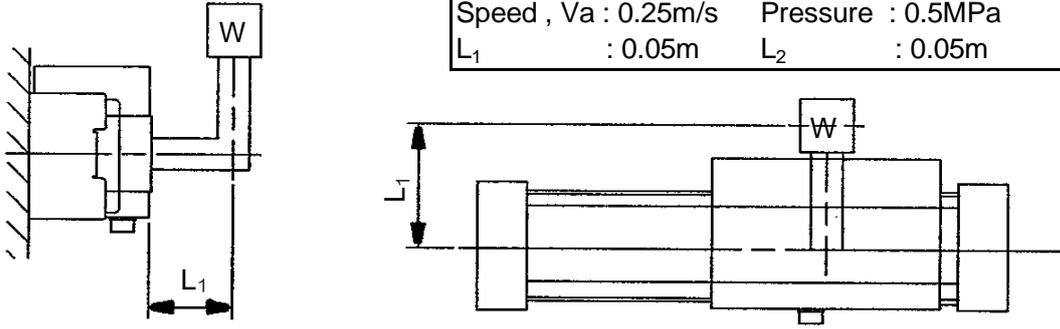
ML2B/W₁

ML2B/W₂

ML2B/W₃

ML2B/W₄

19

5-4 Example of selection

Ⅰ. Without Guide

① Operating Conditions

Model	: ML2B32	Load	: 15N
Speed , Va	: 0.25m/s	Pressure	: 0.5MPa
L_1	: 0.05m	L_2	: 0.05m

	Loading	Static Load	Dynamic Load
①	Side load due to W	W_3	—
②	Moment due to W	M_2	—
③	Moment due to we when stopping	—	M_3 V
④	〃	—	M_1 V

② Static Load <normal load>

   ① $W_3max=60Nm$ (Checked from graph with Va)

$$\text{Load factor a1}= \frac{W_3}{W_3max} = \frac{15}{60} =0.25$$

   ② $M_2max=2N \cdot m$ (Checked from graph with Va)

    $M_2=W \times L_1=15 \times 0.05=0.725N \cdot m$

$$\text{Load factor a2}= \frac{M_2}{M_2max} = \frac{0.75}{2} =0.375$$

③ Dynamic load <load applied during stopping)

   Impact Loading, $We=1.4 \times 10 \times Va \times W=1.4 \times 10 \times 0.25 \times 15=52.2N$

   ③ $M_3max=3.5N \cdot m$ (Checked with $V=1.4 \times Va$)

$$M_3=We \times L_2 \times \frac{1}{3} =52.5 \times 0.05 \times \frac{1}{3} =0.88N \cdot m$$

$$\text{Load factor a3}= \frac{M_3}{M_3max} = \frac{0.88}{3.5} =0.25$$

   ④ $M_1max=12N \cdot m$ (Checked with $V=1.4 \times Va$)

$$M_1=We \times L_1 \times \frac{1}{3} =52.5 \times 0.05 \times \frac{1}{3} =0.88N \cdot m$$

$$\text{Load factor a4}= \frac{M_1}{M_1max} = \frac{0.88}{12} =0.073$$

④ Examination of load factor

	an
①	0.25
②	0.375
③	0.25
④	0.073
∑an	0.948
Decision	OK from ∑an≦1

⬇

ML2B32 is selected.

Ⅱ. With Guide
 ① Operating conditions

Model	: ML2B25	Load	: 30N
Speed , Va	: 350mm/s	Mounting position	: wall
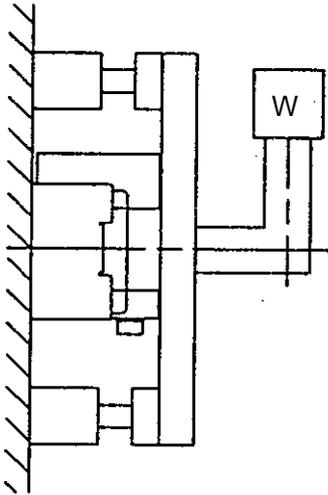
∴ The weight of table is considered as 0 in this case. However, during actual operation, the weight of table should be taken into consideration.

② Allowable kinetic energy

E max=0.43 (J)

V=Vax1.4=350x1.4=490mm/s

$$Ev= \frac{W}{2g} \times V^2 = \frac{30}{2 \times 9.8} \times 0.49^2 = 0.36 \text{ (J)}$$

$$\text{Load factor a5} = \frac{E}{Emax} = \frac{0.36}{0.43} = 0.84$$

③ Examination of load factor

a5 = 0.84 ≦ 1   OK

With above allowable value, there is no problem on the selection.

ML2B25 is selected.

∴ If values are in the range of graph in page 19, there is no problem on the operating conditions.

Chapter 6: Specifications

6-1 Cylinder Specifications

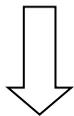| Bore size		$\phi25$	$\phi32$	$\phi40$
Fluid		Air		
Operating method	Cylinder	Double acting type		
	Brake	Integrated pneumatic and spring		
Operating pressure range	Cylinder	0.1~0.8MPa		
	Brake	0.3~0.5MPa		
Proof pressure	Cylinder	1.2MPa		
	Brake	0.75 MPa		
Piston speed		100~1500mm/s (during positioning, 100~500mm/s)		
Ambient and fluid temperature		5~50℃(No freezing)		
Cushion		Both sides air cushion		
Brake type		Integrated pneumatic and spring		
Lubrication		Not required		
Stroke tolerance mm		0~+1.8		
Hardware		JIS B 0209		
Port size	Front and side port	Rc1/8		Rc1/4
	Bottom port	$\phi5$	$\phi6$	$\phi8$

6-2 Sensor specifications

Cable	(Standard product with connector : R04-R8M made by TAJIMI MUSEN DENKI CO.)
Max. transmission distance	20m (when using 6 core twist spare shield wire)
Position detection method	Magnetic scale rod, Detection head (Incremental type)
Magnetic field resistance	14.5mT
Power supply	DC12V±10% (Power supply ripple : Less than 1%)
Current consumption	40mA
Resolution	0.1mm / pulse
Accuracy	$\pm$0.2mm (20℃) Note1)
Output method	Open collector (DC35V, 80mA)
Output signal	Phase A/B phase difference output
Max. response speed	500mm/s
Withstand voltage	AC500V, For one minute (Between case and 12E)
Insulation resistance	DC500V, 50MΩ (Between case and 12E)
Shock resistance	33.3Hz6.8G X,Y directions : For 2 hours, Z : 4 hours In accordance with JIS D1061
Impact resistance	30G X,Y,Z directions : 3 times
Extension cable (Option)	5m,10m,15m,20m (Connector : R03-P8F made by TAJIMI MUSEN DENKI CO.)

Note1) Include digital error of the counter (CEU1,CEU5).
The accuracy as a whole unit after assembling to the device may vary depending on the mount condition and environment. Please execute calibration of the device on customer's own responsibility.

Chapter 7: How to Order

7-1 Cylinder (Hyrodless Monosashi-kun)

ML2 B 25 □ - 500 L □ - Z73 □

Mounting	
B	Standard

Bore size	
25	25mm
32	32mm
40	40mm

Control method	
None	With brake and scale
S	With scale only
B	With brake only

No. of autoswitch	
None	2
s	1
n	n

Type of autoswitch
(See catalog)

No. of adjustment unit	
None	2
S	1

Stroke adjustment unit	
L	Shock absorber + Adjust bolt

Standard stroke

Bore size (mm)	Standard stroke (mm)
25	
32	1～2000 (It is possible to produce it at intervals of 1mm.)
40	

Option

Stroke adjustment unit

φ25	MY-A25L
φ32	MY-A32L
φ40	MY-A40L

Stroke adjustment unit

φ25	MY-S25A	MY-S25B
φ32	MY-S25A	MY-S25B
φ40	MY-S32A	MY-S32B

7-2 Controller

CEU2 □

Output method	
None	NPN open collector output
P	PNP open collector output

3 points preset counter

CEU1 □ - □

Counter operating power supply	
None	AC80～120V
D	DC24V±5%
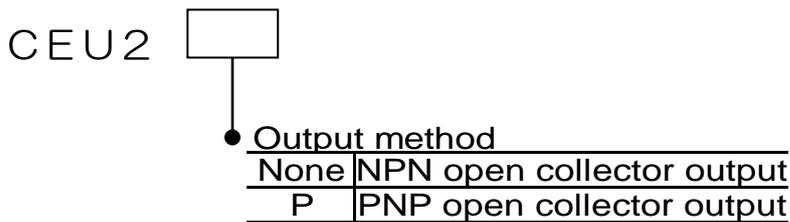
Output method	
None	NPN open collector
P	PNP open collector
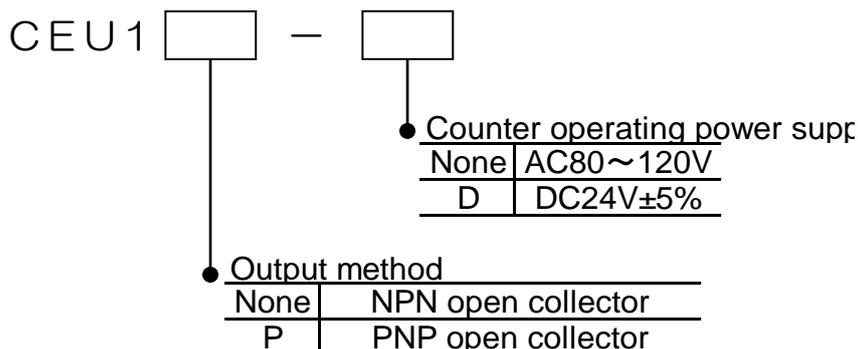
7-3 Extension cable

C E 1 － R ☐ ☐

Length of cable ●

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

● Additional symbol

None	Extension cable
C	Extensin cable + Connector

Connection of connector

Contact	A	B	C, D	E	F	G
Color of wire	White	Yellow	Brown, Blue	Red	Black	(Shield)

7-4 Specifications of Made to order ML2B

[Holder mounting bracket : ① ②]

Holder mounting bracket ① : -X416

Holder mounting bracket ② : -X417

Stroke fine adjustment range

Holder mounting bracket			X416	X417
Length of spacer L (mm)	ML2B25		11.5	23
	ML2B32		12	24
	ML2B40		16	32
Stroke fine adjustment range (mm)	ML2B25	per one side	−11.5～−23	−23～−34.5
		Both sides	−23～−46	−46～−69
	ML2B32	per one side	−12～−24	−24～−36
		Both sides	−24～−48	−48～−72
	ML2B40	per one side	−16～−32	−32～−48
		Both sides	−32～−64	−64～−96

How to order

1) When ordering stroke adjustment unit integrated into cylinder body.

M L 2 B 2 5 － 3 0 0 L ☐ － X 4 1 6 Z

Note)This stroke shows ● the stroke before mounting stroke adjustment unit.

Stroke adjustment unit ●

None	without adjustment unit
L	Shock absorber + adjust bolt

No. of stroke adjustment unit ●

None	2
S	1

● Symbol of holder mounting bracket
X416
X417

● Bracket

None	One side only
W	Both sides bracket
Z	The one for X417 is

2) When ordering stroke adjustment unit only.
   Add "X416" and "X417" at the end of part No. of unit.

   Ex.　MY-A25L-X416

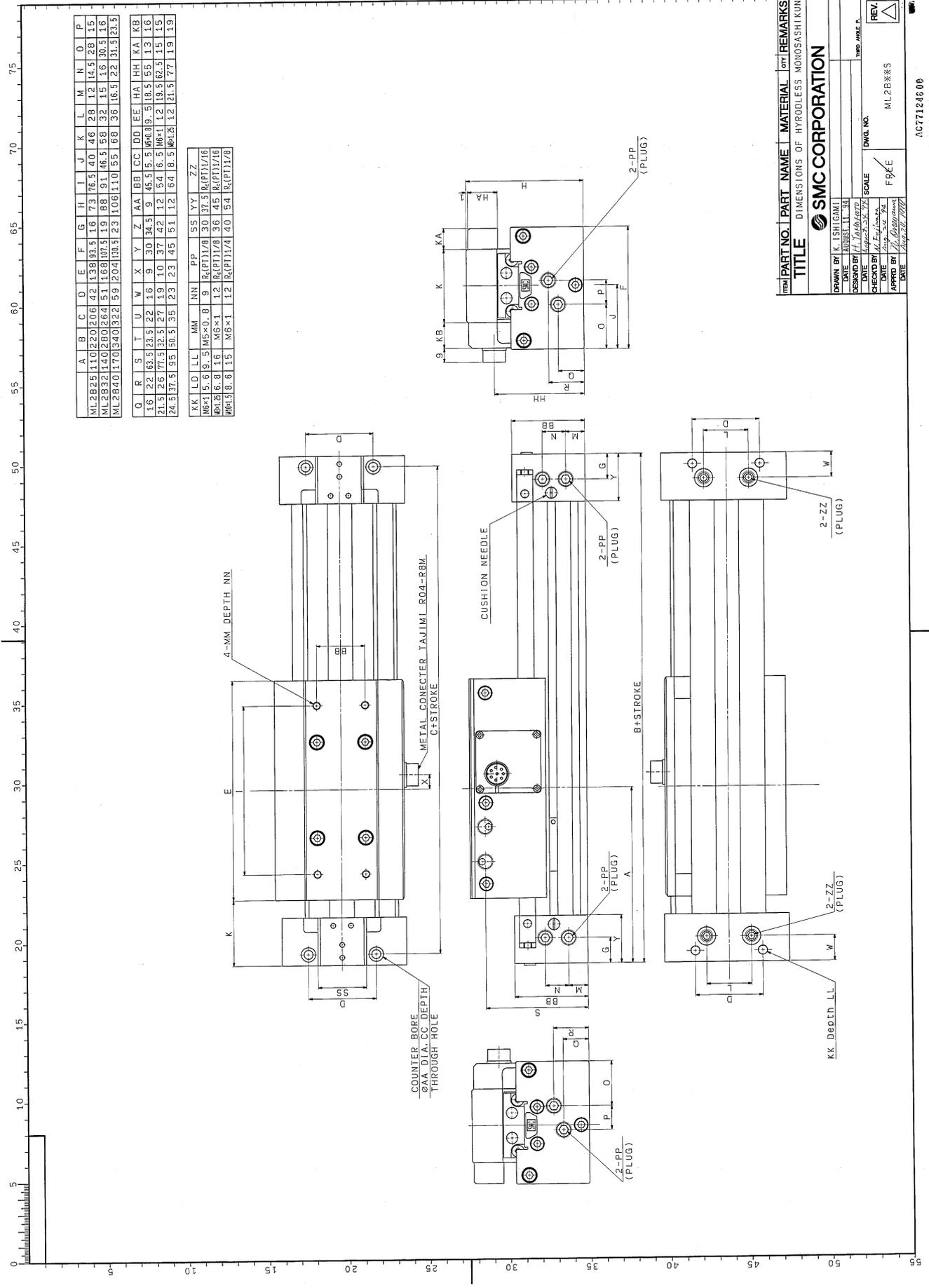3) When ordering holder mounting bracket only.
   Add "N" at the end of part No. of unit.

   Ex.　MY-A25L-X416N

Chapter 8: External Dimension Drawing

8-1 Hyrodless Monosashi-kun (with brake, scale)

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
ML2B25	110	220	206	42	138	93.5	30	73	76.5	40	46	45.5	30.5	16	69	41
ML2B32	140	280	264	51	168	107.5	37	88	91	46.5	58	54	32	15	84	56
ML2B40	170	340	322	59	204	130.5	45	106	110	55	64	64	41.5	19	102	68

	AA	BB	CC	DD	EE	FF	GG	HH	II	JJ	KK	LL	MM	NN	OO	PP	QQ	RR
ML2B25	106	30	1.6	1.2	13.5	63.5	22	24	16	28	15	28	16	22	9	56	34.5	37.5
ML2B32	133	36	1.9	1.5	16	77.5	27	32	19	32	16	30.5	21.5	26	10	62.5	42	45
ML2B40	164	40	2.3	16.5	22	95	35	37	23	36	17.5	37.5	24.5	37.5	23	77	51	54

	MA	LA	MB	LB	MC	LC	MD	LD	ND	PA	PB
ML2B25	M5×0.8	9	M6×1	9.5	M5×0.8	9.5	9	5.5	5.6	Rc(PT)1/8	Rc(PT)1/16
ML2B32	M6×1	12	M8×1.25	15	M6×1	12	11	6.5	6.8	Rc(PT)1/8	Rc(PT)1/16
ML2B40	M6×1	12	M10×1.5	15	M8×1.25	12	14	8.5	8.6	Rc(PT)1/4	Rc(PT)1/8

2-PA (CYLINDER OPERATING PORT)

4-MA DEPTH LA

METAL CONNECTER R04-R8M(TAJIMI)

C+STROKE

2-MC DEPTH LC (MANNUAL)

COUNTERBORE
4-∅MD DEPTH LD
∅ND THROUGH HOLE

2-PA (PLUG)

PA (BRAKE RELEASING PORT)

PA (BRAKE OPERATING PORT)

CUSHION NEEDLE

2-PA (PLUG)

B+STROKE

2-PB (PLUG)

4-MB DEPTH LB

2-PA (PLUG)

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
ML2B25	110	220	206	42	138	93.5	16	73	76.5	40	46	28	1.2	14.5	28	1.5
ML2B32	140	280	264	51	168	107.5	19	88	91	46.5	58	32	1.5	16	30.5	16
ML2B40	170	340	322	59	204	130.5	23	106	110	68	36	16.5	22		31.5	23.5

	Q	R	S	T	U	V	W	X	Y	Z	AA	BB	CC	DD	EE	HA	HH	KA	KB
ML2B25	16	22	63.5	23.5	22	16	9	9	30	34.5	9	45.5	5.5	M5×0.8	5.5	18.5	55	1.3	1.6
ML2B32	21.5	26	77.5	32.5	27	19	10	10	37	42	12	54	6.5	M6×1	1.2	19.5	62.5	1.5	1.5
ML2B40	24.5	37.5	95	50.5	35	23	23	23	45	51	12	64	8.5	M10×1.25	1.2	21.5	77	1.9	1.9

	KK	LD	LL	MM	NN	PP	SS	YY	ZZ
ML2B25	M6×1	5.6	9.5	M5×0.8	9	Rc(PT1)1/16	30	37.5	Rc(PT1)1/16
ML2B32	M8×1.25	6.8	16	M6×1	12	Rc(PT1)1/8	36	45	Rc(PT1)1/16
ML2B40	M10×1.5	8.6	15	M6×1	12	Rc(PT1)1/4	40	54	Rc(PT1)1/8

4-MM DEPTH NN

METAL CONECTER TAJIMI R04-R8M

C+STROKE

COUNTER BORE
ØAA DIA.CC DEPTH
THROUGH HOLE

CUSHION NEEDLE

2-PP (PLUG)

B+STROKE

2-ZZ (PLUG)

KK Depth LL

8-3 With brake

Model	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
ML2B25	110	220	206	138	93.5	16	16	73	76.5	40	46	28	12	14.5	28	15
ML2B32	140	280	264	168	107.5	19	19	88	91	46.5	58	32	15	16	30.5	16
ML2B40	170	340	322	204	130.5	23	23	106	110	55	68	36	16.5	22	31.5	23.5

Model	Y	Z	AA	BB	CC	DD	EE	HA	KA	KB	KK	LD
ML2B25	30	34.5	9	45.5	5.5	M5×0.8	9.5	69	30.5	16	M6×1	5.6
ML2B32	37	42	12	54	6.5	M6×1	12	84	32	15	M6×1.25	6.8
ML2B40	45	51	12	64	8.5	M6×1.25	12	102	41.5	19	M10×1.5	8.6

Model	Q	R	S	T	U	W	MM	NN	PP	SS	YY	ZZ	LL
ML2B25	16	22	63.5	23.5	22	16	M5×0.8	9	Rc(PT)1/8	37.5	3.0	Rc(PT)1/16	9.5
ML2B32	21.5	26	77.5	32.5	27	19	M6×1	12	Rc(PT)1/8	45	3.6	Rc(PT)1/16	16
ML2B40	24.5	37.5	95	50.5	35	23	M6×1	12	Rc(PT)1/4	54	4.0	Rc(PT)1/8	15

MANNAL 2-DD DEPTH

4-MM DEPTH NN
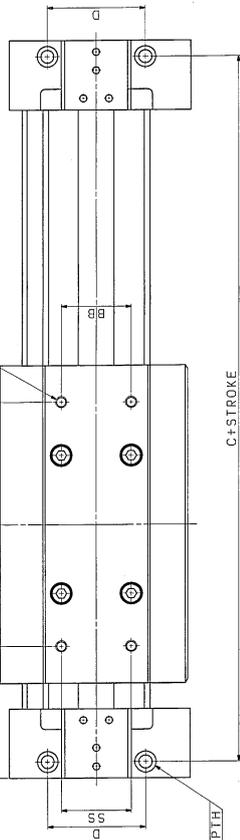
COUNTER BORE
AA DIA. CC DEPTH
THROUGH HOLE

C+STROKE

B+STROKE

CUSHION NEEDLE

PP
BRAKE RELEASE PORT

PP
BREKE OPERATE PORT

2-PP (PLUG)

2-ZZ (PLUG)

KK DEPHT LL

8-4 With shock absorber

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
ML2B25	110	220	206	42	138	93.5	30	73	76.5	40	46	45.5	30.5	16	69	43
ML2B32	140	280	264	51	168	107.5	37	88	88	46.5	58	54		19	84	56
ML2B40	170	340	322	59	204	130.5	45	106	110	55	68	64	41.5	19	102	68

	AA	BB	CC	DD	EE	FF	GG	HH	II	JJ	KK	LL	MM	NN	OO	PP	QQ	RR
	106	30	16	12	13.5	63.5	22	24	16	28	15	28	16	22	9	56	34.5	37.5
	133	36	19	15	15	77.5	27	32	19	28	21.5	30.5	21.5	26	10	62.5	45	45
	164	40	23	16.5	22	95	35	37	23	36	24.5	37.5	37.5			77	51	54

	MA	LA	MB	LB	MC	LC	MD	LD	ND	PA	PB
	M5×0.8	9	M6×1	9.5	M5×0.8	9.5	9	5.5	5.6	Rc(PT1/8)	Rc(PT1/16)
	M6×1	12	M8×1.25	15	M6×1	12	11	8.5	6.8	Rc(PT1/8)	Rc(PT1/16)
	M6×1	12	M10×1.5	15	M8×1.25	14	12	8.6	8.6	Rc(PT1/4)	Rc(PT1/8)

	h	EA	EB	EC	ED	EY	FA	FB	FC	FF	FH	FW	TA	TT
	3.5	10	20	6.5	60	53.5	46.7	33	13	6	12	46	7	MAX.16.5
	4.5	12	25	8.5	74	67	67.3	43	17	6	16	56	12	MAX.20
	4.5	15	31	9.5	94	81.5	67.3	43	17	8	16	56	12	MAX.25

2-PA (CYLINDER OPERATING PORT)

SHOCK ABSORBER

CUSHION NEEDLE

2-PA (PULG)

STROKE ADJUSTMENT UNIT

4-MA DEPTH LA

METAL CONNECTOR Q4-R8M(TAJIMI)

C+STROKE (SHOCK ABSORBER STROKE)

2-MC DEPTH LC (MANNUAL)

COUNTERBORE 4-ØMD DEPTH LD ØND THROUGH HOLE

PA (BRAKE OPERATING PORT)

PA (BRAKE RELESING PORT)

B+STROKE

2-PB (PULG)

4-MB LB

ML2BX-※L

Model	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
ML2B25	110	220	206	42	138	93.5	30	73	76.5	40	46	45.5	30.5	16	69	43
ML2B32	140	280	264	51	168	107.5	37	88	91	46.5	58	54	32	16	84	56
ML2B40	170	340	322	59	204	130.5	45	106	110	55	68	64	41.5	19	102	68

Model	AA	BB	CC	DD	EE	FF	GG	HH	II	JJ	KK	LL	MM	NN	OO	PP	QQ	RR
ML2B25	106	30	1.6	12	13.5	63.5	22	24	16	28	15	28	16	22	9	56	34.5	37.5
ML2B32	133	36	1.9	16	16	17.5	27	32	19	32	16	30.5	21.5	26	10	62.5	42	45
ML2B40	164	40	1.4	16.5	17.5	37	35	37	23	36	17	37.5	24.5			77	51	54

Model	MA	LA	MB	LB	MC	LC	MD	LD	ND	PA	PB
ML2B25	M5x0.8	9	M6x1	9.5	M5x0.8	9.5	9	5.5	5.6	Rc1/8	Rc1/16
ML2B32	M6x1	12	M8x1.25	15	M6x1	12	11	6.5	6.6	Rc1/8	Rc1/16
ML2B40	M8x1.25	14	M10x1.5	15	M8x1.25	12	14	8.5	8.6	Rc1/4	Rc1/8

Model	h	EA	EB	EC	ED	EY	FA	FB	FC	FD	FF	FH	FW	TA	TT
ML2B25	3.5	10	20	6.5	60	53.5	46.7	33	13	11.5	6	12	46	7	MAX.16.5
ML2B32	4.5	12	25	8.5	74	67	67.3	43	17	12	6	16	56	12	MAX.20
ML2B40	4.5	15	31	9.5	94	81.5	67.3	43	17	16	6	16	56	12	MAX.25

8-6 With stroke adjustment unit, X417

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
ML2B25	110	220	206	42	138	93.5	30	73	76.5	40	46	45.5	30.5	16	69	43
ML2B32	140	280	264	51	168	107.5	37	88	91	46.5	58	54	32	16	84	56
ML2B40	170	340	322	59	204	130.5	45	106	110	55	68	64	41.5	19	102	68

AA	BB	CC	DD	EE	FF	GG	HH	II	JJ	KK	LL	MM	NN	OO	PP	QQ	RR
106	30	16	12	13.5	63.5	22	24	16	28	15	28	16	22	9	56	34.5	37.5
133	36	19	15	16	77.5	27	32	19	32	16	30.5	21.5	26	10	62.5	42	45
164	40	23	16.5	22	95	35	37	32	36	17.5	37.5	24.5	23	23	77	51	54

MA	LA	MB	LB	MC	LC	MD	LD	ND	PA	PB
M5x0.8	9	M6x1	9.5	M5x0.8	9.5	5.5	5.5	9.5	Rc1/8	Rc1/16
M6x1	12	M8x1.25	15	M6x1	12	6.5	6.8	11	Rc1/8	Rc1/16
M8x1.25	14	M10x1.5	15	M8x1.25	12	8.5	8.6	14	Rc1/4	Rc1/8

h	EA	EB	EC	ED	EY	FA	FB	FC	FD	FF	FH	FW	TA	TT
3.5	10	20	6.5	60	53.5	46.7	33	13	23	12	12	46	7	MAX.16.5
4.5	12	25	8.5	74	67	67.3	43	17	24	16	16	56	12	MAX.20
4.5	15	31	9.5	94	81.5	67.3	43	17	32	16	16	56	12	MAX.25
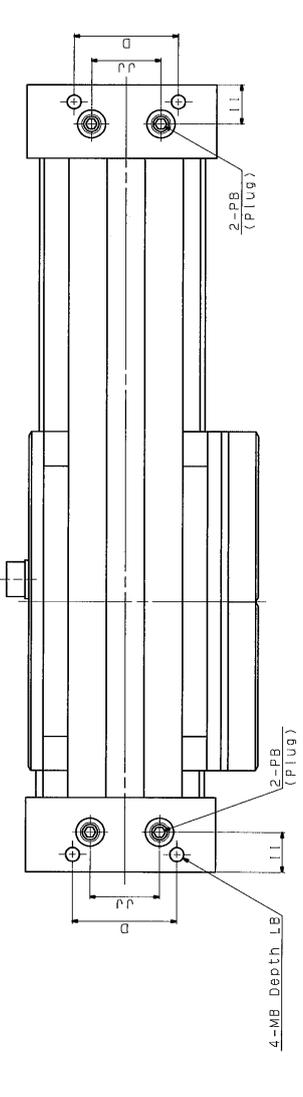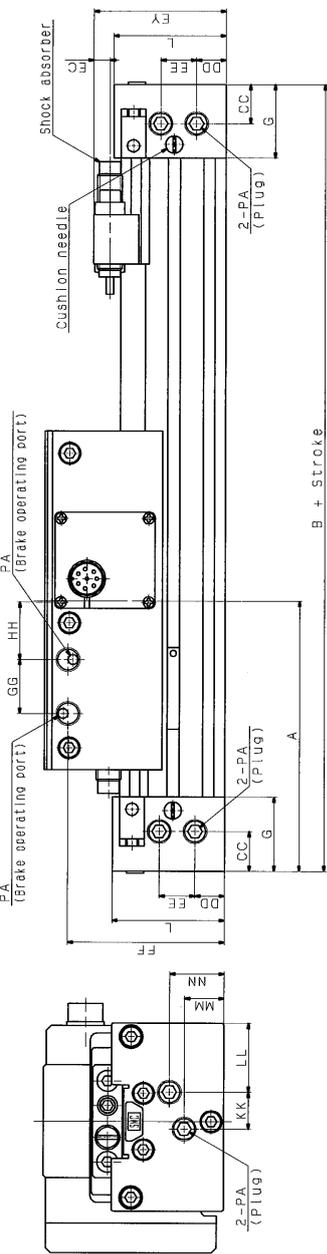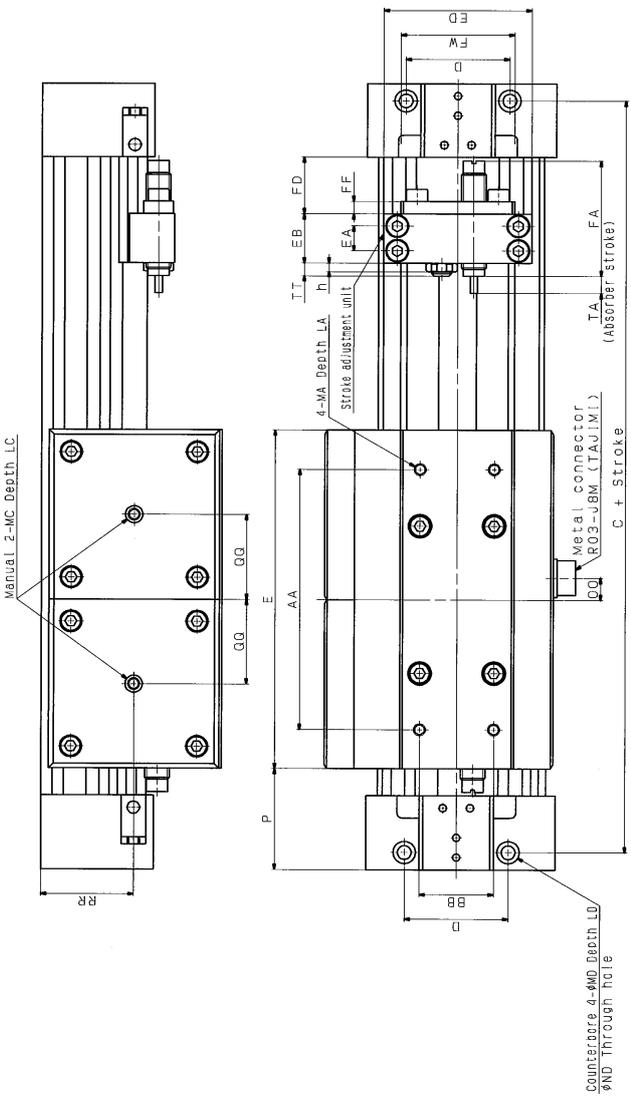
Chapter 9: Construction / Parts list

ML2B□S
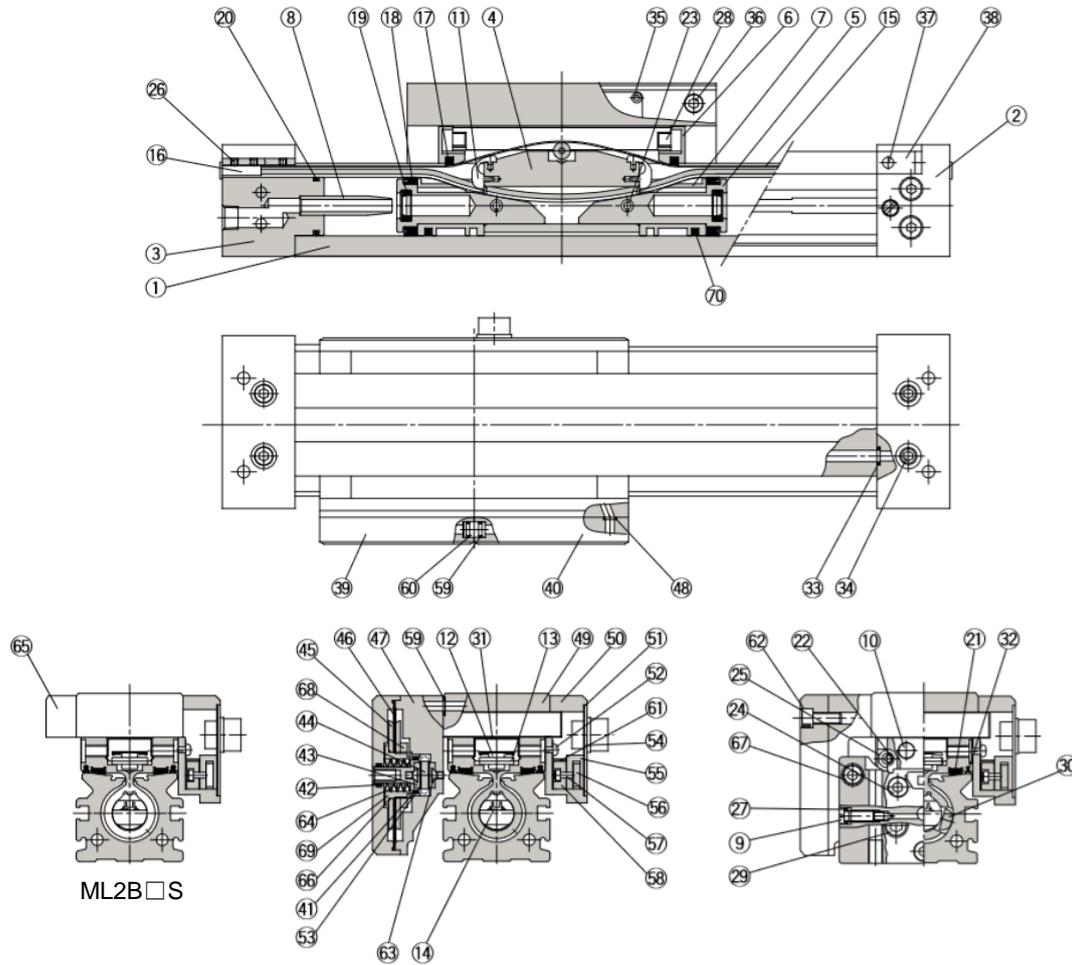
No.	Description	Material	Qty.	Note	No.	Description	Material	Qty.	Note
1	Cylinder tube	Aluminum alloy	1	Hard anodized	36	Hexagon socket head cap screw	Carbon steel	3	Chromated
2	Head cover WR	Aluminum alloy	1	Hard anodized	37	Parallel pin	Stainless steel	4	
3	Head cover WL	Aluminum alloy	1	Hard anodized	38	Tension plate	Carbon steel	4	Nickel plated
4	Piston yoke	Aluminum alloy	1	Anodized	39	Side cover L	Aluminum alloy	1	Hard anodized
5	Piston	Aluminum alloy	2	Hard anodized	40	Side cover R	Aluminum alloy	1	Hard anodized
6	End cover	Special resin	2		41	O-ring	NBR	2	
7	Wear ring	Special resin	2		42	O-ring	NBR	2	
8	Cushion ring	Aluminum alloy	2	Anodized	43	Brake shoe	Sintered metal	4	
9	Cushion needle	Carbon steel	2	Nickel plated	44	Brake plate	Stainless steel	1	Hard chrome plated
10	Stopper	Carbon steel	4	Nickel plated	45	Diaphragm shell	Stainless steel	4	
11	Belt separator	Special resin	2		46	Diaphragm	NBR	2	
12	Guide roller	Special resin	1		47	Brake body	Aluminum alloy	1	Hard anodized
13	Parallel pin	Carbon steel	1		48	O-ring	NBR	1	
14	Seal belt	Special resin	1		49	Slide table	Aluminum alloy	1	Hard anodized
15	Dust seal band	Stainless steel	1		50	Sensor body	Aluminum alloy	1	Chromated
16	Belt clamp	Special resin	2		51	Connector gasket	NBR	1	
17	Scraper	NBR	2		52	Round head Phillips screw	Carbon steel	2	Chromated
18	Piston seal	NBR	2		53	Brake guide	Carbon steel	2	Gas soft treated
19	Cushion seal	NBR	2		54	Connector cover A/B	Carbon steel	1	Chromated
20	Tube gasket	NBR	2		55	Sensor guide	Sintered metal	1	
21	Bearing	Special resin	2		56	Scale plate	Carbon steel	1	Nickel plated
22	Spacer	Stainless steel	4		57	Hexagon socket head cap screw	Carbon steel	2	Chromated
23	Spring pin	Carbon steel	2		58	Sensor unit	—	1	
24	Hexagon socket head cap screw	Carbon steel	6	Chromated	59	O-ring	NBR	6	
25	Hexagon socket button head screw	Carbon steel	4	Chromated	60	Joint valve	Stainless steel	1	
26	Hexagon socket head set screw	Carbon steel	8	Chromated	61	Sensor holder	Stainless steel	1	
27	O-ring	NBR	2		62	Hexagon socket head cap screw	Carbon steel	8	Chromated
28	Double round parallel key	Carbon steel	2		63	Cross recessed countersunk head screw	Carbon steel	4	Chromated
29	Hexagon socket head taper plug	Carbon steel	6	Chromated	64	Brake spring	Carbon steel	2	
30	Magnet	—	2		65	Side plate	Aluminum alloy	1	Chromated
31	Top cover	Stainless steel	1		66	O-ring	NBR	2	
32	Side scraper	Special resin	2		67	Hexagon socket head cap screw	Carbon steel	8	Chromated
33	O-ring	NBR	4		68	Diaphragm nut	Carbon steel	2	Chromated
34	Hexagon socket head taper plug	Carbon steel	4	Chromated	69	Brake holder	Carbon steel	2	Gas soft treated
35	Phillips truss head screw	Carbon steel	4	Chromated	70	Lube-retainer	Special resin	2	

32

Chapter 10: Cushion Capacity

10-1 Selection of cushion

<Air cushion>

Standard Hyrodless Monosashi-kun is equipped with an air cushion.

Air cushion is installed not to operate piston at low speed when piston approaches to stroke end, but to avoid shock when piston with large kinetic energy stops at stroke end. The range of load and speed absorbed by air cushion is within the limit line of air cushion in graph.

<Stroke adjustment unit with shock absorber>

This is used on the occasion when operating with load and speed of over the limit line of air cushion or when cushion is needed out of the air cushion stroke range due to stroke adjustment.

<L-Unit>

This is used on the occasion when cushion is needed out of the air cushion stroke range although load and speed are within the limit line of air cushion or when operating with the range of load and speed of over the air cushion limit line and below the unit limit line.

<Note>

① Absorbing capacity of unit is for the occasion when all stroke of equipped shock absorber is used. When effective stroke becomes shorter due to stroke adjustment, absorbing capacity becomes extremely small. Therefore, fix adjustment bolt to project 0.5mm above shock absorber.
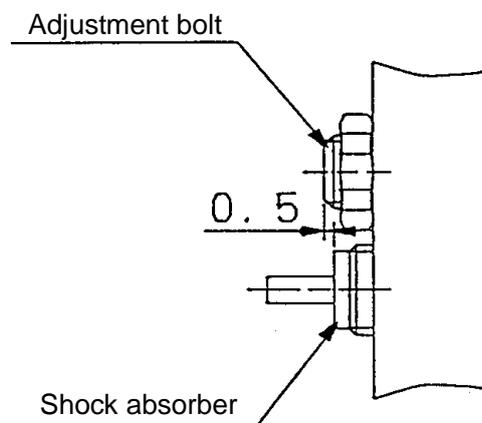
② When shock absorber is used in the range of air cushion stroke, air cushion needle shall be almost full opened (about one and a half turn from the position of full close.)

Air cushion stroke   Unit : mm

Bore size (mm)	Cushion stroke
ϕ25	15
ϕ32	19
ϕ40	24

10-2 Absorbing capacity of air cushion and stroke adjustment unit

For ML2B25

Horizontal collision:
at P=0.5MPa

For ML2B40

Horizontal collision:
at P=0.5MPa

For ML2B32

Horizontal collision:
at P=0.5MPa
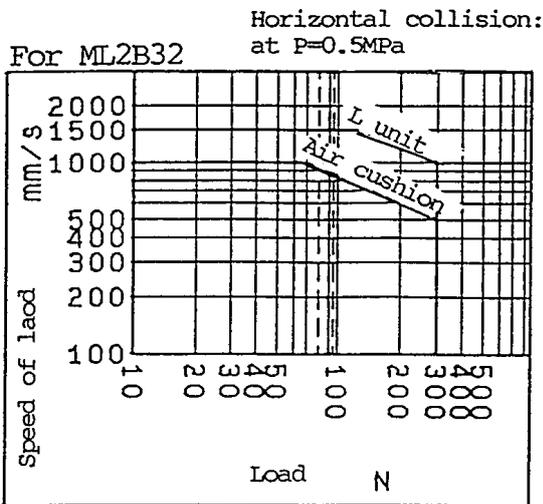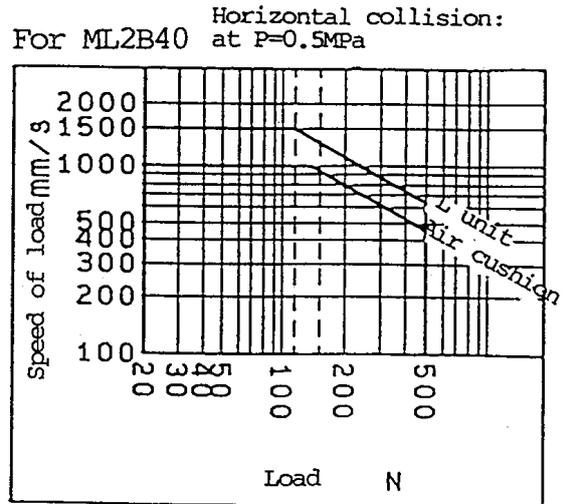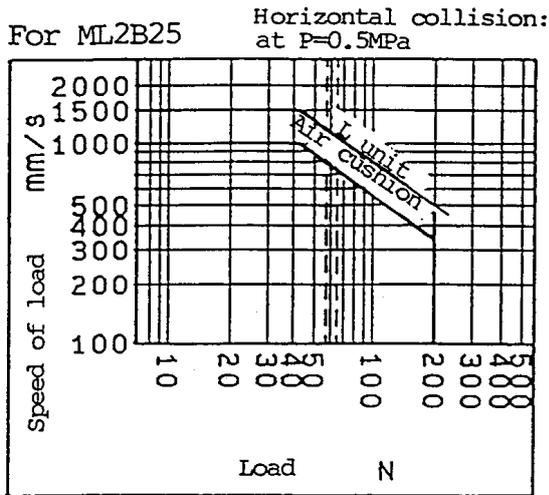
Stroke adjustment unit

Torque for bolt   unit : N.m

Bore size (mm)	Torque
25	3
32	5
40	10

Stroke adjustment unit lock pla

Torque for bolt   unit : N.m

Bore size (mm)	Torque
25	1.2
32	3.3
40	3.3

Stroke adjustment unit with shock absorber

Calculation of absorbing energy

	Horizontal collision	Vertical collision (descent)	Vertical collision (ascent)
Type of collision			
Kinetic energy E_1	$\dfrac{1}{2}\, m \cdot v^2$		
Thrust energy E_2	$F \cdot s$	$F \cdot s + m \cdot g \cdot s$	$F \cdot s - m \cdot g \cdot s$
Absorption energy E	$E_1 + E_2$		

V： Speed of load (m/s)   m： Weight of load (kg)   F： Thrust of cylinder (N)

g： Gravitational acceleration (9.8m/s)   s： Stroke of shock absorber (m)

Note) Speed of load is the speed of the moment when load collides with shock absorber.

34

10-2 Adjusting Method

Lock nut for adjusting bolt
Unit fixing bolt
Lock plate fixing bolt
Lock plate
Shock absorber

<Travel and fix of unit body>
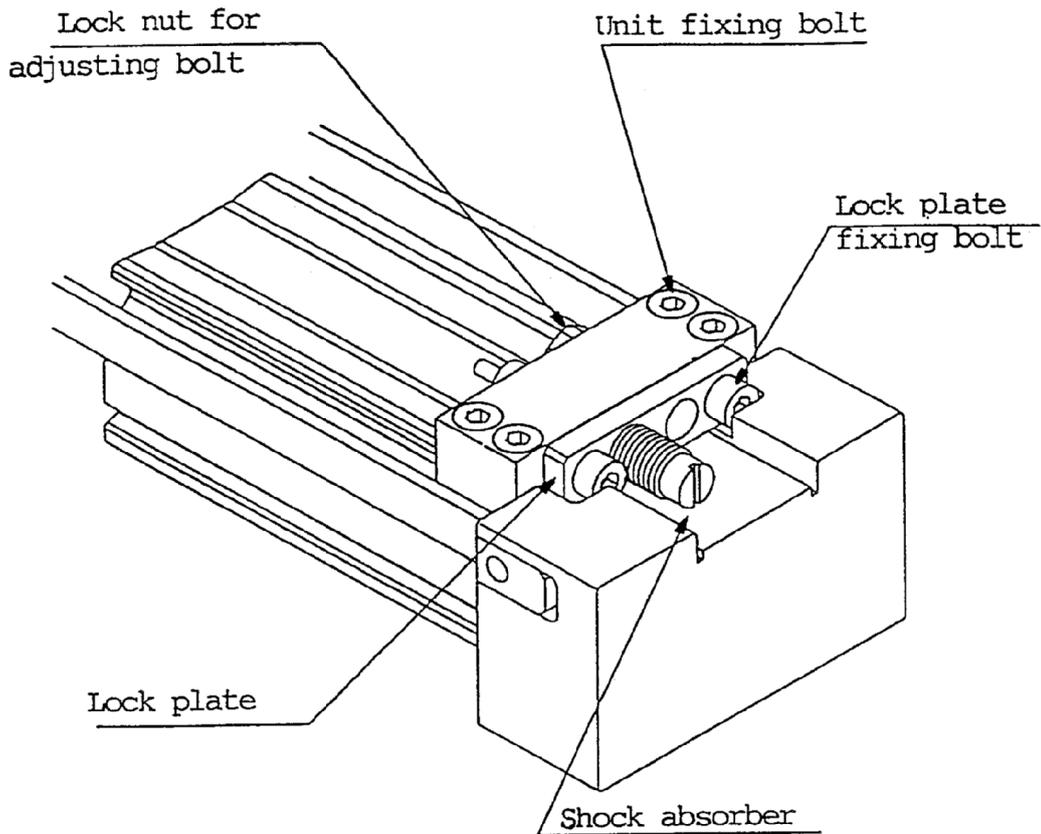
Unit body can be traveled by loosening 4 pieces of bolt. Unit body can be fixed by tightening unit body evenly with 4 pieces of bolt at the specific position. The position, however, may got out of the position depending on the energy size for collision. Mounting brackets for adjusting holder are provided for –X416 and –X417. For the length of your request other than that, please consult with us separately. (See bolt torque for fixing stroke adjusting unit.)

<Stroke adjustment of adjusting bolt>

Loosen lock nut for adjusting bolt and fix with lock nut after adjusting stroke with wrench from lock plate side.

<Stroke adjustment of shock absorber>

After adjusting stroke by loosening two pieces of lock plate fixing bolt to turn shock absorber, fix shock absorber by tightening lock plate fixing bolt evenly. On this occasion, care shall be taken so that bolts are not tightened too much. (Please refer to torque for stroke adjustment unit lock plate bolt.)

Note) Although there are some cases where a little bend will be caused on lock plate due to tightening of lock plate bolt, it does not affect on shock absorber and locking function.

Chapter 11: Stopping Operation

11-1 Overrun (ML2 + Sequence controller)
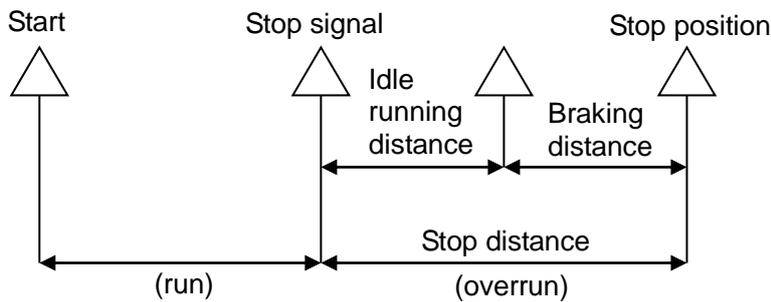
When cylinder is stopped inter-mediately, "idle running distance" (from detection of stop signal to beginning of brake operation) and "braking distance "(from beginning of brake operation to slider stop) are occurred as shown in the figure left.

The graph below shows the relation between piston speed and overrun.
(The length of overrun is changed by piston speed, load, tubing condition and control method. Be sure to adjust the stop signal position, etc. by trial operation with the actual machine.)
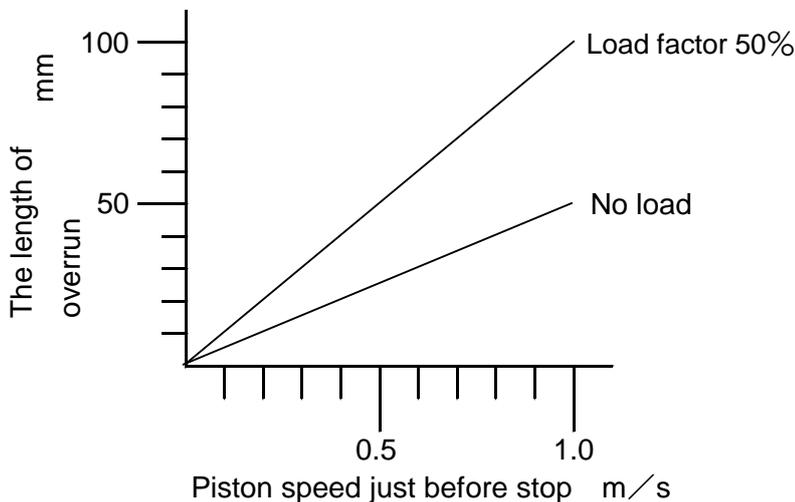
Operating pressure 0.5MPa
Brake releasing pressure 0.3MPa
Mounting position Horizontal

11-2 Dispersion of stopping position

When cylinder is stopped intermediately, the stopping position is not fixed.

Dispersion of stopping position is changed by piston speed, load, tubing condition and control method, etc. Please refer to the table below.

ML2 + Sequence controller

Piston speed just before stop mm／s	100	300	500	800	1000
Stopping accuracy mm	±0.5	±1.0	±2.0	±3.0	±4.0

Conditions
Operating pressure 0.5MPa
Brake releasing pressure 0.3MPa
Load factor 25％

ML2 + CEU2

Piston speed just before stop mm／s	500mm／s
Stopping accuracy mm	±0.5

# Chapter 12: Manual Operating Procedure

[Brake release]

①Supply brake releasing pressure of 0.3～0.5MPa from brake releasing port on slider side.

②Thread bolt into manual port on slider side.

③Exhaust brake releasing air.

[Brake operation]

①Supply brake releasing pressure of 0.3～0.5MPa from brake releasing port on slider side.

②Remove bolt threaded into manual port.

③Exhaust brake releasing air.
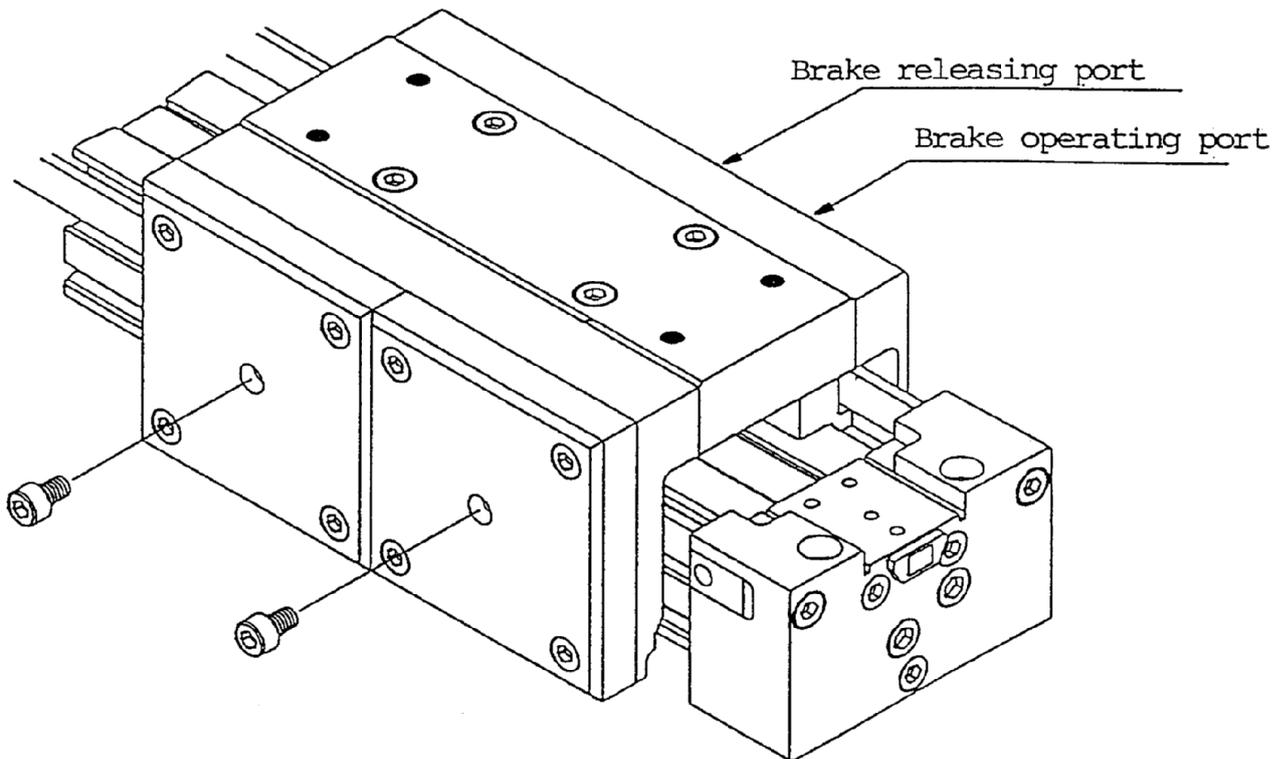
Bolt for manual release

ML2B25	M5×0.8	L=8
ML2B32	M6×1	L=10
ML2B40	M8×1.25	L=12

Chapter 13: Installation & Wiring

13-1 Installation of Cylinder

1. It should be installed at high flatness surface. For uneven surface. Shim adjustment should be done to achieve smooth operation of slider with a minimum operating pressure of 0.1MPa.

2. Installed with utilizing both sides head cover. Do not fix cylinder's position through slider, as shown in diagram (a). With overloading the bearing, operation error occurs.
Besides that, for the case of single sided fixing method (as refer in diagram (b), consultancy should be made, due to bending of tube may occur and thus, lead to the occurs of operation error.

(a) Fixing through Slide   (b) Single side's Fixing
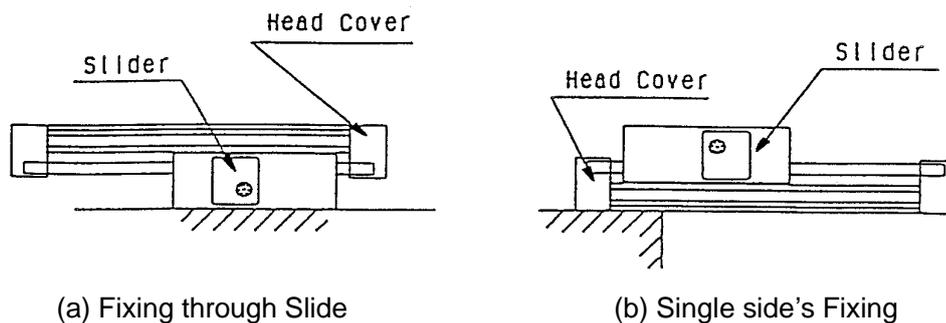
There are 2 ways, as shown in diagram below, to fix cylinder's position.
Utilizing the installation method, with the consideration of mounting surface and situation.
(Side support, option, should be used for support purposes only.)

(c) Fastening through Upper Surface   (d) Fastening through Lower Surface
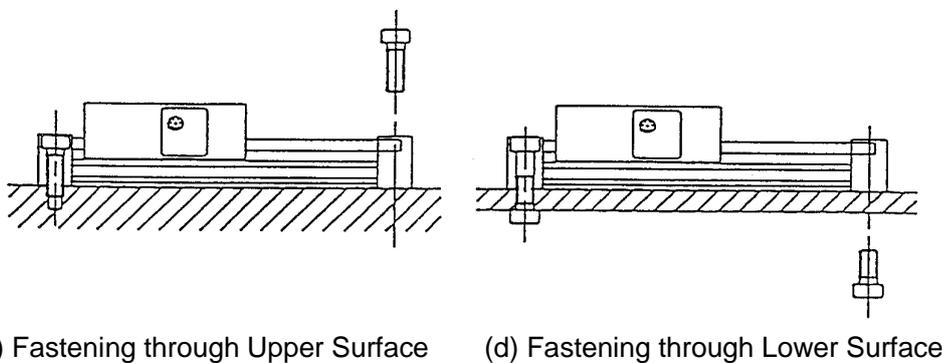
3. With loading within allowable range of Hyrodless Monosashi-kun, supporting structure (LM Guide) is still necessary to be installed as a support for the applied loading. Besides that, for the case of long stroke, floating structure design should be brought in to overcome misalignment problem.

4. Cylinder has to be covered when it is used at environment that has chips, dust, oil mist and etc.

5. Be aware of not to harm (dented marks and etc.) the outer surface of cylinder tube, which will lead to the damage of bearing and scraper. Consequently, disoperation will occur. Besies that, be aware of not to apply too much of impact and momentum upon slider as slider is only supported by plastic made bearing.

6. Do not apply load onto brake and scale plate, its bending will lead to operation error. Once, brake and scale plate have been adjusted during installation state. Re-adjustment is not required and

should be advoided.

Note：Grease used are lithium based grease with concentration class 1 or 2.

· Hyrodless Monosashi-kun uses magnetic sensor to detect position. Therefore, if strong magnetic field appears nearby, operation error will occur.

Surrounding magnetic field should be below than 14.5mT.

Note: 14.5mT magnetic field will be just as the same as the resulted magnet field from 15,000A welding current's welding machine (within 18cm). To prevent from the effect of magnetic field, sensor should be covered by magnetic material.
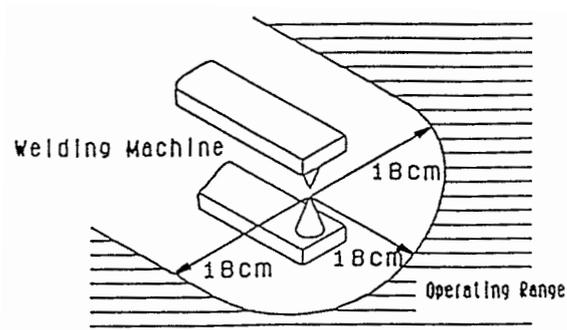
· Prevent sensor unit from contacting with water, oil and etc.

· Do not install Hyrodless Monosashi-kun near to motor, welding machine, and others facility which will produce noise, which will cause counter malfunction.

Besides that, separate the power line from others.

The longest transmission distance for Hyrodless Monosashi-kun is 20m. Wiring above than the figure, should be taken noted at.

13-2 Electrical Wiring

Output method

Output signal of Hyrodless Monosashi-kun is phase difference output of A phase / B phase (open collector output) as shown in the figure below.

1 pulse signal is sent to both output terminals A and B at every 0.1mm travel of Hyrodless Monosahi-kun.
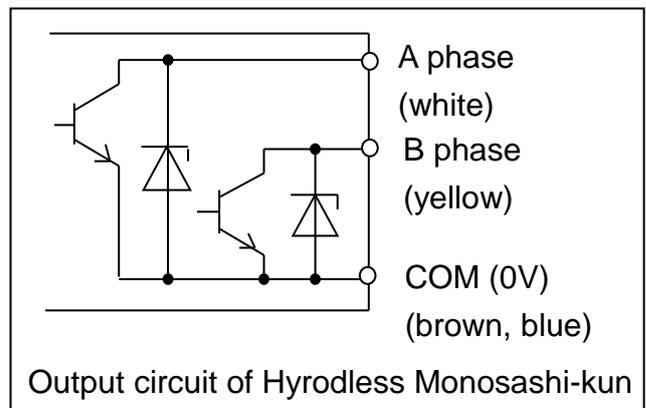
Also maximum response time of sensor for Hyrodless Monosashi-kun is maximum 1500 mm/sec (15Kcps) in cylinder speed.
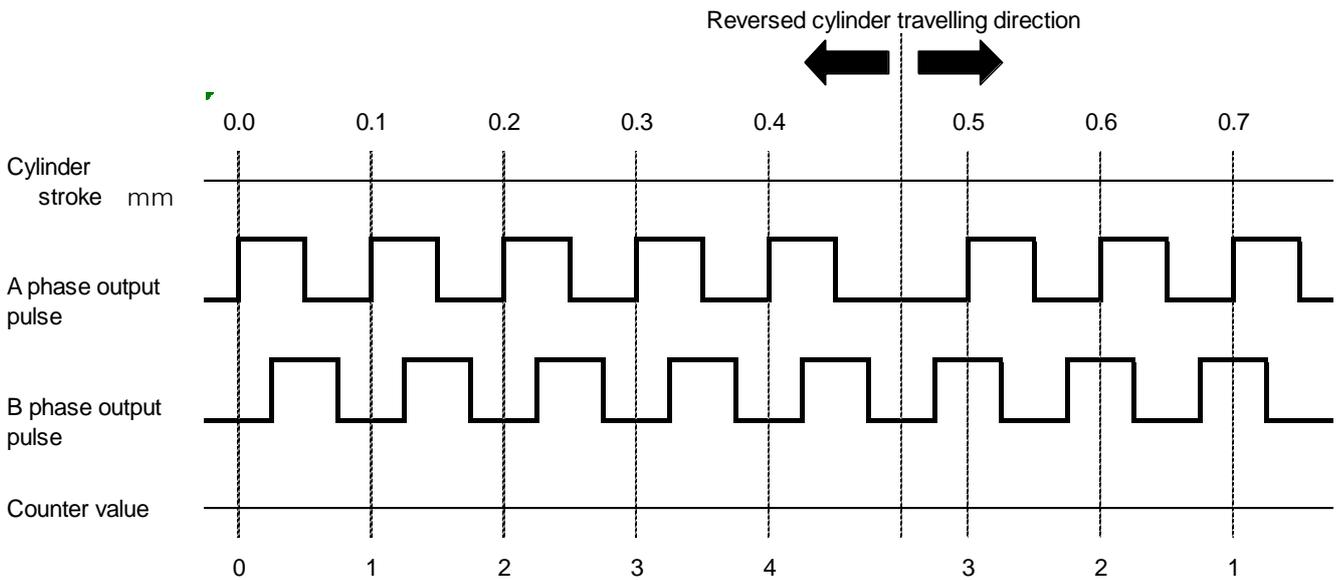
Input / Output

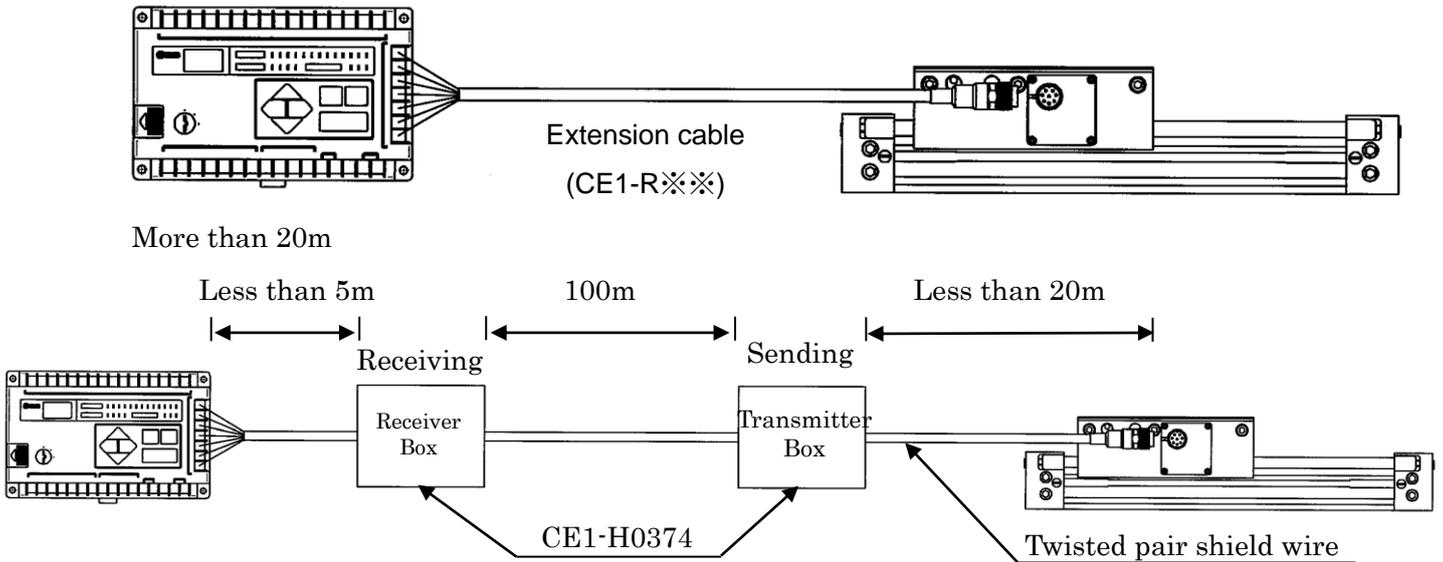Input / Output of Hyrodless Monosashi-kun is performed by connector came from sensor.

Signal

Symbol of contact	Signal
A	A phase
B	B phase
C,D	COM (0V)
E	12V (Power supply)
F	0V (Power supply)
G	GND (Shield)

Output circuit of Hyrodless Monosashi-kun

13-3 Connection of Extension Cable

Use specified (SMC) extension cable. Cable length is 5m – 20m with interval of 5m. For the distance of more than 20m, use specified transmission box (Model No.: CE1-H0374).

＊Example of cable connection

Extension cable
(CE1-R※※)

More than 20m

Less than 5m   100m   Less than 20m

Receiving   Sending

Receiver Box   Transmitter Box

CE1-H0374   Twisted pair shield wire

＊Note

①Clamp and fix the connector and sensor connection to reduce tension acting on them.

②Separate cable with power line or other lines which make noise.

③When cable is necessary to have U-shaped bend, set the bending radius to be above 25mm.

Bending performance: According to the drawing shown below, life span about 4 million cycle can be achieved.

200mm

R25
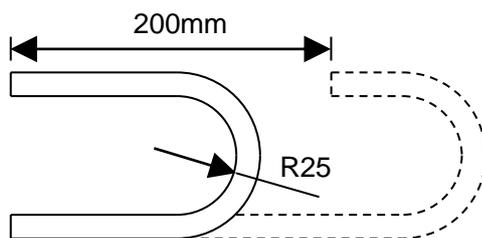
Reciprocating with bending speed 100times/min.