

OPERATION MANUAL

PRODUCT NAME: **Brake Position Determination System's**

MODEL : ML2B: HYRODLESS Monosashi-kun Measuring

Cylinder With Brake

CEU2: Controller

- 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

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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 pneumatically 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.

- Inspection and maintenance of machinery/equipment should only be performed after confirmation of safe locked-out control positions.
- When equipment is to be removed, confirm the safety process as mentioned above. Cut the supply pressure for this equipment and exhaust all residual compressed air in the system.
- 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:

- Conditions and environments beyond the given specifications, or if products are used outdoors.
- 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.
- An application which has the possibility of having negative effects on people, property, or animals, requiring special safety analysis.
- 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. Environments to avoid

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

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

- Place where ambient temperature exceeds the range of 5°C to 60°C.
- Place where ambient humidity exceeds the range of 35% to 85% RH.
- Place where condensation occurs due to sudden temperature change.
- Place where atmosphere containing corrosive gas, flammable gas or organic solvent.
- Place where atmosphere containing 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.
- Place where the products are exposed to direct sunlight or radiated heat.
- Place where strong electromagnetic noise is generated (place where strong electric field, strong magnetic field or surge is generated).
- Place where static electricity is discharged or condition that the products have electrostatic discharge.
- Place where strong high frequency is generated.
- Place where damages of thunder are expected.
- Place where vibration or impact is directly given to the products.
- 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

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

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

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

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

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

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

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

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

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

④ 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 prevent equipment damage and mal-function.

①Operating pressure:

Actuating part: 0.1 – 0.8MPa

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 slider 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 slider may lurch at a speed greater than the control speed of the speed controller.

Installation

Warning

1. Connect the slider 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.
3. 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

① Foreign matter should not enter. Entering of foreign matter will cause malfunction.

② Cutting chips and sealing materials at piping threads should not enter valves when piping and fittings are screwed in. Leave 1.5 to 2 threads when seal tape is used.

Lubrication

Caution

1. Lubrication of cylinder

① This cylinder is pre-lubricated and can be used without lubrication.

② In 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

Chapter 2: General

2-1 Features

Controller (CEU2) is a special controller designed for Monosashi-kun with Brake. Upon the input, controller will stop the cylinder, smoothly and precisely at position as inputted.

Stopping positions of Hydrolless Monosashi-kun are stored into "Step", ranging from step 1 to 32. Steps will be grouped together and form as "Program". CEU2 allows maximum storage of 16 programs.

Program	P1	P2	P3	P16
Step	S1	S1	S1		S1
	S2	S2	S2		S2

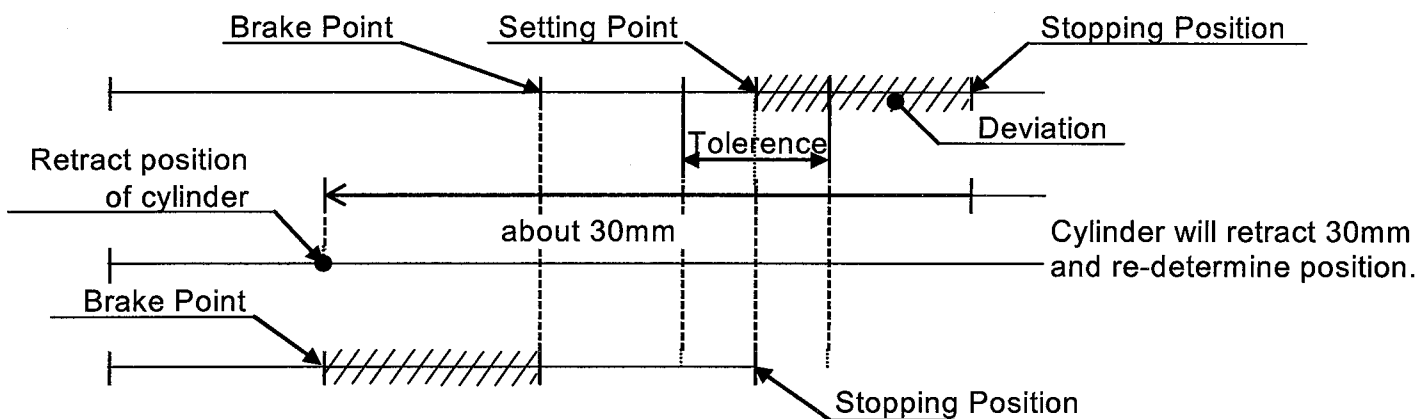
	S32	S32	S32		S32

Following are CEU2's special feature: -

1. Predictive Control & Learning Function

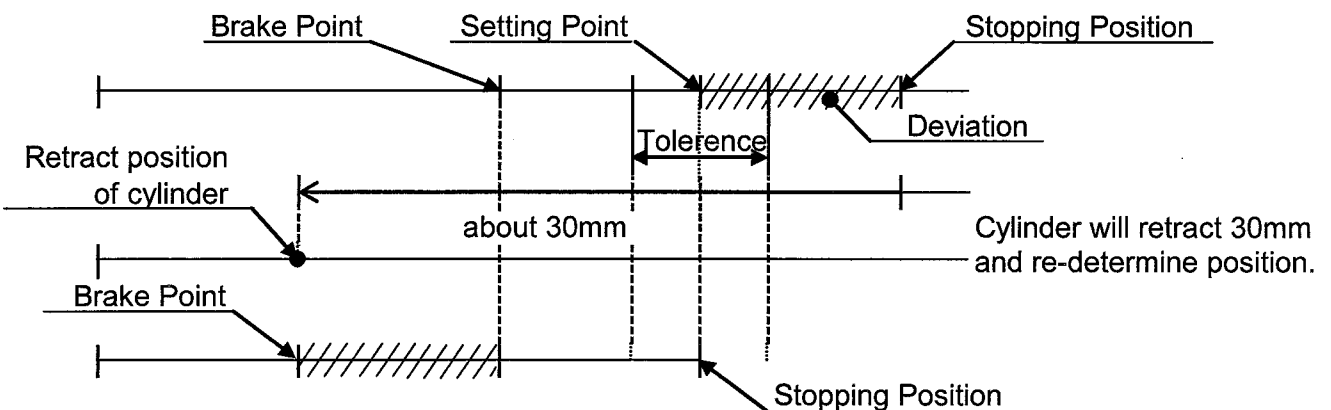
(Allow High Repeatability and Precision. $\pm 0.5\text{mm}$)

With learning function, after every execution, brake point will be amended, according to the deviation of stopping position from setting position.



Position, falling within the tolerance range, is determined.

2. Equipped Function with Retries → If stopping position deviates from setting position's tolerance, retries function will execute to revise the brake point.



Position, falling within the tolerance range, is determined.

3. Error Detector

When system is found faulty, error detector will take action, detect and analysis error. Finally, error messages will be displayed. Thus, ease of debugging time.

4. DIN Rail installation is possible.

2-2 Position Control

1. With controller, valve outputs to achieve precise positioning.
2. For the situation whereby cylinder stopping position does not fall into the tolerance range, retries will be performed. First, it will retract (30mm), and then extend to achieve setting position.
3. With learning ability, brake point will be recognized and thus lead to precise positioning with taking into the consideration of factors like loading & pressure condition, momentum & impact when stopping.
4. Stopping method applied is through air balance and brake to lock the movement. While brake applies the combination of spring and pneumatic locking method.
5. Position is determined when positioning falls on the setting tolerance range.
6. Position determination will follow the sequence of selected program's steps.
7. Only programs are available for selection. Program steps are not selectable.

2-3 Positioning at Cylinder Rod End

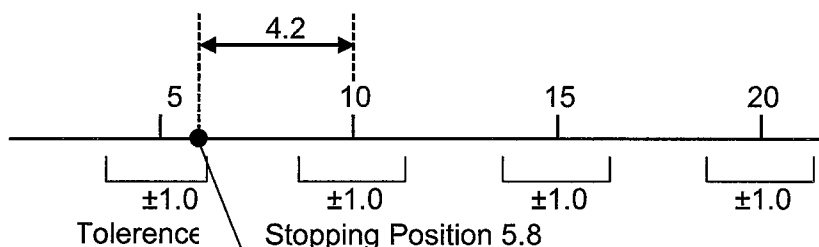
Do not use cylinder with cushion, if determined position falls at cylinder rod's end (left or right, refer to table 1). This is due to drastically change of speed occurring at stroke end will cause imprecision and easy occurring of learning error (Err6).

Table 1	Unit mm
ML2B25	15
ML2B32	19
ML2B40	24

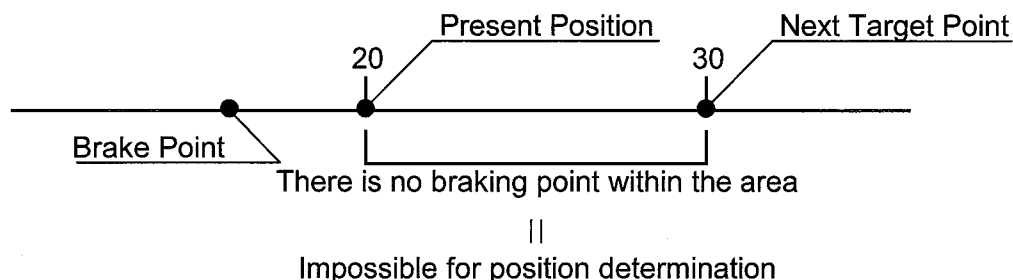
2-4 Minimum Interval

Minimum interval has to be set 5mm and above.

With the setting of 5-10-15... so on and so forth, error (Err5: Date error) will occur, as the distance between present stopping position and next stopping position will less than 5mm, due to the exist of setting point's tolerance. Hence, it is very important to take tolerance into the consideration, during setting of interval between two setting points.



However, even with interval of 5~30mm, the result after learning may not be satisfactory (brake point is not situated within moving distance) and error (Err6: Learning Error) will occur. This is due to the violation of working conditions, such as load, speed and installation direction.



Operating Condition: a. Speed: 100mm/sec

b. Tubing's length (form valve): 50cm below

c. Supply Pressure: 0.5MPa (for both brake and driving purposes)

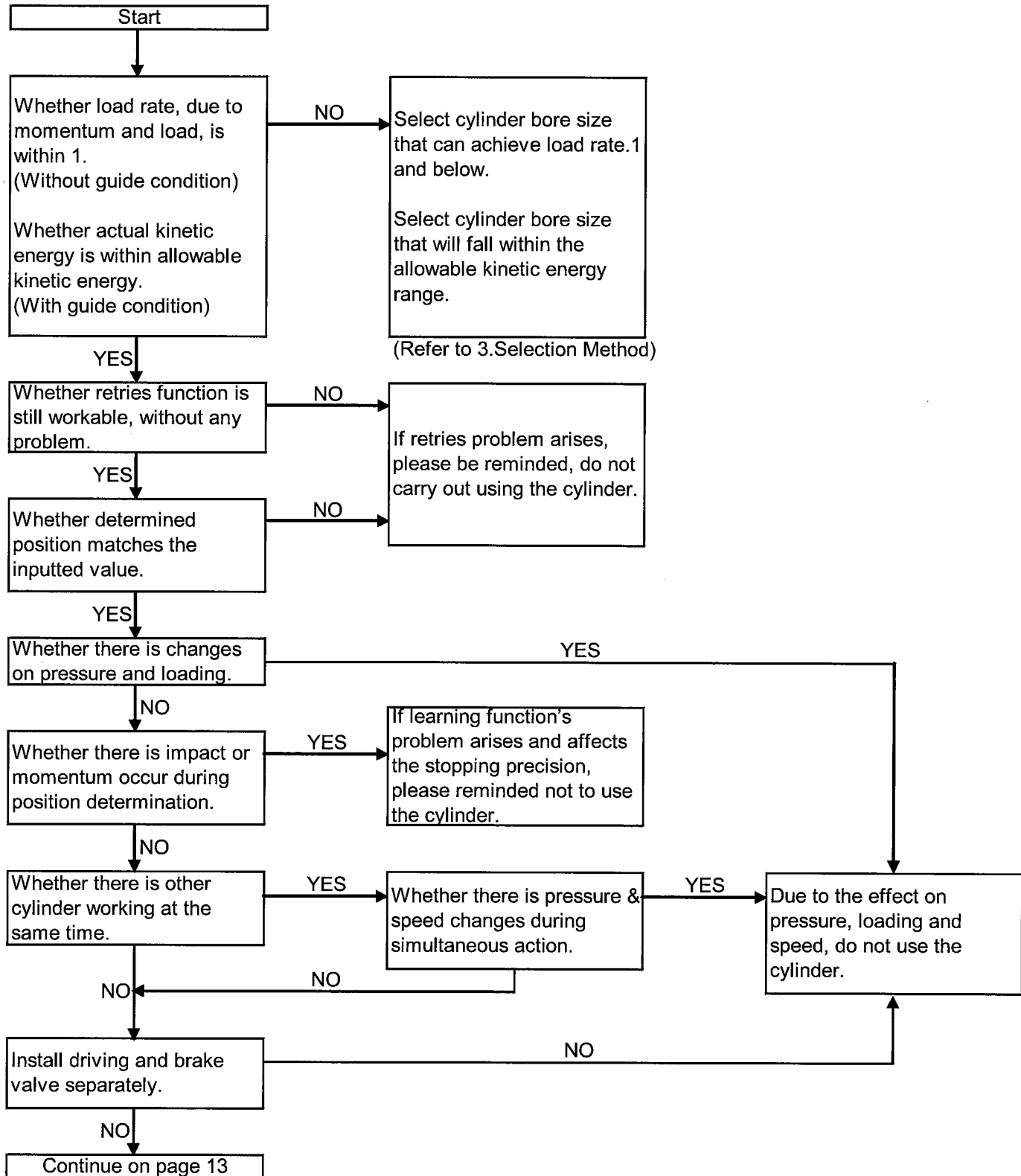
d. Load: within allowable kinetic energy

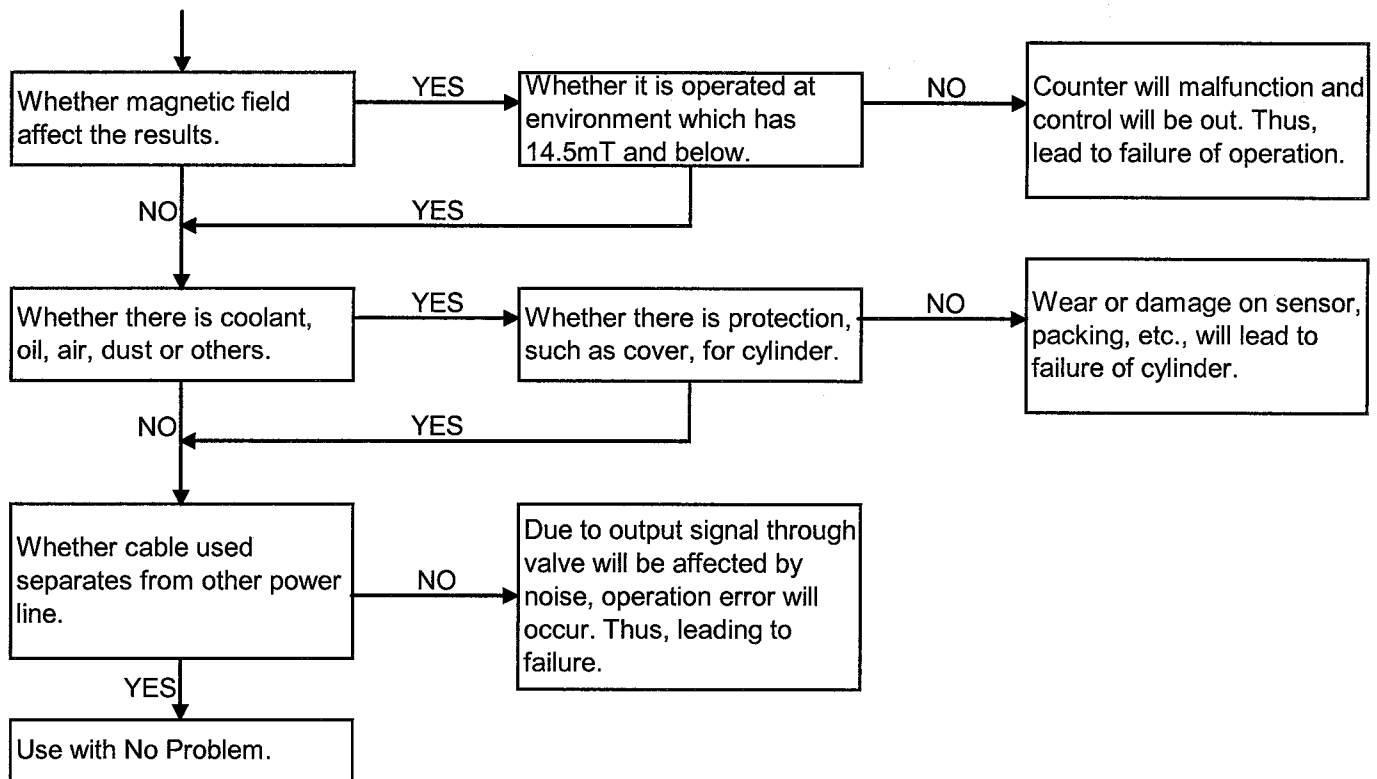
Chapter 3: System Configuration

3-1 System Checking Flow Chart

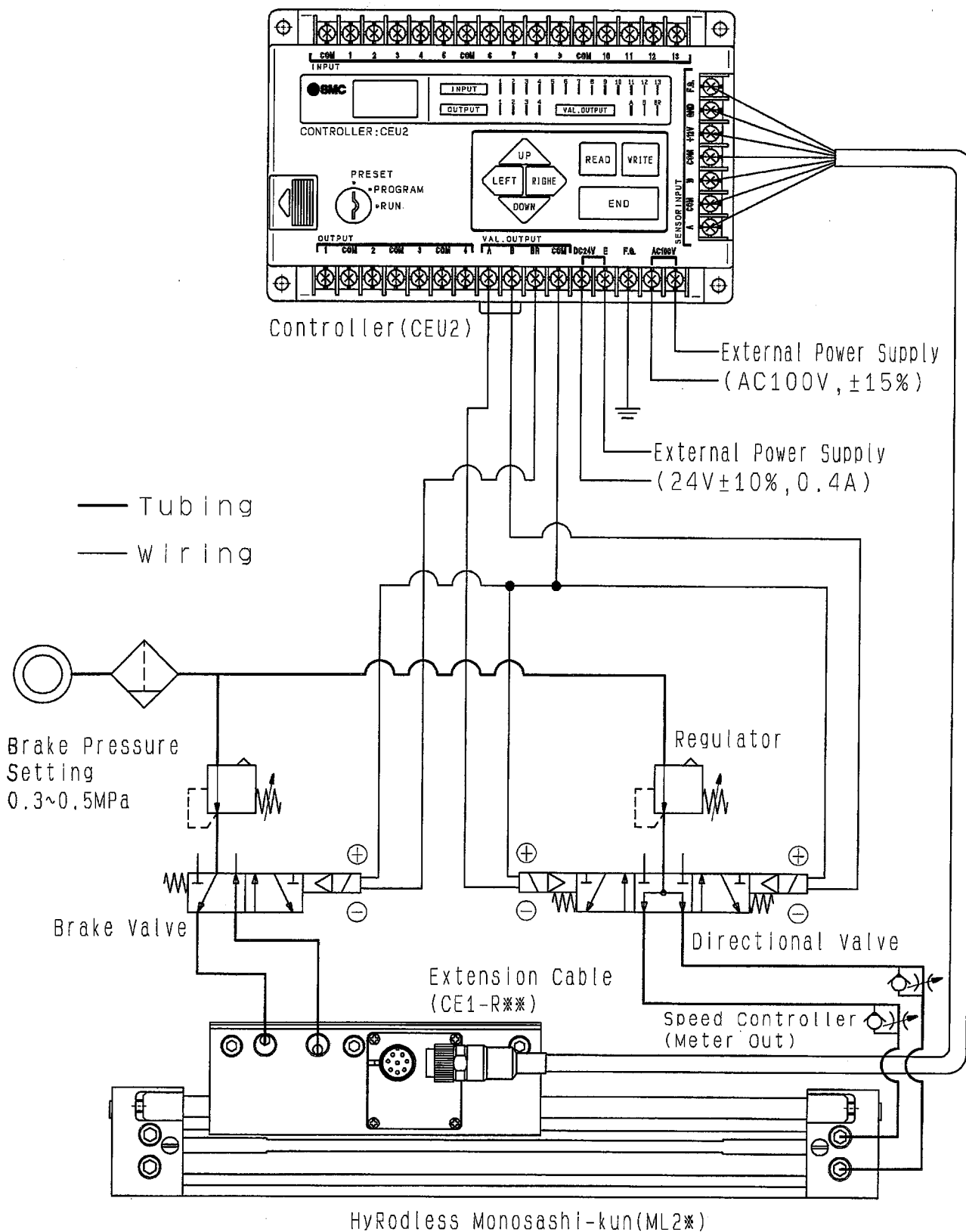
< ML2 (HyRodless Monosashi-kun) + CEU2 (Controller) >

Refer to Check Flow below, to determine brake position, so as to reduce the possibility of occurring errors, which are mostly due to the stopping precision, caused by brake position.

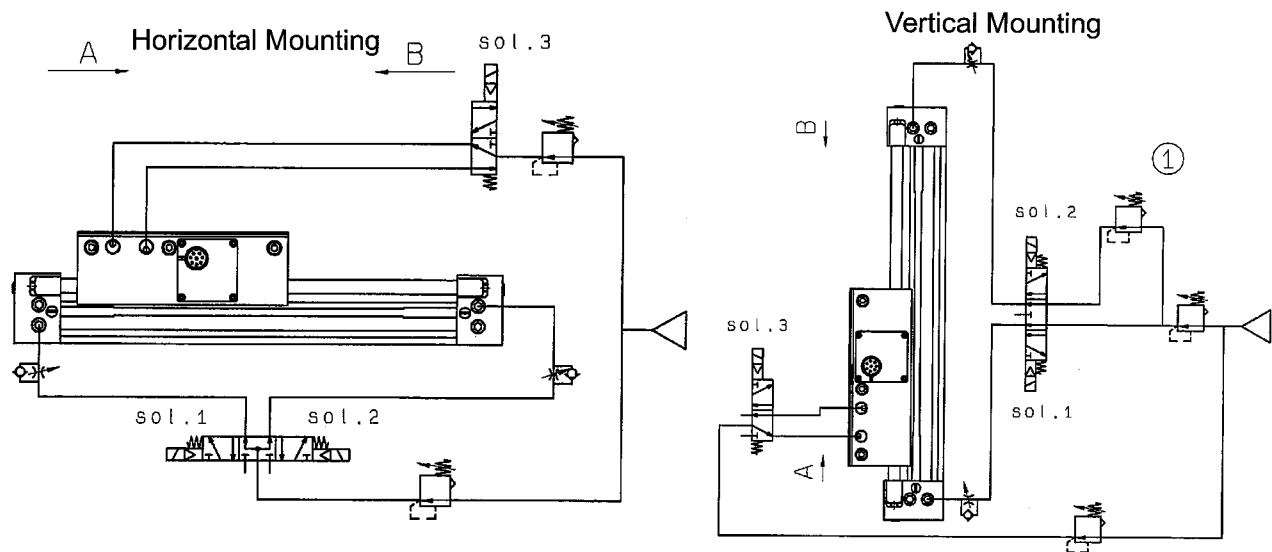




3-2 System Configuration



3-3 Pneumatic Circuit



<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

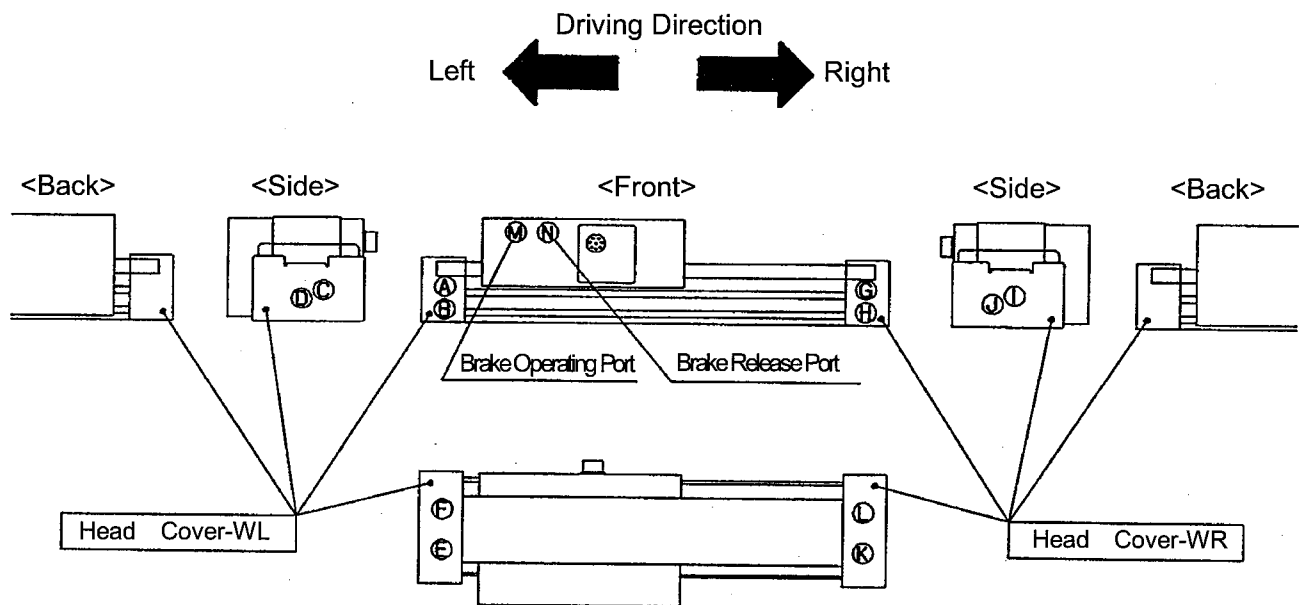
- With the above circuit, maintaining the slider at center by balancing both sides (left & right) supply pressure to achieve air balance state.
- At the situation of vertical mounting, maintain the slider at the center and reduce the upper portion's supply pressure accordingly to counter for the weight 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.

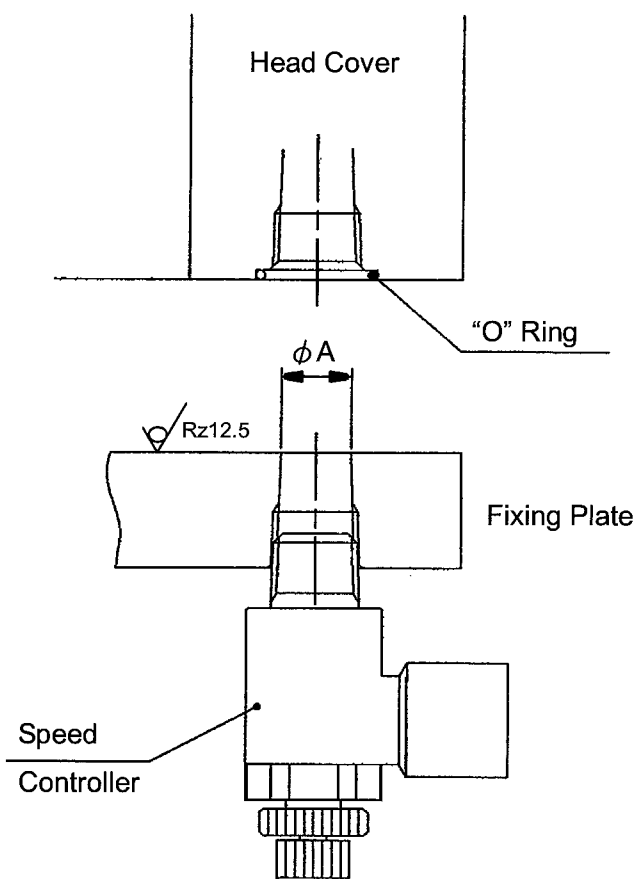


Tube Part No.		1	2	3	4	5	6
Head Cover Type		Head Cover-WL			Head Cover-WR		
Tubing Side		Front	Side	Bottom	Front	Side	Bottom
Driving Direction	Left	A	C	E	G	I	K
	Right	B	D	F	H	J	L

Note: 1. Tubing should be group accordingly with reference to the above table's grouping, 6 in each side.

2. It is possible to connect speed controller at the ports, where the tube 1,2,4&5 are.

Bottom face's installation dimension



	$\phi 25, \phi 32$	$\phi 40$
"O" Ring	C9	C11.2
ϕA	$\phi 6$	$\phi 8$

Chapter 4: Selecting Method

4-1 Selecting Procedure

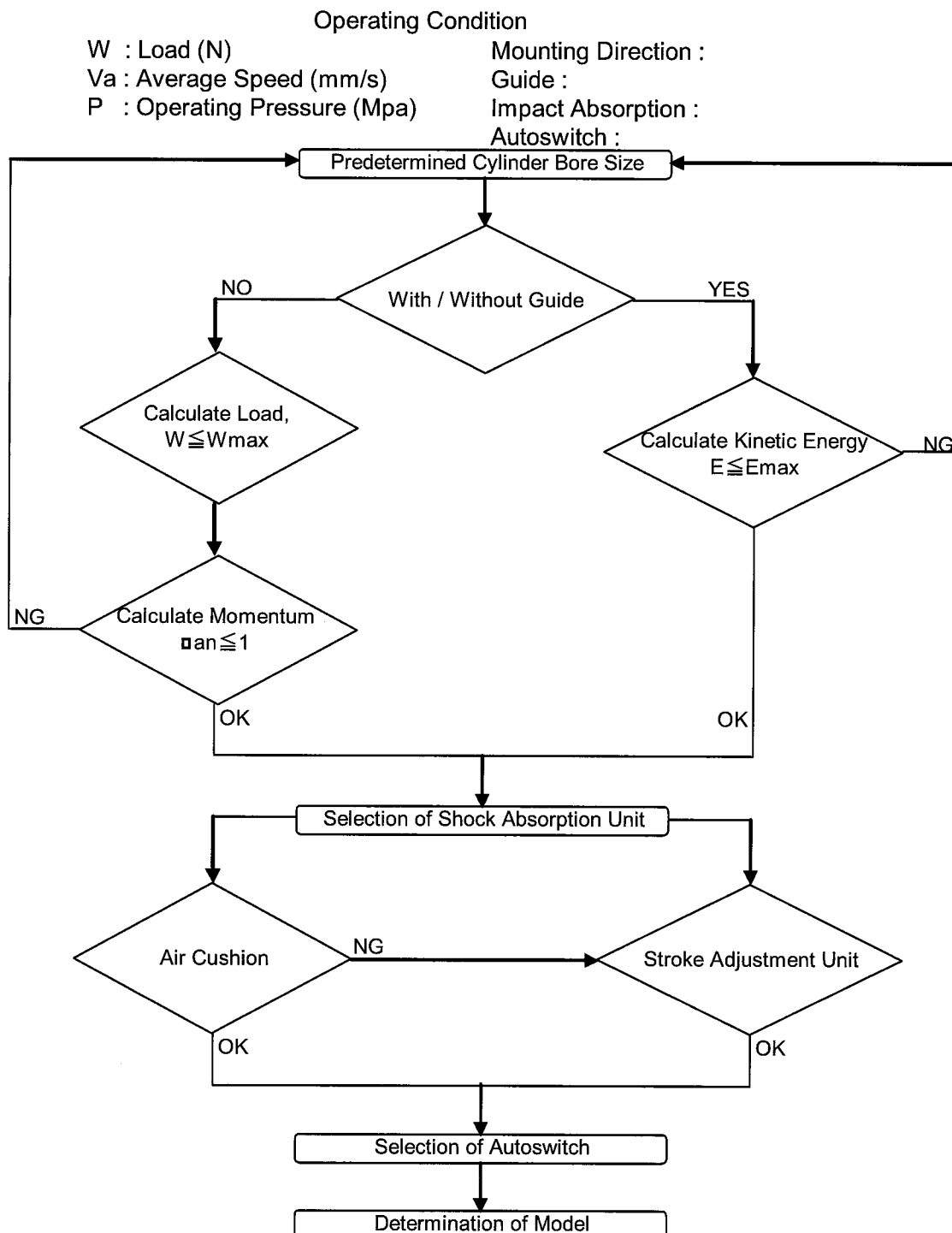
Follow procedures stated below, so as to select the most suitable cylinder with respect to application: -
As maximum load, allowable momentum and kinetic energy will vary with respect to working conditions like mounting direction, guide (with or without), etc. Hence, during calculation of allowable load, below stated factors should be strictly followed: -

- Maximum load.
- Static Momentum.
- Kinetic Momentum (during impact with stopper and locking).
- Allowable Kinetic Energy.

Be aware of not to exceed the summation value of load rate, $1(\sum a_n > 1)$.

(For the situation, $\sum a_n > 1$, select larger cylinder bore size)

Besides that, when positioning is necessary, maximum speed that can be achieved shall be 500mm/s and below.



4-2 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 Momentum
E	(J)	: Load's Kinetic Energy
g	(m/s)	: Gravity Acceleration (9.8m/s ²)

<Piston Speed>

$$V=1.4 \times V_a$$

<Maximum Load>

$$W_e=1.4 \times V_a \times W \times 10$$

<Maximum Allowable Momentum>

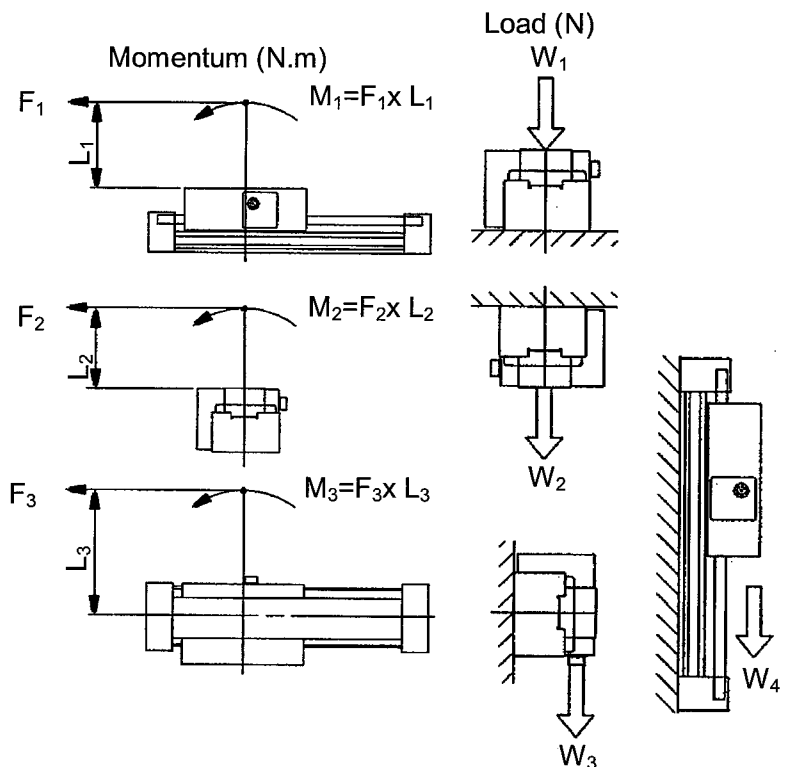
$$M = \frac{W_e \times L}{3} = 5 \times V_a \times W \times L$$

<Load Rate>

$$a_n = \frac{F}{F_{\max}} = \frac{M}{M_{\max}} = \frac{E}{E_{\max}}$$

F / M / E : Calculate Load / Momentum / Kinetic Energy

F_{max} / M_{max} / E_{max}: Max. loading / momentum / kinetic energy under the condition of allowable speed (value obtained from graph)



<Allowable Kinetic Energy>

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

• Allowable Momentum & Maximum Loading

Model	Allowable Momentum N.m			Maximum Loading 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

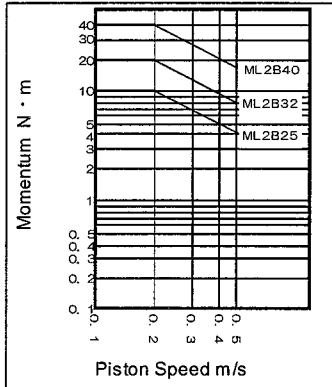
• Allowable Kinetic Energy

	ML2B25	ML2B32	ML2B40
Allowable Kinetic Energy J	0.43	0.68	1.21

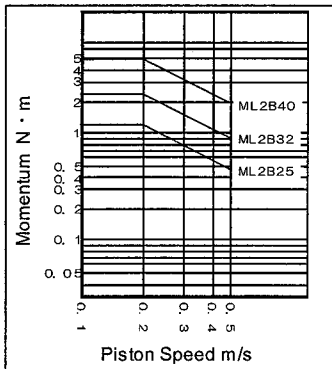
Max. Allowable Momentum

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.

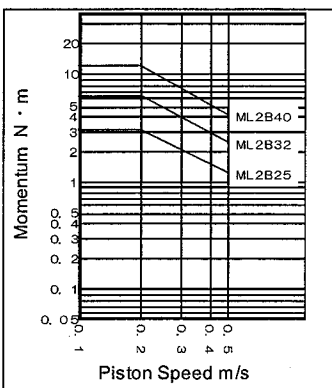
ML2B / M_1



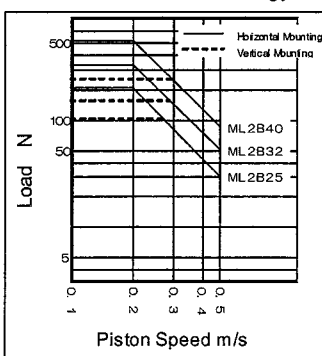
ML2B / M_2



ML2B / M_3



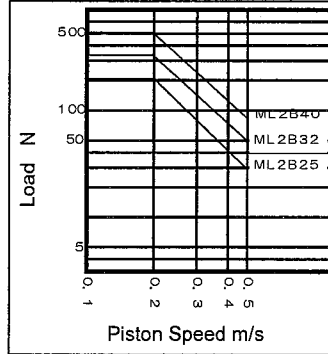
Allowable Kinetic Energy



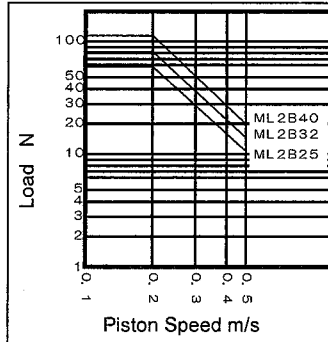
Max. Load

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.

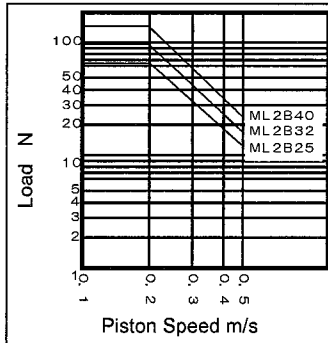
ML2B / W_1



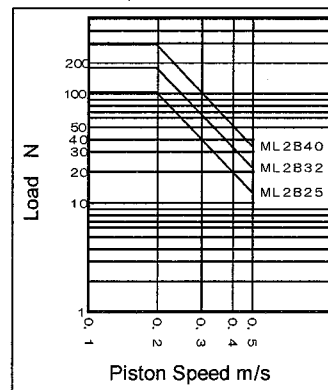
ML2B / W_2



ML2B / W_3



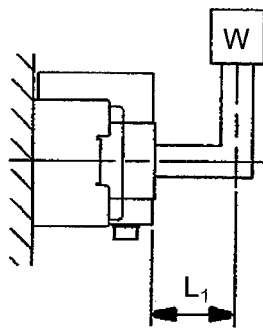
ML2B / W_4



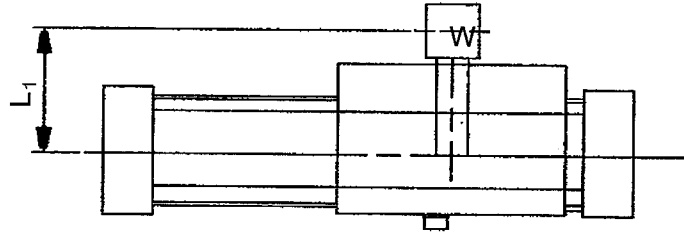
4-3 Selection Example

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 Loading	Dynamic Loading
A	Load due to W	W ₃	—
B	Momentum due to W	M ₂	—
C	Momentum due to we when stopping	—	M ₃ V
D	//	—	M ₁ V

2. Static Load <normal load>

B W₃max=60Nm (Checked from graph with Va)

$$\text{Load Rate } a1 = \frac{W_3}{W_{3\max}} = \frac{15}{60} = 0.25$$

B M₂max=2Nm (Checked from graph with Va)

$$M_2 = W \times L_1 = 15 \times 0.05 = 0.75 \text{ Nm}$$

$$\text{Load Rate } a2 = \frac{M_2}{M_{2\max}} = \frac{0.75}{2} = 0.375$$

3. Dynamic Load <normal load & load due to moment>

Impact Loading, We=1.4x10xVaxW=1.4x10x0.25x15=52.5N

C M₃max=3.5Nm (Checked with V=1.4xVa)

$$M_3 = W \times L_2 \times \frac{1}{3} = 52.5 \times 0.05 \times \frac{1}{3} = 0.88 \text{ Nm}$$

$$\text{Load Rate } a3 = \frac{M_3}{M_{3\max}} = \frac{0.88}{3.5} = 0.25$$

D M₁max=12Nm (Checked with V=1.4xVa)

$$M_1 = W \times L_1 \times \frac{1}{3} = 52.5 \times 0.05 \times \frac{1}{3} = 0.88 \text{ Nm}$$

$$\text{Load Rate } a4 = \frac{M_1}{M_{1\max}} = \frac{0.88}{12} = 0.073$$

4. Examination of Load Rate

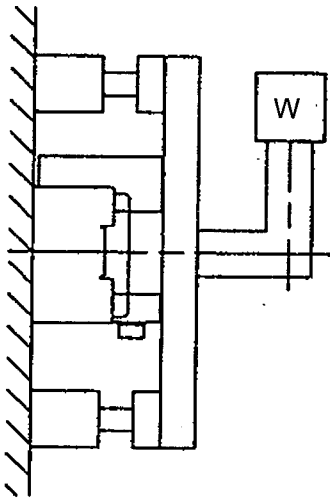
	an
A	0.25
B	0.375
C	0.25
D	0.073
□ an	0.948
Decision	□ an ≤ 1



ML2B32 is selected

II . With Guide

1. Operating Conditions



Model	: ML2B25	Load	: 30N
Speed , Va	: 350mm/s	Mounting Direction	: upon wall

∴ The weight of table is considered as 0 in this case.

However, during actual application, it should be taken into consideration.

2. Allowable Kinetic Energy

$$E_{\max} = 0.43 \text{ (J)}$$

$$V = V_a \times 1.4 = 350 \times 1.4 = 490 \text{ mm/s}$$

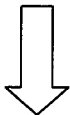
$$E_v = \frac{W}{2g} \times V^2 = \frac{30}{2 \times 9.8} \times 0.49^2 = 0.36 \text{ (J)}$$

$$\text{Load Rate } a_5 = \frac{E}{E_{\max}} = \frac{0.36}{0.43} = 0.84$$

3. Examination of Load Rate

$$a = 0.84 \leq 1 \quad \text{OK}$$

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



ML2B25 is selected

(Refer to graph in page 19: If operating conditions, load and speed, fall into permissible range, selection is approved.)

Chapter 5: Specifications

5-1 Cylinder Specifications

Bore Size		$\phi 25$	$\phi 32$	$\phi 40$
Operating Fluid		Air		
Operating Method	Cylinder	Double Acting Type		
	Brake	Integrated Pneumatic and Spring		
Operating Pressure	Cylinder	0.1~0.8MPa		
	Brake	0.3~0.5MPa		
Proof Pressure		1.2MPa (Cylinder) , 0.75MPa (Brake)		
Piston Speed		100~1500mm/s (during positioning, 100~500mm/s)		
Ambient Temperature		5~60°C (No freezing)		
Cushion		Both sides Air Cushion		
Brake Type		Integrated Pneumatic and spring		
Lubrication		None		
Stroke's tolerance		0~+1.8		
Hardware		JIS B 0209		
Port Size	Front & Side Port	Rc1/8		Rc1/4
	Bottom Port	$\phi 5$	$\phi 6$	$\phi 8$

5-2 Controller Specifications

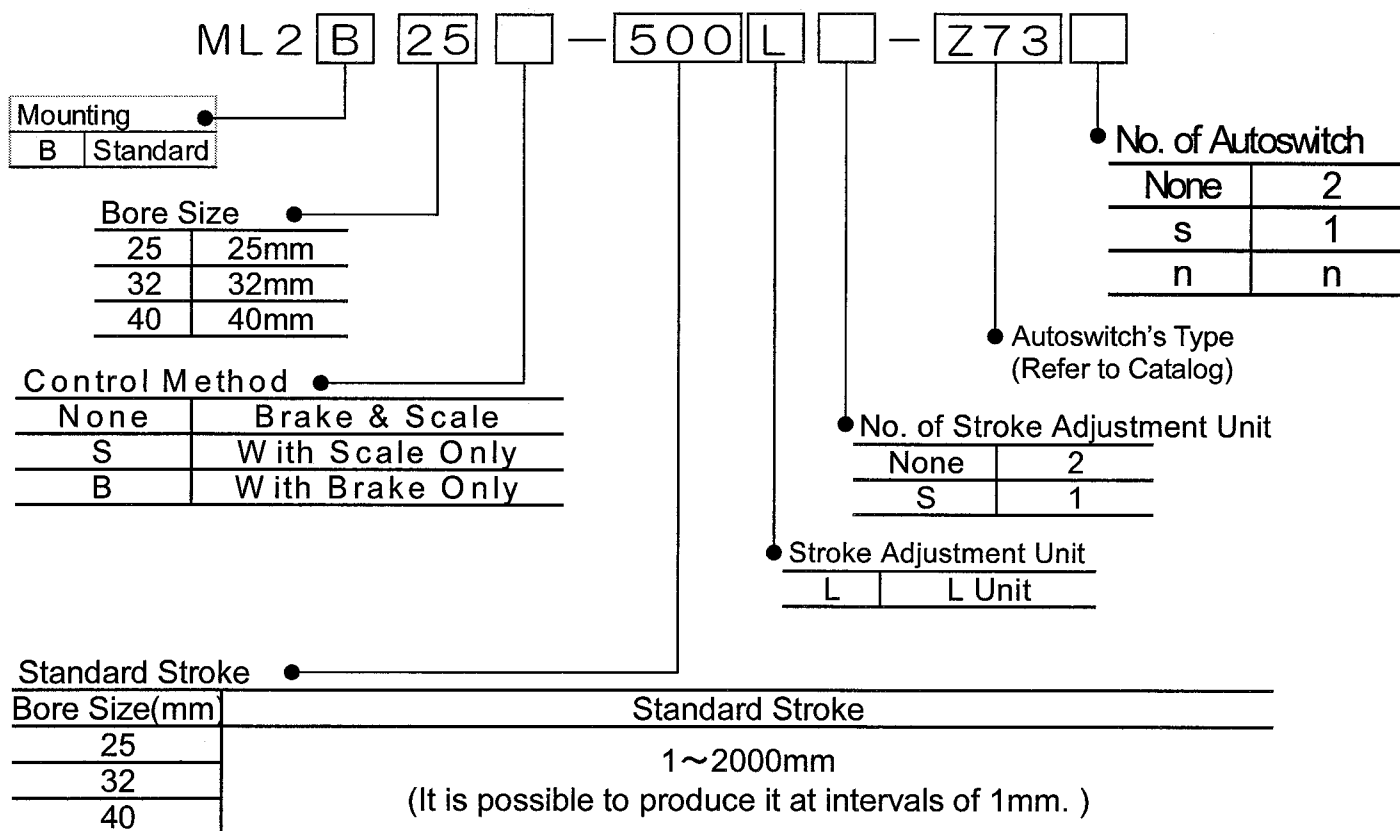
Type	CEU2	CEU2P
Model Nomenclature	Controller	
Mounting	Surface Mounting (Din Rail or Screw)	
Operating Modes	PRESET · PROGRAM · RUN	
Display	Back lighted Display	
Position Setting Capacity	1-16 Programs Each Program 1-32 steps	
Position Control Method	P.T.P. (Point To Point)	
Control Axes	One Axis	
Position Setting Method	Key Input to Controller	
Position Setting Range	9999.9mm	
Min. Setting Range	0.1mm	
Memory	8kbyte Static RAM (5-Year Battery Backup)	
Min. Setting Interval	5mm and above	
Input Signal	START, GOHOME, PROGRAM#, PAUSE, EMERG, STOP, SETHOME RESET, AUTO/MANUAL, IN/OUT (Manual mode only)	
Output Signal	Move Completed, At Home, Program End, Error	
Controlled Output	NPN Open Collector (DC30V, 50mA)	PNP Open Collector (DC30V, 50mA)
Power Supply	AC100V \pm 15%, 50Hz/60Hz & DC24V \pm 10%, 0.4A	
Operating Temp. Range	0~50°C	
Operating Humidity Range	25~85%	
Shock Resistance	10~55Hz, Amplitude 0.75mm Each Axis for 2 hours	
Noise Resistance	Square Wave (1 μ s Pulse Width) \pm 1500V at Power Terminal, 600V at Input Terminal	
Impact Resistance	10G, 3 times at each axis	
Proof Voltage	AC1500V, 1Min (less than 3mA), between Case & AC Line AC500V, 1Min (less than 3mA), between Case & 12VDC	
Current Consumption	Below 1.0A	
Insulation Resistance	Above 50M Ω , between Case & AC Line	
Mass	690g	

5-3 Sensor Specifications

Connector	Connector : R04-R8M, Tajimi Musen Denki Company
Max. Transmission Distance	20m (6 core twisted pair shielded wire)
Position Detection Distance	Magnetize Scaled Piston Rod & Detection Head (Incremental Type)
Magnetize Field Resistance	14.5mT
Power Supply	DC12V \pm 10% (ripple less than 1%)
Current Consumption	40mA
Resolution	0.1mm/pulse
Accuracy	\pm 0.2mm (20°C)
Output Type	Open Collector (DC35V, 80mA)
Output signal	Phase A & B with Differential Output
Max. Response Speed	500mm/s (sensor : 1500mm/s)
Proof Voltage	AV500V, 1 min (Case to 12E)
Insulation Resistance	DC500V, above 50M Ω (Case to 12E)
Shock Resistance	33.3Hz6.8G, 2hours at X,Y and 4hours at Z JIS D1061 as standard
Impact Resistance	30G, 3 times at each axis
Extension Cable (Option)	5m, 10m, 15m, 20m (Connector : R03-J8M, Tajimi Musen Denki Company)

Chapter 6: Model

6-1 Hyrodless Monosashi-kun With Brake



Option

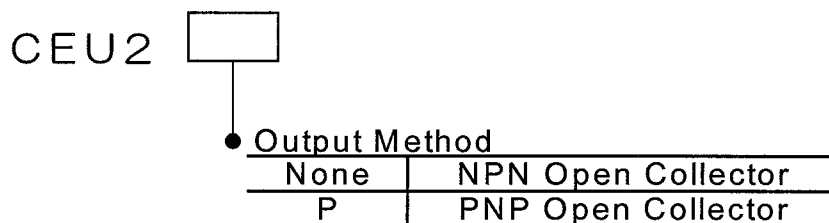
Stroke Adjustment Unit

φ 25	MY-A25L
φ 32	MY-A32L
φ 40	MY-A40L

Stroke Adjustment Unit

φ 25	MY-S25A	MY-S25B
φ 32	MY-S25A	MY-S25B
φ 40	MY-S32A	MY-S32B

6-2 Controller



6-3 Extension Cable

CE 1-R

Length of Cable ●

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

● Postscript

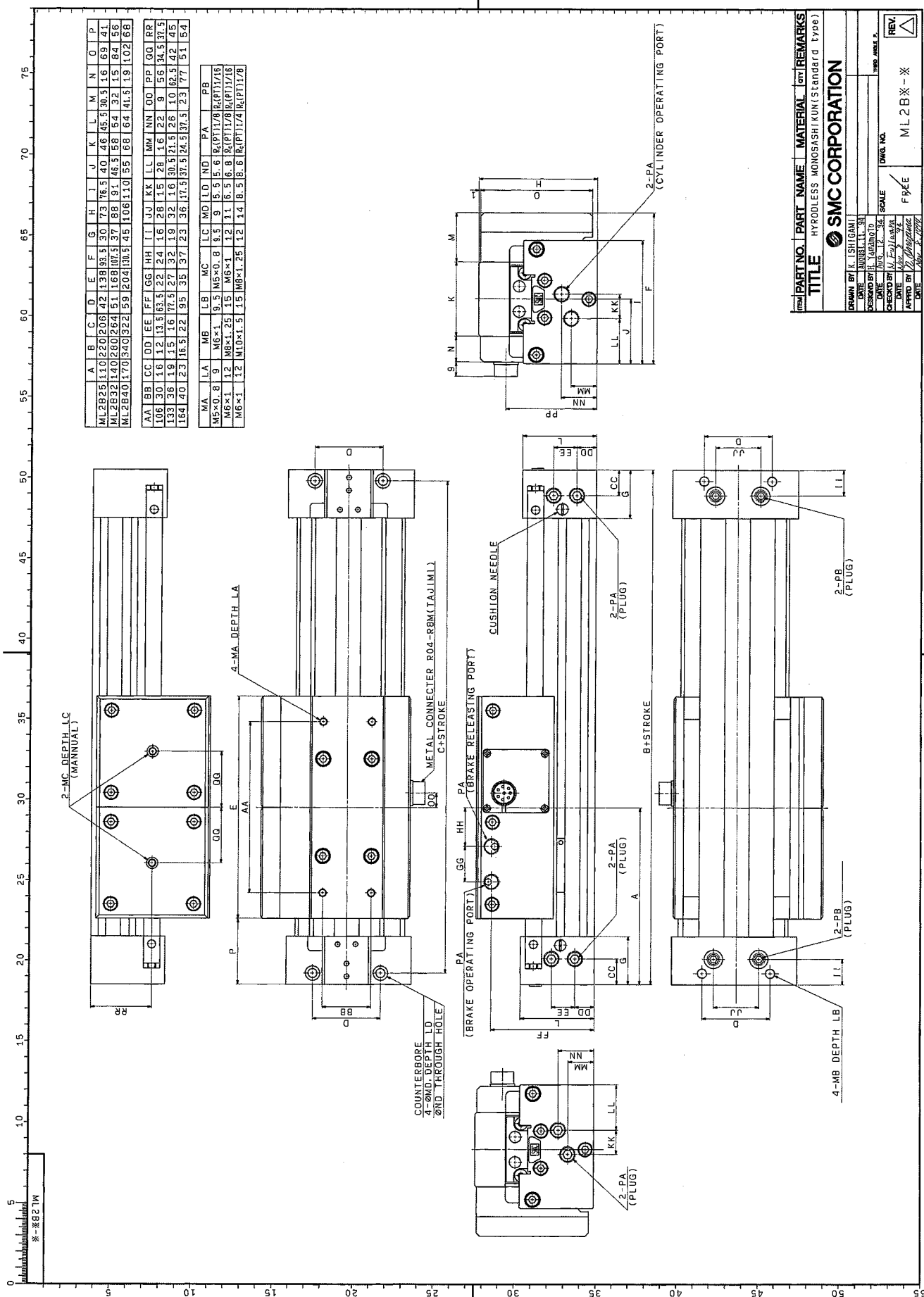
None	Extension Cable
C	Extensin Cable + Connector

Connector's Connection

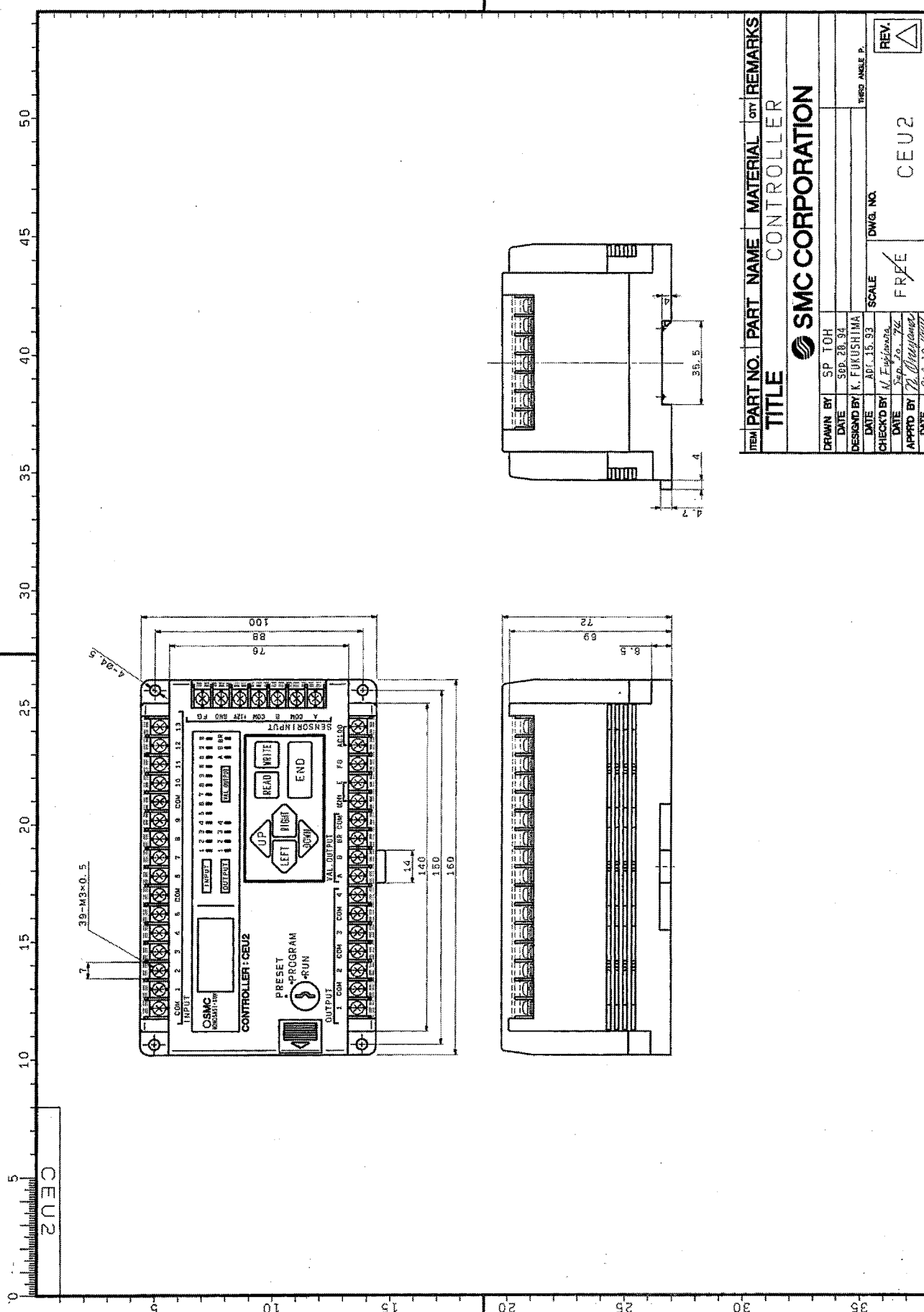
Symbol	A	B	C, D	E	F	G
Core Wire Color	White	Yellow	Brown, Blue	Red	Black	(Shield)

Chapter 7: External Dimension Drawing

7-1 Hyrodless Monosashi-kun With Brake



CEUS
5

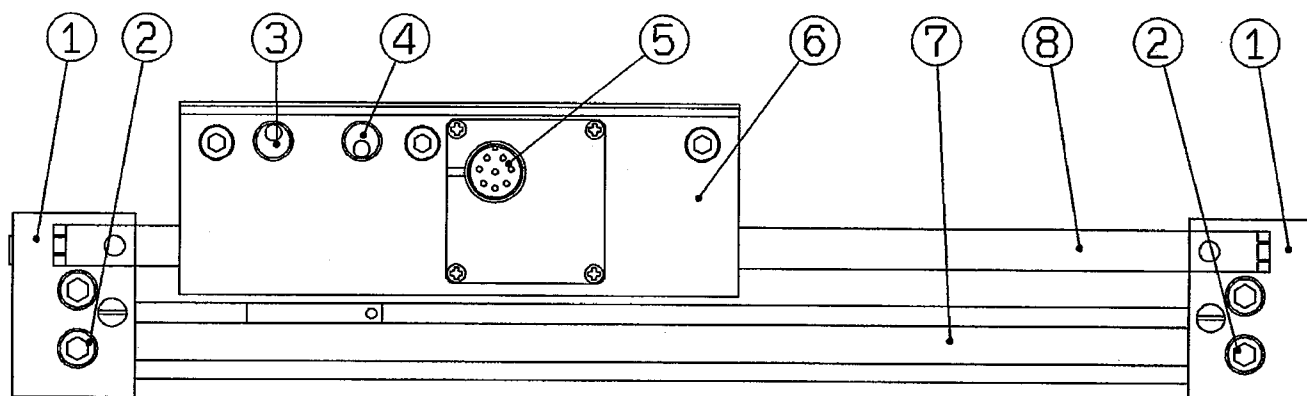


28



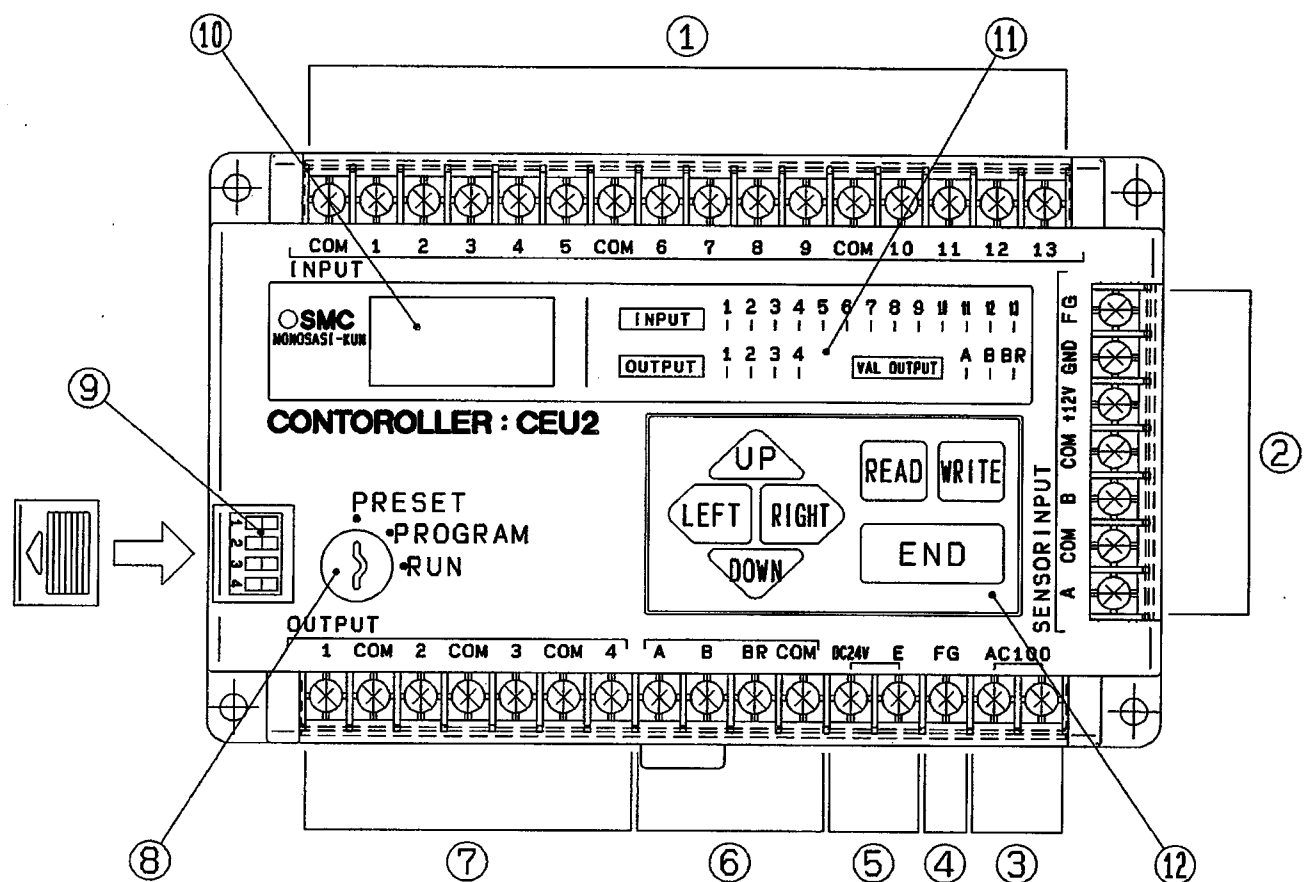
Chapter 8: Part Identification

8-1 Hyrodless Monosashi-kun With Brake



- | | | |
|------------------------|-----------------------|------------------------|
| ① Head Cover | ② Plug (Driving Port) | ③ Brake Operating Port |
| ④ Brake Releasing Port | ⑤ Connector | ⑥ Slider |
| ⑦ Cylinder Tube | ⑧ Scale Plate | |

8-2 Controller



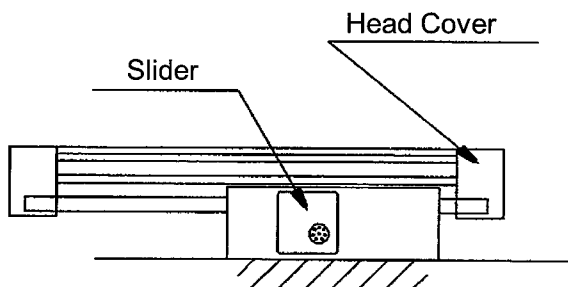
- | | | |
|----------------------------|-------------------------|------------------------------------|
| ① External Input Terminal | ② Sensor Input Terminal | ③ AC Power Supply Input Terminal |
| ④ Earth Terminal | ⑤ DC Input Terminal | ⑥ Valve Output Terminal |
| ⑦ External Output Terminal | ⑧ Mode Switch | ⑨ Dip Switch for Condition Setting |
| ⑩ LCD Display | ⑪ Input Signal Monitor | ⑫ Input Data Key |

Chapter 9: Installation & Wiring

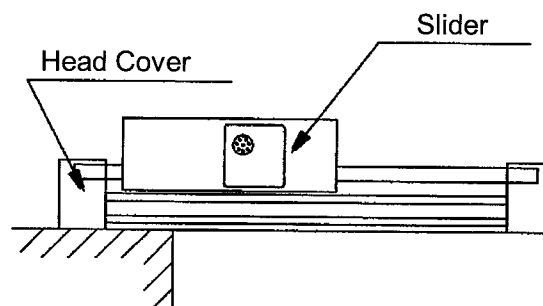
9-1 Installation

9-1-1 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. Beside 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.

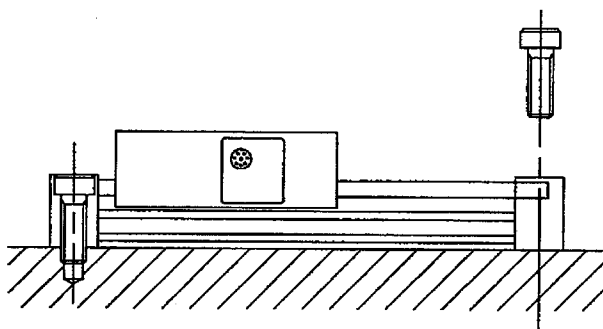


(a) Fixing through Slide

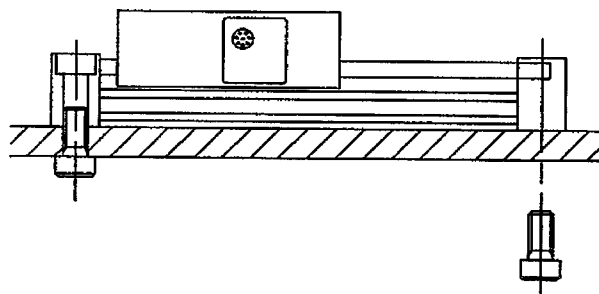


(b) Single side's Fixing

There are 2 ways, as shown in diagram below, to fix cylinder's position. Utilising 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



(d) Fastening through Lower Surface

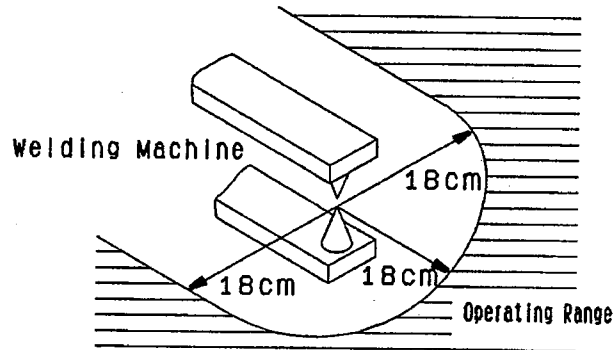
3. With loading within allowable range of Hyrodless Monosashi-kun, supporting structure (LM Guide) is still necessary to be installed as a support for the applied loading. Besides that, for the case of long stroke, floating structure design should be brought in to overcome misalignment problem.
4. Cylinder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

Note: Grease used is 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 magnetic 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.

9-1-2 Installation of Controller

1. During installation of controller, use M4 bolt and DIN rail.
2. Prevent from direct shining of sun, high or low temperature's environment.
[Operating temperature range : 0°C~50°C]
3. Do not utilize it at high humidity's environment.
[Operating humidity range: 25%~85%]
4. Keep it within noise protection material and away from high voltage and power supply wire.
5. Prevent from mounting it at high dust, salty or ferrous contains environment.
6. Do not mount it at high vibration and impact environment.
[Proof vibration: 10~55Hz, range 0.75mm, x, y, z, each axis for 2 hours]

9-2 Wiring

9-2-1 The Connection of Power Supply

Power Supply Speciation : AC100V \pm 15% (AC85V~AC115V), 50 / 60Hz
DC24V \pm 10%, 0.4A

Use wire with 0.75mm² or more in the diameter of wire sectional area and twist it.

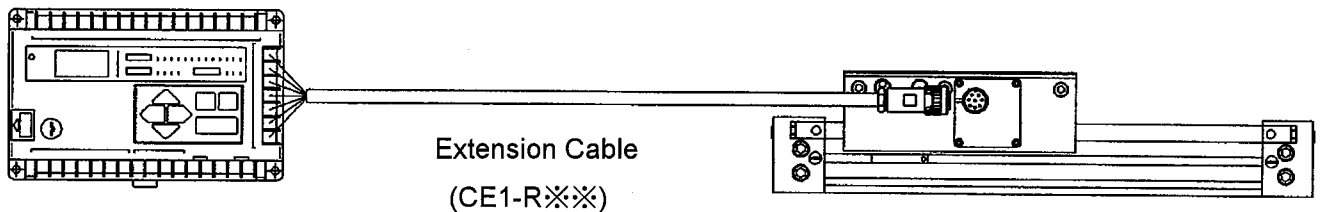
FG is meant for preventing lightening strike, use wire, 0.75mm² or more in the diameter of wire sectional area, to connect to earth.

If FG is not connected to earth, controller's noise filter will not be able to function properly. Hence, noise ill be generated and lead to misreading / disoperation of cylinder.

9-2-2 The Connection of Extension Cable

Use specified (SMC) extension cable. Cable length, 5m~20m, with interval of 5m.

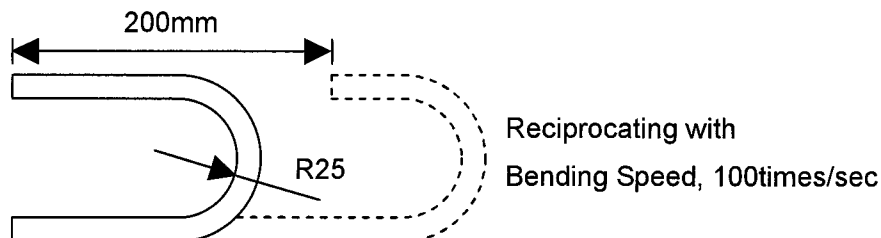
* Example on Cable Connection



* Note

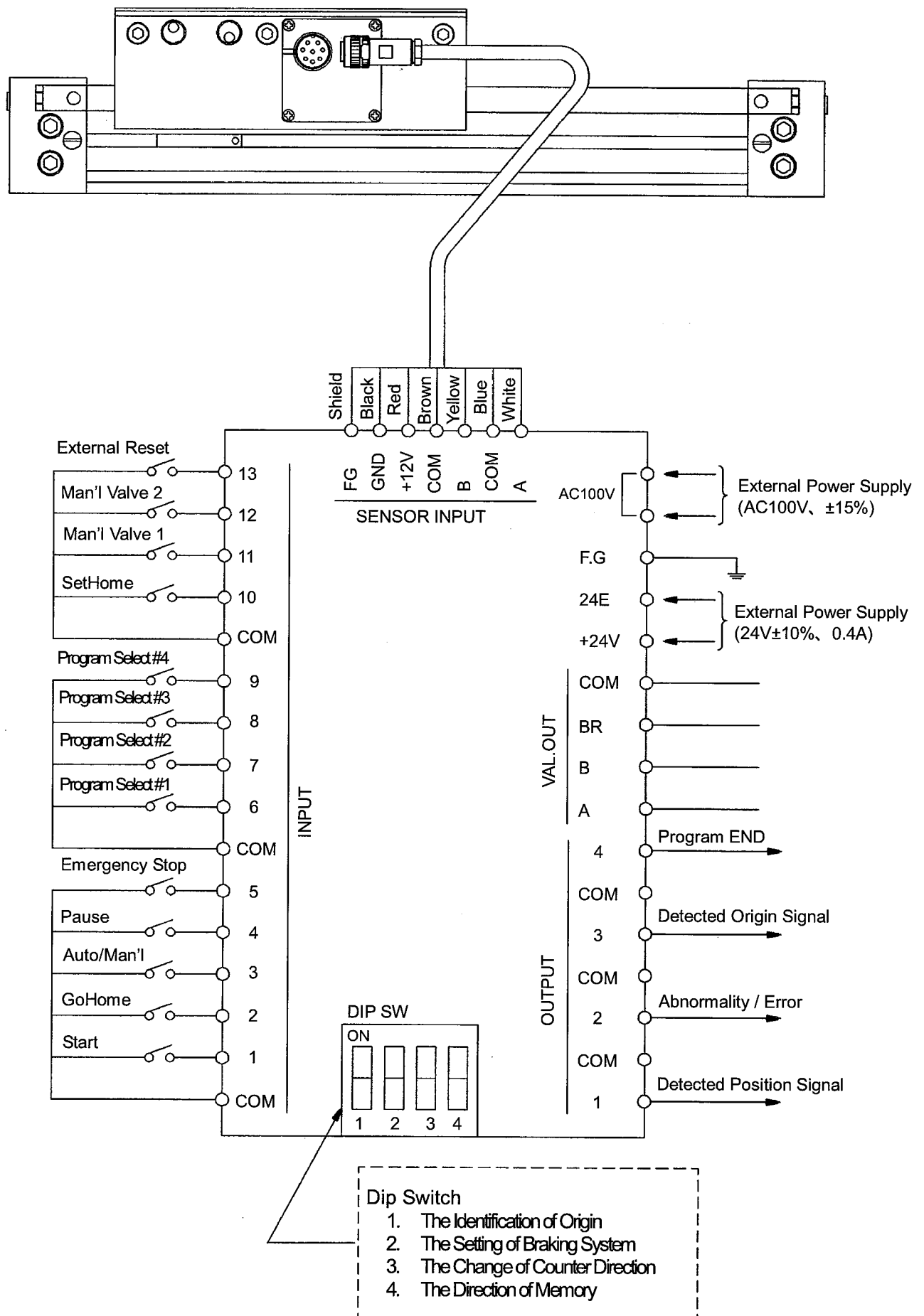
1. Clamp and fix the connector and sensor connection to reduce tension acting on them.
2. Separate cable with power line to prevent from the occurring of noise.
3. When cable is necessary to have U bend, set the bending radius to be above 30mm.

Bending Ability: According to drawing shown below, life span about 4 million cycles can be achieved.



9-3 Input Signal Wiring

9-3-1 Input Signal Wiring Diagram



9-3-2 Input Signal Content

- Start One started, setting position will be inputted. One step of movement per one shot (above 50msec).
 Next : Start signal (above 50msec's signal) will be received and activated to carry out subsequence step, only if homing has been performed and origin signal has been fed back to controller.
- Homing When slider returns to origin, signal above 50msec will be inputted.
- Auto / Man'l When the terminal and COM is in open state, auto mode is on. Vise versa (short circuit), manual mode is on.
- Auto Mode When start signal is inputted. Motion will be executed step by step.
- Hand Mode Man'l 1 (terminal 11) or Man'l 2 (terminal 12) and COM is short circuit to control either moving forward or backward.
 Motion direction depends on tubing and wiring.
- Pause During positioning, motion is stopped by this command. When the command is cancelled, positioning will be resumed from the stopped position.
 Next : Please take note that Err5 (operating error) will arise, if the stopping position after pausing is less than 5mm away from setting point.
- Emergency Stop During positioning, the input of this command will lead to immediate forced stoppage of executing motion. However, it cause the controller show error message, Err10.
 Next : After emergency stop, homing will perform.
- Program Selection 1,2,3 & 4 Select program according to following table (Binary Code) : -

Program No.	N Terminal No.			
	6	7	8	9
1	0	0	0	0
2	1	0	0	0
3	0	1	0	0
4	1	1	0	0
5	0	0	1	0
6	1	0	1	0
7	0	1	1	0
8	1	1	1	0
9	0	0	0	1
10	1	0	0	1
11	0	1	0	1
12	1	1	0	1
13	0	0	1	1
14	1	0	1	1
15	0	1	1	1
16	1	1	1	1

0 Open between IN6~9 and COM

1 Short circuit between IN6~9 and COM

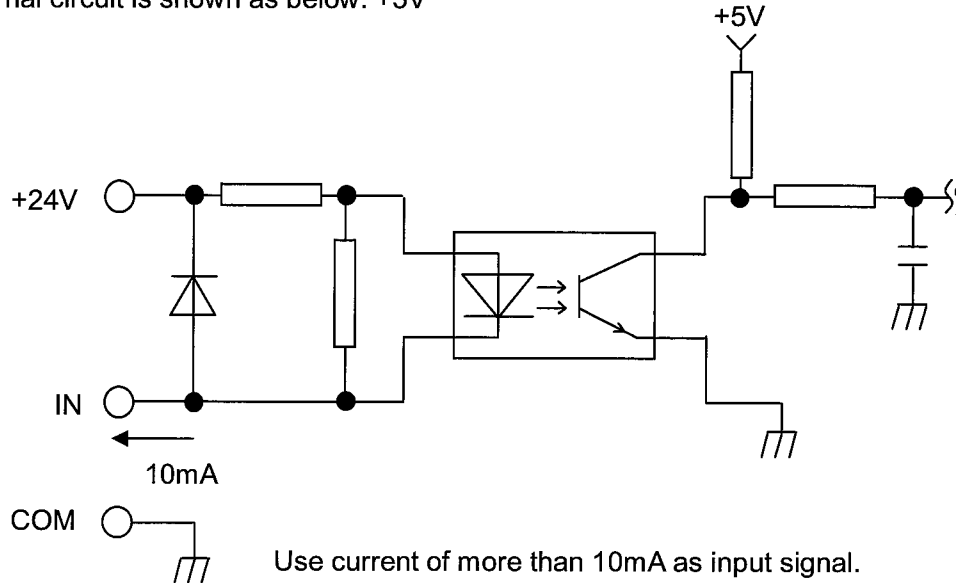
- Set Home When dip switch is set ON, origin's signal is inputted.
 When dip switch is set OFF, origin input is not required.
- Man'l 1 Used at Manual Mode. When signal is inputted, cylinder rod either moves forward or backward.
- Man'l 2
- External Reset The input of signal above 50msec will lead to reset of the system.
 When

9-3-3 Input's Wiring

Input signal consists of 13 signals. With +24V input, +5V and photo-couple will be in isolation state.

Signal's name: Start, Homing, Auto / Man'l , Pause, Emergency Stop, Program Selection #1
Program Selection #2, Program Selection #3, Program Selection #4, Set Home,
Man'l 1, Man'l 2 and External Reset

Input internal circuit is shown as below: +5V



9-3-4 Output's Wiring

Output signal consists of 4 signals. Together with +5V, photo-couple is insulated.

Signal's name: Position Detected, Origin Calculated, Program END, Error

Maximum terminal Voltage: DC+30V

Maximum Current : 50mA (0~50°C)

Output Internal's Circuit

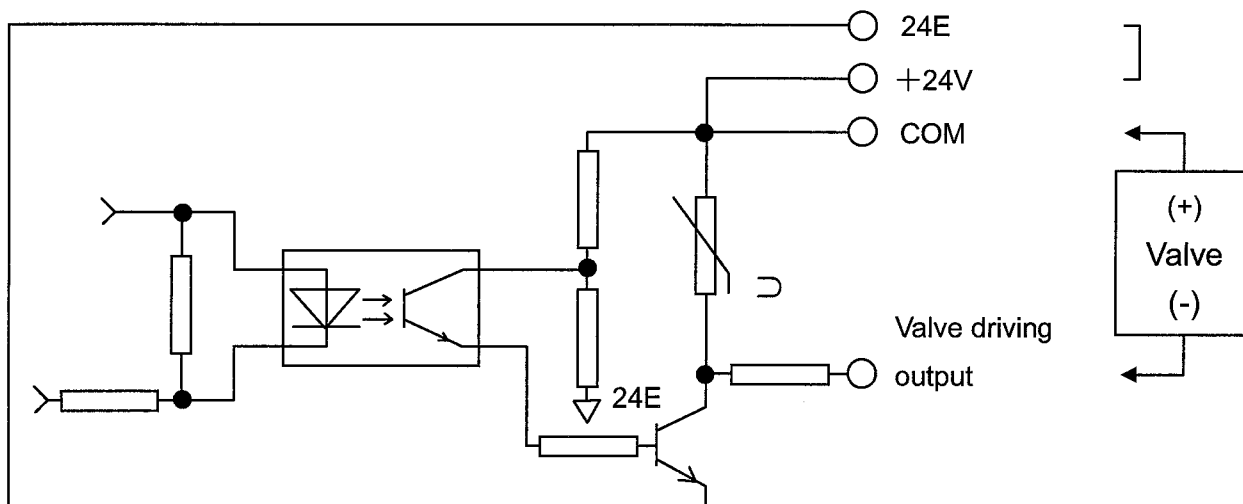
Model	Connection Method
CEU2	<p>NPN Output Transistor</p> <p>Controller: CEU2</p> <p>Max DC +30V, 50mA</p>
CEU2P	<p>PNP Output Transistor</p> <p>Controller: CEU2P</p> <p>Max DC +30V, 50mA</p>

9-3-5 Solenoid Valve's Wiring

Solenoid valve driving output consists of 3 signals, +5V together with photo-couple is in isolation state.

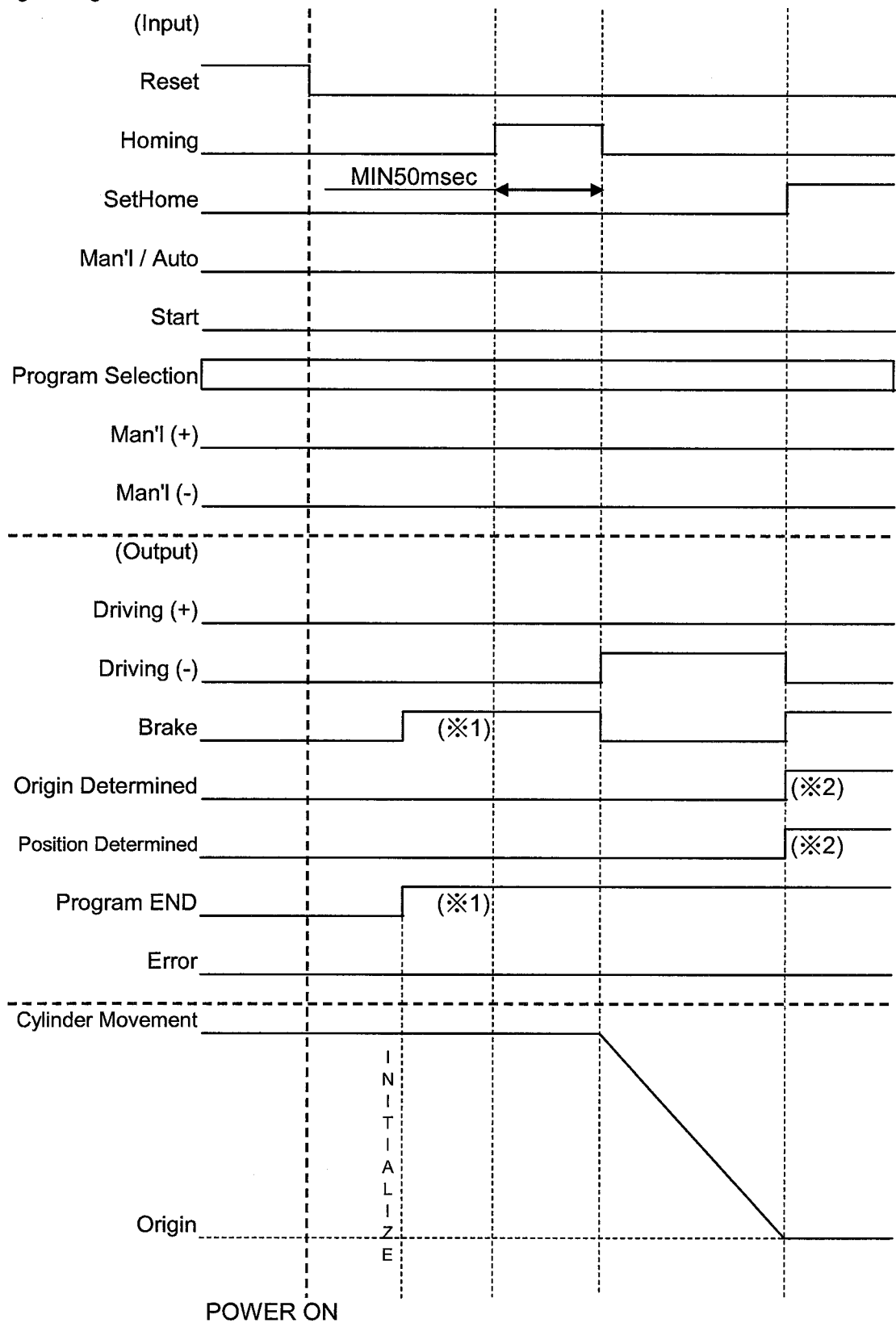
Signal's name: Brake, Driving A & B
Maximum terminal's Voltage: DC+24V
Maximum Current : 80mA (0~50°C)

Solenoid output's internal circuit is shown as below: -



Chapter 10: Timing Chart

Homing Timing Chart

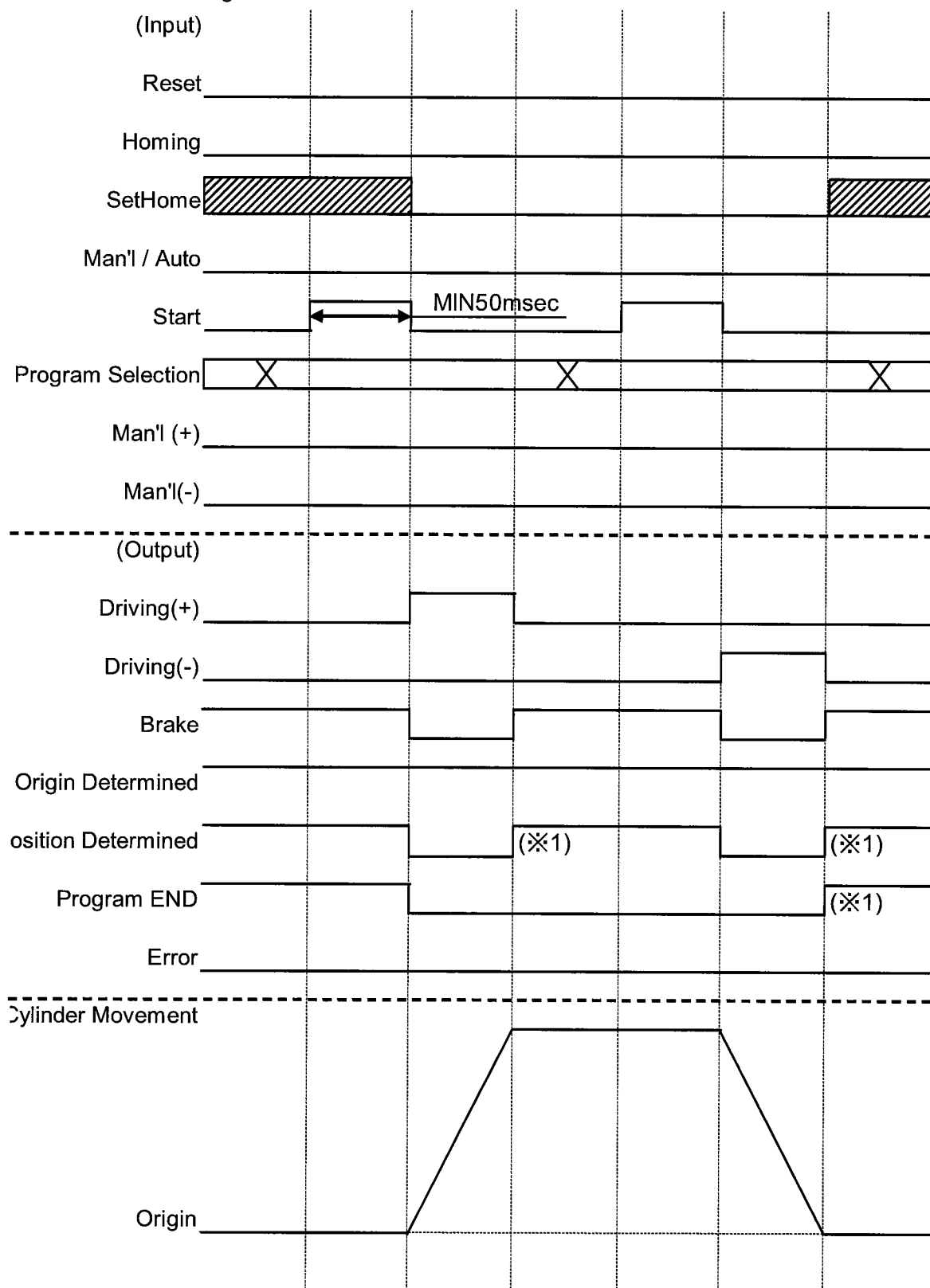


Note: Homing will be executed only on RUN mode and during automatic executing.

(※1) After resetting and re-supplying power, controller will need 2.0sec(max) to resume operation.

(※2) Timing between stopping till output is a presetted timing t1(preset data p7).

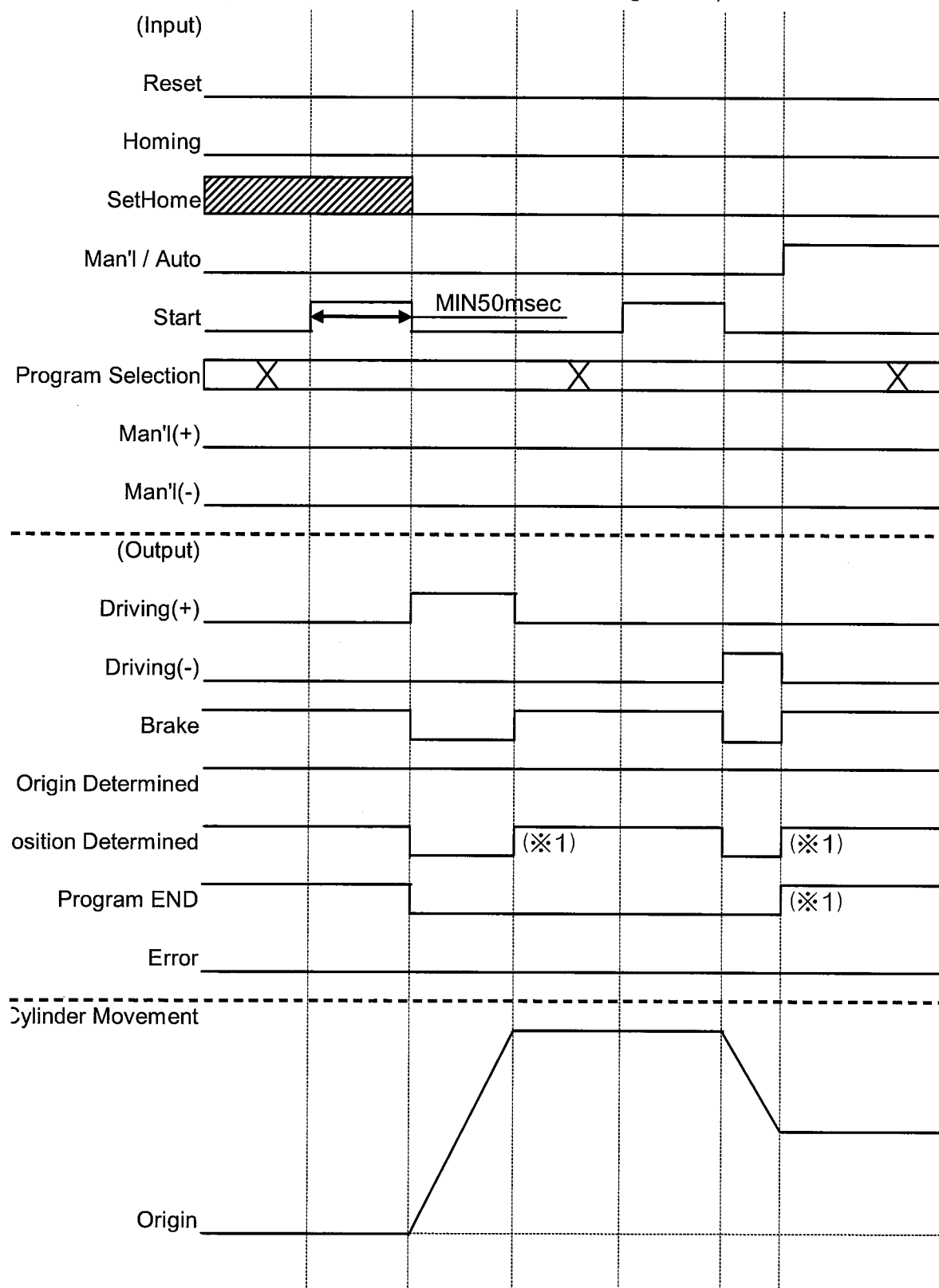
Automatic Execution Timing Chart



Note: During the period between start and program END, program selection is not available.

(※1) Timing between stopping till output is 0.2sec(max).

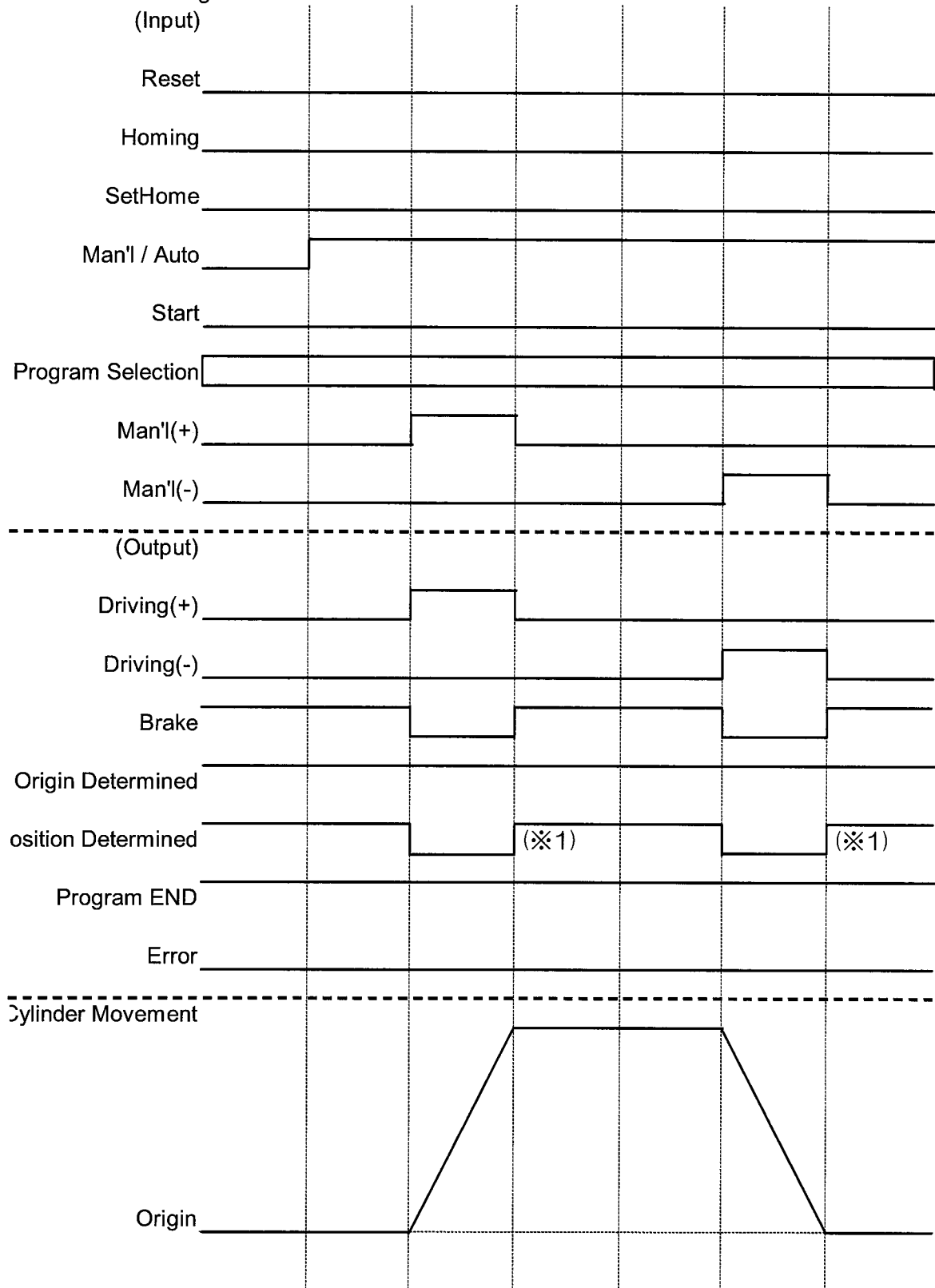
Automatic Execution Timing Chart (Activation of Manual mode during motion)



Note: If Manual mode of RUN mode is activated during Auto mode, motion will stop.

(※1) Timing between stopping till output is 0.2sec(max).

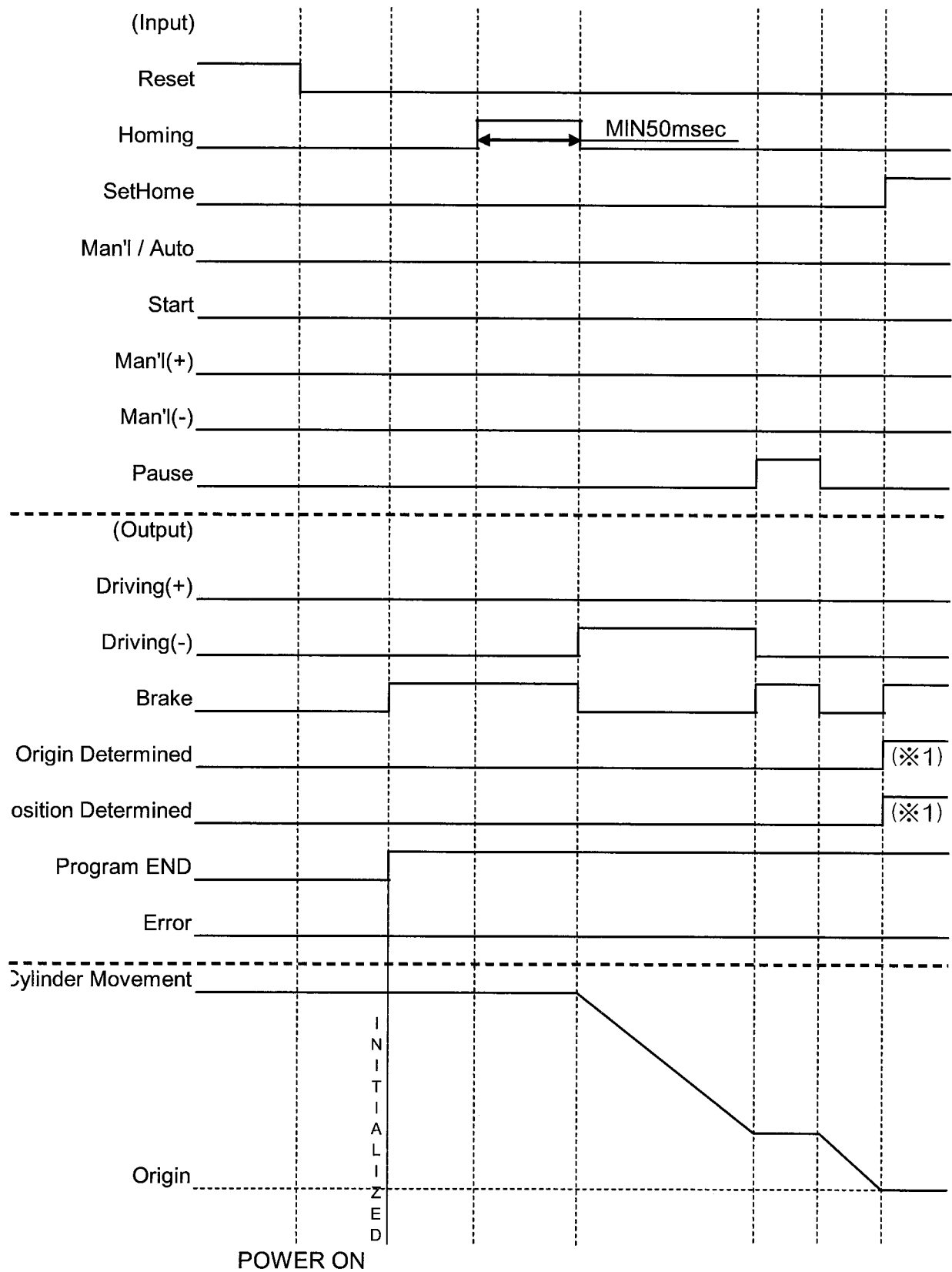
Manual Execution Timing Chart



Note: During manual operation, Start signal is not effective.
 Pressing Man'l(+) and Man'l(-) together will not take effect too.
 In spite of software determines origin, manually operation is done to achieve the origin.

(※1) Timing between stopping till output is 0.2sec(max).

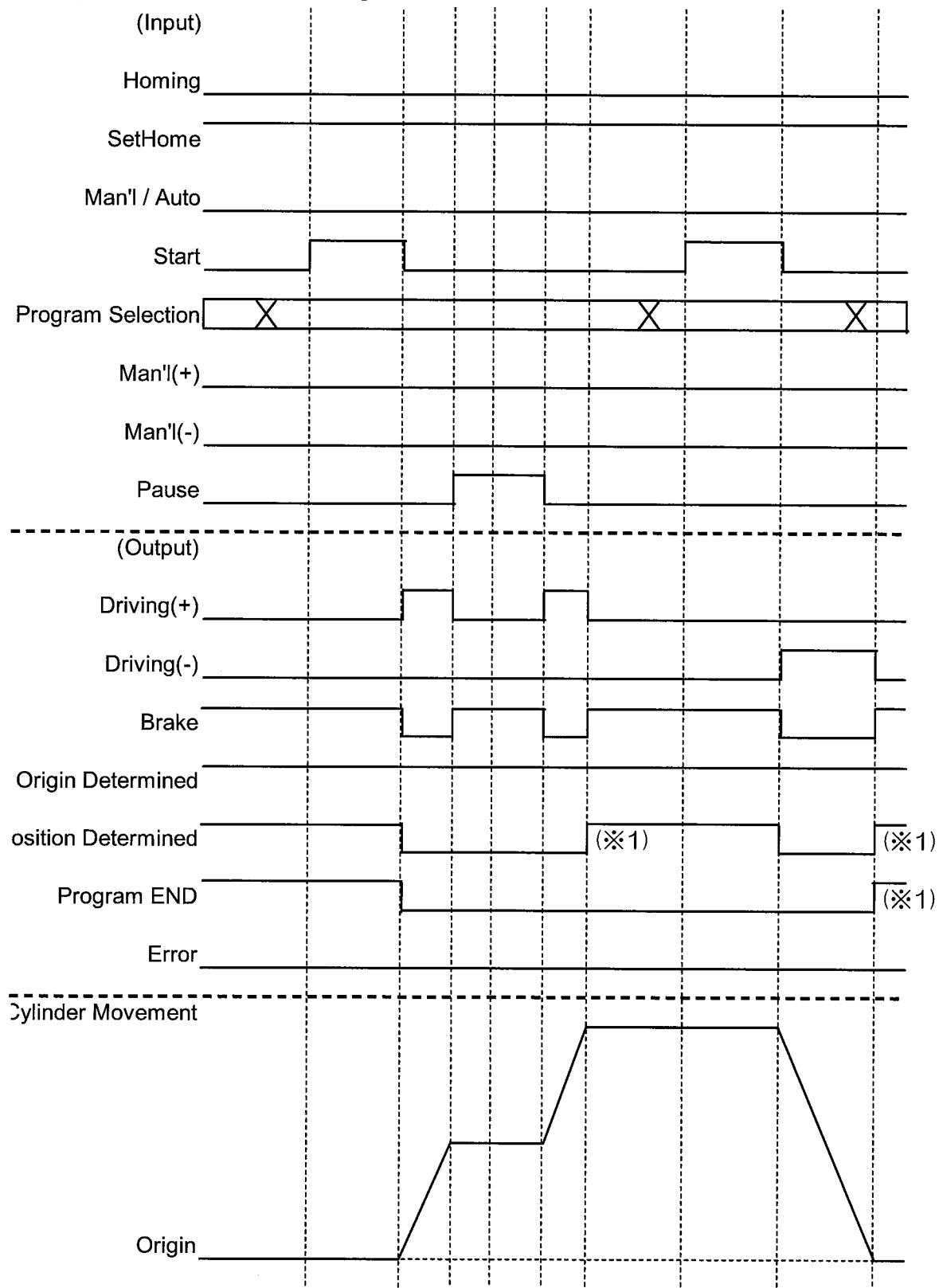
Pause during Homing Timing Chart



Note: Homing will be executed, only on RUN mode and during automatic executing.

(※1) Timing between stopping till output is a preseted timing, t1(preset data P7).

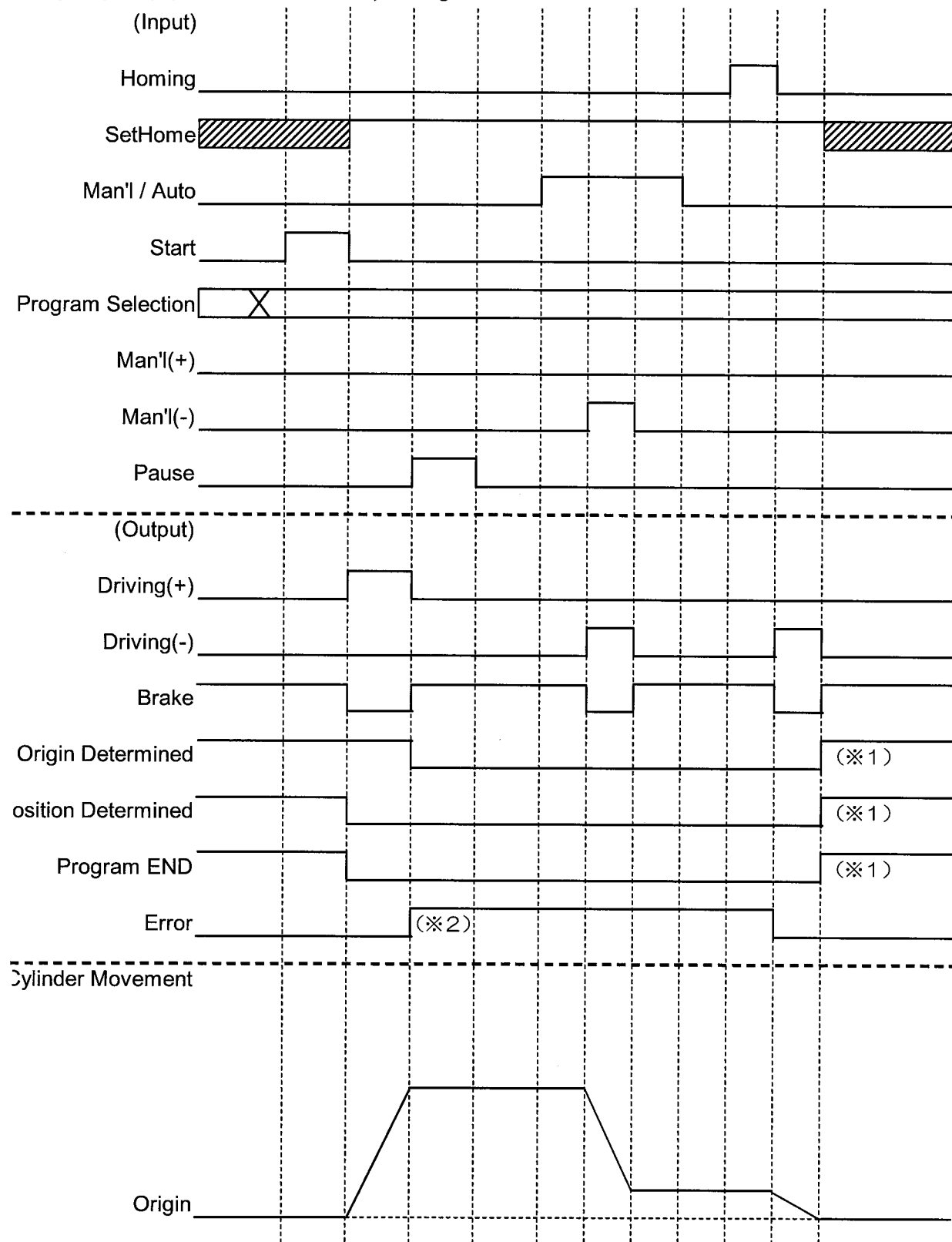
Pause during Automatic Execution Timing Chart



Note: During manually operation. Pause is effective less.

(※1) Timing between stopping till output is 0.2sec(max).

Emergency Stop (Automatic Execution) Timing Chart



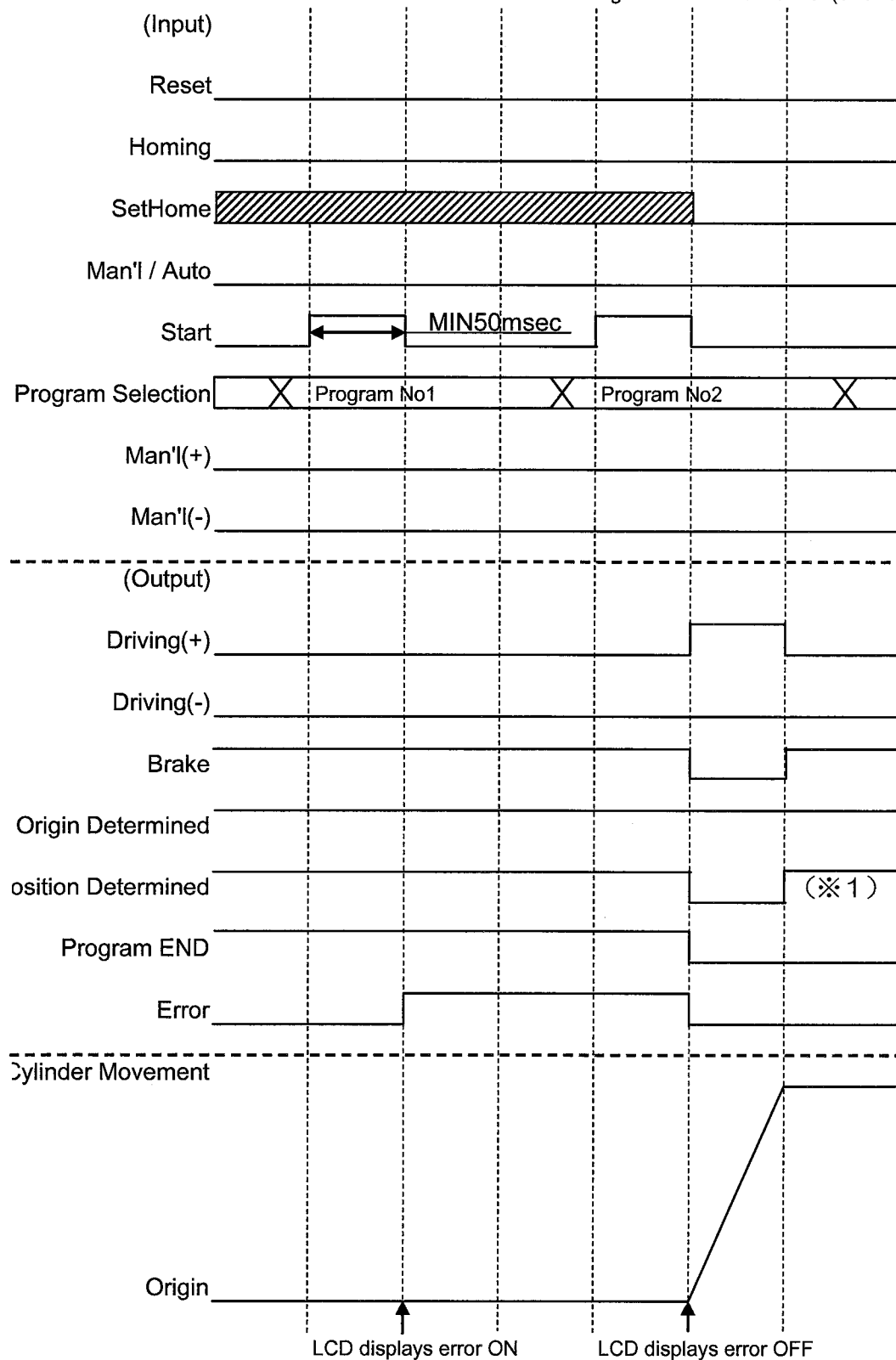
Note: When Emergency Stop is set to be ON, error will be also set ON. Vice versa.
Therefore, the display of error does not really show that error output.
Emergency stop is also effective at Manual mode.

(※1) Timing between stopping till output is a preset timing, t1(preset data P7).

(※2) Timing between stopping till output is 0.2sec(max).

Data Error (Program free of error) Timing Chart

Program No.1 Data Error (or no)
Program No.2 Data Normal (or error)



Note: When LCD displays error ON, press ON to clear the error.
Therefore, it is quite different from error output.
Data error will be recognized while the first step is executed.

(※1) Timing between stopping till output is 0.2sec(max).

Chapter 11: Data Setting

11-1 Data Presetting

11-1-1 Data Classification & Content

P1	Cylinder Stroke	Input stroke.
P2	Tolerance	Input positioning tolerance range. Retries will perform to assure the positioning within the tolerance range.
P3	Retries	Input no. of retries. Maximum retries will be 9. Since Err9 (positioning error) will appear when positioning is not able to be set within the range, it is advisable to set the max. retries no.
P4	Bore Size	Input cylinder bore size.
P5	Load Rate	Input the load rate (the amount of correction for load against the movement of cylinder rod). Use formula as shown below : -

$$\text{Load(kg)} \div \frac{\text{Bore size(cm)} \times r^2 \times \pi \times \text{Operating Pressure(Mpa)}}{4}$$

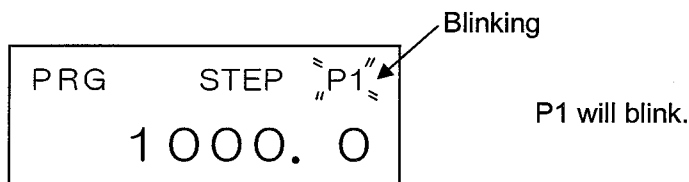
<Eg.> Bore size: ϕ 40cm Load : 20kg(Allowable kinetic Energy) Operating Pressure : 0.5MPa

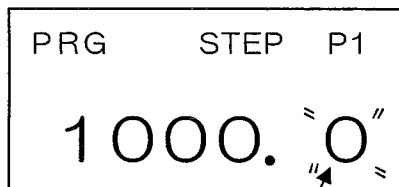
$$20\text{kg} \div \frac{4 \times 4 \times \pi \times 0.5}{4} \times 1000 = 31.8 = 30\%$$

P6	No. of Brake operation	
P7	Origin Detection Time	Set the Origin Detection time(t1) (10ms as 1 unit, maximum will be 9.99s) After inputting the homing (returning to origin's) signal. If sensor does not receive any signal within t1 (situation whereby the cylinder stops), this reflects homing is not achieved. Setting of response time should take into consideration of load, mounting condition, tubing length, etc. The response time should be re-calibrated, if the operating conditions change. When controller dip switch No.1, is set to ON, homing will be confirmed with addition to the autoswitch is ON.
P8	Err12 (Operating Error) confirmation time, t2.	<ul style="list-style-type: none"> * Input Err12's decision time. * 10msec as 1 unit. Max. will be 9.99sec. * Within the time frame, if there is no signal feedback by sensor (cylinder stops) after inputting of Start's signal, Err12 will be reported. * Setting of the detection time should take into the consideration of load, mounting condition, tubing length, etc. If the operating conditions change, re-calibrate the detection time.

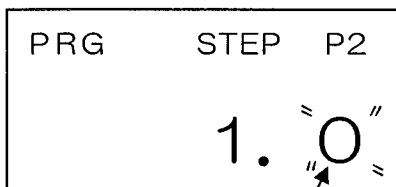
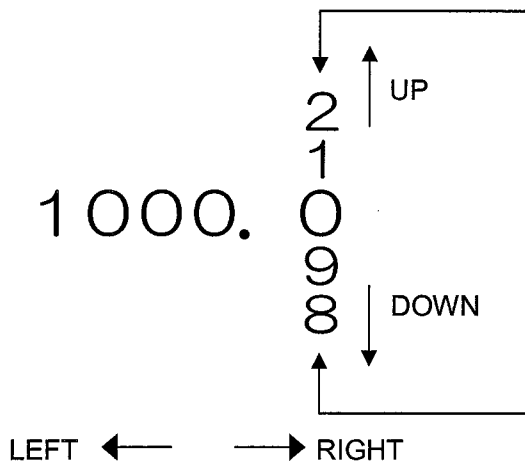
11-1-2 Input Method

Turn the controller switching mode to preset.



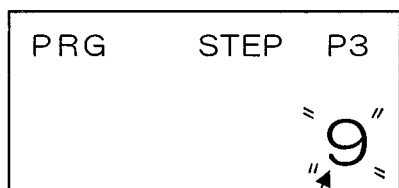
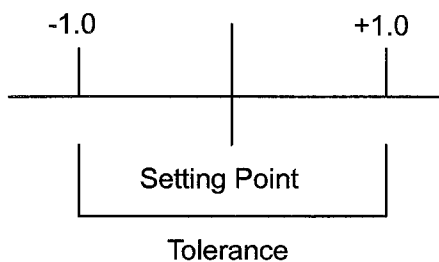


Blinking



Blinking

<Reference>



Blinking

Press either READ or WRITE to proceed to the input condition for cylinder stroke setting, while at the same time, the first decimal point will start to blink.

Use LEFT and RIGHT buttons to select digit to be changed and set the digit to the desired setting through UP and DOWN, buttons. With that, input desired cylinder stroke.

After setting of cylinder stroke, press WRITE to switch to the next input condition. The display will indicate PRG STEP P2 and the current tolerance setting. At the same time, the first decimal point will start blinking.

Next, enter desired tolerance value as in above mentioned method. The maximum possible input value is 9.9mm.

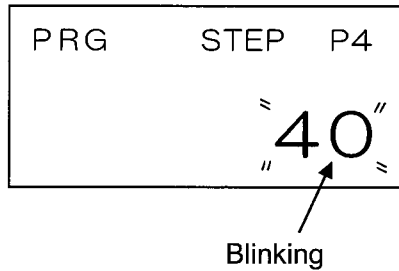
With input of tolerance, 1.0, any point fall between the set point ± 1.0 will be accepted. If the attempt falls outside the range, retries will perform to get into the required range.

If the required position is no achieved within the maximum retries, positioning error (Err9) will be shown.

After setting of tolerance range, press WRITE to switch to the next input condition. The display will indicate PRG STEP P3 and the current maximum retries.

Next, enter desired maximum retries. The maximum possible input value is 9.

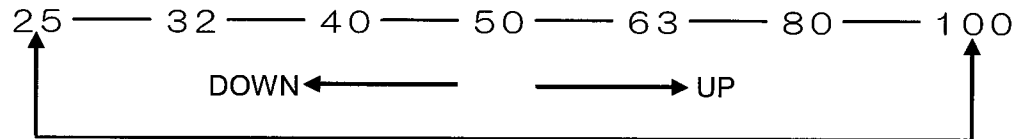
During initial setup, predictive control is executing. Hence, it is suggested to set the maximum retries to 5 or above.



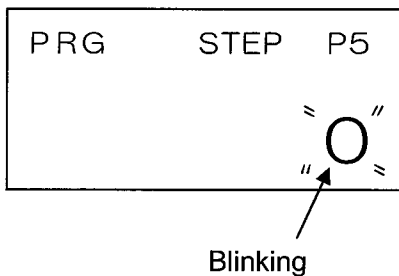
After setting of maximum retries. Press WRITE to switch to the next input condition. The display will indicate PRG STEP P4 and the current cylinder bore size, which is blinking.

Next, enter appropriate cylinder bore size.

Setting value will vary as shown below.



Note : Hyrodless Monosashi-kun (ML2)'s bore size setting are $\phi 25$, $\phi 32$, $\phi 40$ only.



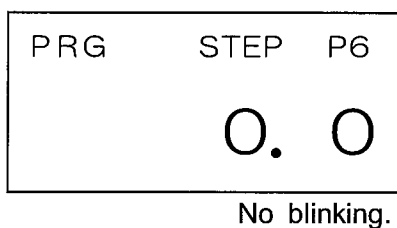
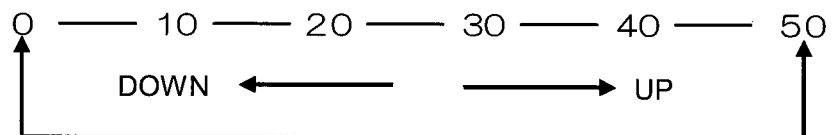
After setting of cylinder bore size, press WRITE to switch to the next input condition. The display will indicate PRG STEP P5 and the current load rate, which is blinking.

Next, enter correct load rate.

<Calculation>

Load \div Cylinder Puching Force x 100

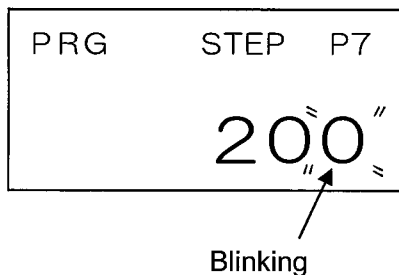
Setting value will vary as shown below.



After the above setting, press WRITE to switch to the next input condition. The display will indicate PRG STEP P6 and the current no of brake operation.

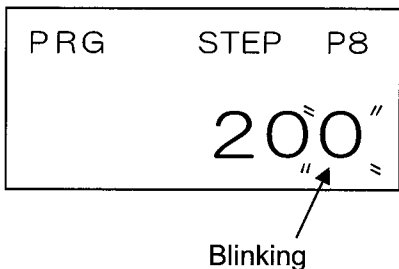
The display number shows the operation number of brake assembly that had been activated. 1 unit represents 10,000. Setting is not required.

Note:
Change the brake assembly,
when the counter readhes
300.0.
(refer to P54 12-2)



After reviewing of number of brake operation, press WRITE to switch to next input operation. The display will indicate PRG STEP P7 and present origin detection time.

Next, enter desired origin detection time. The setting range is 0~9.99sec (1 unit as 10msec). Set the data with taking into the consideration of cylinder operating conditions.



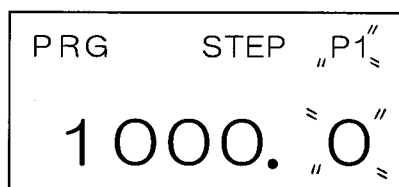
After the above setting, press WRITE to switch to next input operation. The display will indicate PRG STEP P8 and present operating error detection time.

Next, enter desired operating error detection time. The setting range is 0~9.99sec (1 unit as 10msec). Set the data with taking into the consideration of cylinder operating conditions.

After the above setting, press WRITE to end the whole preset operation.

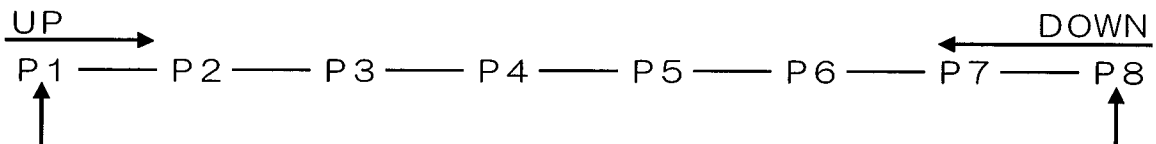
11-1-3 Confirmation of Set Data

Turn the controller switching mode to preset.



← When P1 is blinking, use UP & DOWN key to reconfirm each and individual present value.

← When the input, value is blinking, press READ once to shift the operation back to P1.

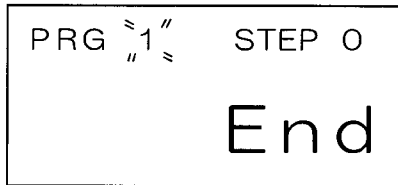


11-2 Program Setting

Input desired cylinder positions.

11-2-1 Input Method

Turn the controller switching mode to PROGRAM.

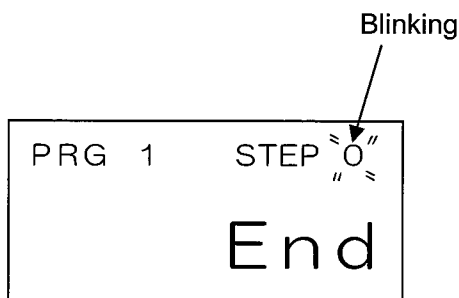


Note:

Step 0 for every program is END.

Program no "1" will start blinking.

Set the program no. through UP & DOWN buttons.

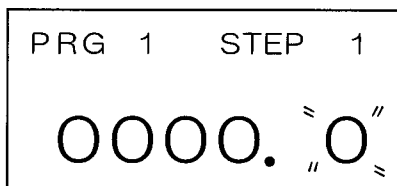


Program No.

, 1, 2, 15, 16
UP DOWN

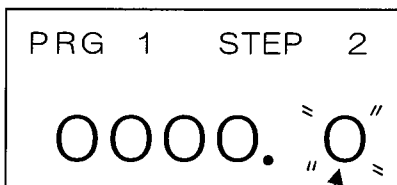
After above setting, press WRITE to end the operation. Step "0" starts to blink.

Next, press either READ or WRITE to proceed to next stage.



The display "End" will be replaced by "0000.0", leading to the input STEP 1.

Input first setting position into STEP 1.



Blinking

Then, press WRITE to proceed to STEP 2. Set the following setting positions, STEP by STEP.

After inputting the last data into last STEP, press WRITE, and then END to end the program setting.

Note:

Controller will show Err7 during operation, if END is not inputted at the end of program.

With above mentioned inputting steps.
Input program shown below: -

<Input example>

Step \ Program	P1	P8
S1	50.0	68.0
S2	300.0	30.5
S3	30.0	
S0	End	End

Turn the controller switching mode to PROGRAM.

Press WRITE for 2 times.

The display "End" will be replaced by "0000.0", leading to the input STEP 1.

PRG 1 STEP 0
End

Blinking

Press LEFT for 2 times.

Blinking is shifted to "0", the first decimal point.

PRG 1 STEP 1
0000.0

Blinking

Press UP for 5 times to set value of 5.

PRG 1 STEP 1
0050.0

Blinking

Press WRITE for one time.

Press LEFT for 3 times to shift the blinking cursor.

PRG 1 STEP 2
0000.0

Blinking

Press UP 3 times to set the value of 3.

PRG 1 STEP 2
0300.0

Blinking

PRG 1 STEP 3
0000.0

Blinking

PRG 1 STEP 3
0030.0

Blinking

PRG 1 STEP 4
0000.0

Blinking

Blinking

PRG 1 STEP 1
0050.0

Blinking

PRG 1 STEP 1
0050.0

Blinking

PRG 8 STEP 0
End

PRG 8 STEP 1
0000.0

Blinking

Press WRITE one time.
Press LEFT 2 times to shift the blinking cursor.

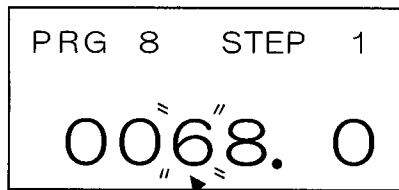
Press UP 3 times to set the value 3.

Press WRITE one time to enter into program STEP 4,
which is the end of program 1.
Press END to end the program setting for program 1.

Program 1's programming ends.

Set the program no. to 8 through UP to PRG "8".

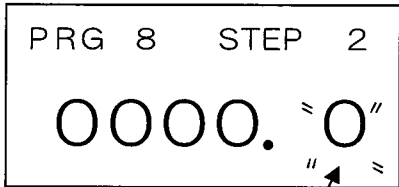
Press WRITE for 2 times.
The display "End" will be replaced by "0000.0", leading
to input STEP 1.



Blinking

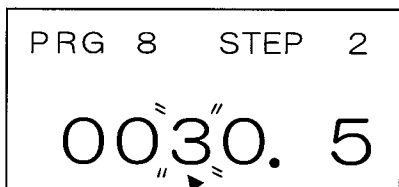
First, press LEFT one time.
Next, use DOWN to set the value of "8".

Press LEFT one time.
Then use DOWN to set the value of "6".



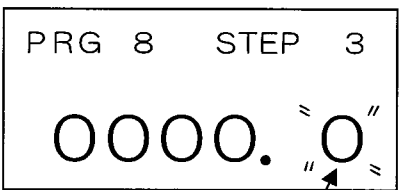
Blinking

Press WRITE one time.
Press UP 5 times to set the value of "5".



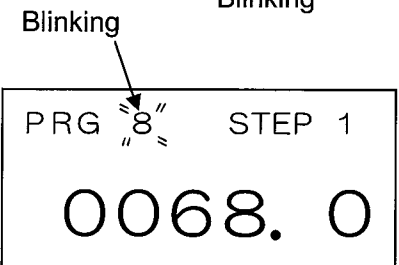
Blinking

Press LEFT 2 times.
Press UP 3 times to set the value of "3".



Blinking

Press WRITE to enter input STEP 3, which is the end of program 8.
Press END to the program setting for program 8.

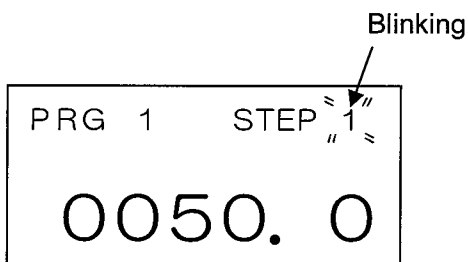


Blinking

Program 8's programming ends.

11-2-2 Confirmation of Input Data

Turn the controller switching mode to PROGRAM.



Blinking

When PRG "1" is blinking, use UP & DOWN to select desired program to be checked.
Next, press READ to proceed to the specified program's STEP "1".
Then, use UP & DOWN to check and confirm every step.

11-3 Selection of Dip Switch

No.1 . . . The Identification of Origin

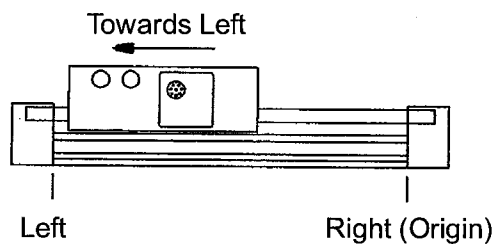
- OFF . . . When cylinder stops, if there is no signal feedback from sensor within t1 (Preset data P7), counter value will be reset to "0" and origin is obtained / recognized.
Generally, origin will be at the stroke end.
If origin is set within the stroke, install stopper with respect to the origin.
- ON . . . When the cylinder stops at origin, situated at the location where autoswitch or limit switch is, if the sensor signal is feedback t1, counter value will be reset to "0.0" and origin is obtained.
Install the origin wire to terminal 10.

No.2 . . . The Setting of Braking System

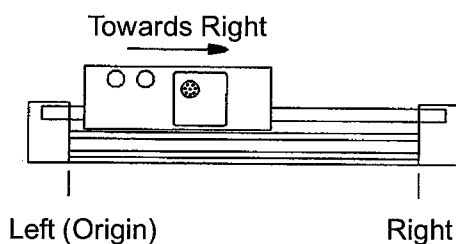
- OFF . . . In this state, ON means brake is activated. OFF means brake is in releasing state.
If power supply of controller is cut off, the brake will be in releasing state.
If cylinder is mounted horizontally and the air balance is not achieved, when power is cut off, the cylinder may keep moving in and out.
If cylinder is mounted vertically, when power is cut off, cylinder rod will fall to the bottom end, due to its own weight.
- ON . . . In this state, OFF means brake is activated. ON means brake is in releasing state.
If power supply of controller is cut off, the brake will be in clamping state.
- Note: Please take note at piping, which may lead to opposite setting.

No.3 . . . The Change of Counter Direction

- OFF . . . Going to left will be an increment on counter. The origin is set to be at right.



- ON . . . Going to right will be an increment on counter. The origin is set to be at left.



No.4 . . . Deletion of Memory : Delete all the input data, back to the initial state.

Generally, set the state to OFF. If input data is required to be deleted, set the state to ON. Next, reset the power supply through terminal 13. After achieving the initial state, set the state back to OFF.

Chapter 12: Driving

12-1 Setting of Origin Direction

Location's detection method used by Hyrodless Monosashi-kun cylinder is incremental method. Please set the origin and reference accordingly.

Cylinder stroke end, either left or right end, will be the origin. When dealing with cylinder with cushion. Please do not over monitoring the cushion effect.

When stopper is used, please use shock absorber to prevent from the occurrence of impact and "spring back" effect.

12-2 Adjustment of Air Balance (For Vertical Mounting Only)

Due to the stoppage precision, the rate of occurring of abnormal operation and etc. will be greatly affected by the stability of air flow, it is very important to monitor cylinder's air flow closely to achieve air balance state.

Adjustment

1. Manually operate the controller or directional valve & brake valve to shift the piston rod to the center of stroke (under working condition).
2. Release brake and carry out adjustment through regulator. Remember, slider should not move up or down during the adjustment. Use either brake valve (manually) or controller's No.2's dip switch to release brake.
3. After completion of the adjustment, manually operate brake valve to release and lock the brake system for a few times. If slide is still moving during operation, redo the adjustment.
4. Lastly, check it with testing the attainment of desired location. If piston rod moves to the upper extreme end or move with extraordinarily speed, redo the above adjustment.

Note: If the braking assembly unit has been changed, reset the controller, before executing task.

Chapter 13: Error Messages & Countermeasures

13-1 Controller

Err1: Sub-CPU's ROM, RAM Error

- Content : During power supply to sub-CPU is on, ROM or RAM is found faulty.
Solution : Reset & Retry.
Countermeasure : After resetting, if error occurs again, ROM, RAM may have faulty.
Change ROM, RAM.

Err2: Main-CPU's ROM, RAM Error

- Content : During power supply to sub-CPU is on, ROM or RAM is found faulty.
Solution : Reset & Retry.
Countermeasure : After resetting, if error occurs again, ROM, RAM may have faulty.
Change ROM, RAM.

Err3: Battery Error (Maxell Super Lithium Battery, ER6C)

- Content : During initial checkout, battery voltage less than 3.2V. Input data can only be retained within 2 hours after the error detected. Battery's life is 5 years from the purchasing data.
Solution : Press ON (UP & DOWN).
Countermeasure : Change battery. After changing, verify input data. If data has been deleted, re-input.
After resetting, operation of cylinder is still possible. However, during operation, LCD display will show that "PRG" is blinking. With the power supply ON, data can be retained as long as 2 hours, after the error message appears. Therefore, do not cut off power supply, even during interchanging of battery.

Err4: Backup Error

- Content : After power supply is on or Reset signal is inputted, backup checking is conducted, error is detected during output.
Each and individual data is checked through backup checking. Once, error is detected, clear the error and at the same time, data will be deleted too.

Err41 . . .Preset Data Error

When this error appears, input data will be deleted. Re-input is required.

Err42 . . .Program Data Error

When this error appears, input position's data will be deleted. Re-input is required.

Err43 . . .Learning Data Error

When this error appears, learning data will be deleted and lead to the operation of predictive control (retries will perform again).

When errors appear, re-entry of data is required.

- Solution : Press ON (UP or DOWN).

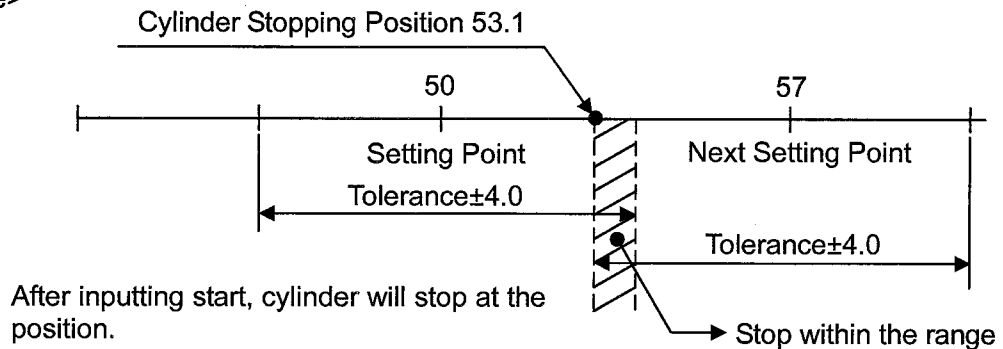
- Countermeasure : Check below 5 points and execute accordingly.
1. Check whether reset is executed during the execution of controller or during motion. Besides that, please verify wiring and sequence of the program.
 2. Verify whether AC100V's deviation is within the tolerance level, $\pm 15\%$ (AC85~115V).
 3. Verify the power supply (AC100V) has been toggled within 20ms.
 4. Check whether controller's FG (frame ground) is being connected to earth.
 5. Verify that there is no moving signal feedback from sensor during the power is being cut off.

Err5: Data Error

- Content : 1. During presetting of data, over stating the cylinder's stroke, or under stating the moving distance of cylinder (less than 5mm), error will be shown.

2. During operation, error will also appear, when moving distance is less than 5mm. However, if the stop position is still within the tolerance of next setting point, stop point will be determined and accepted.

<Example>



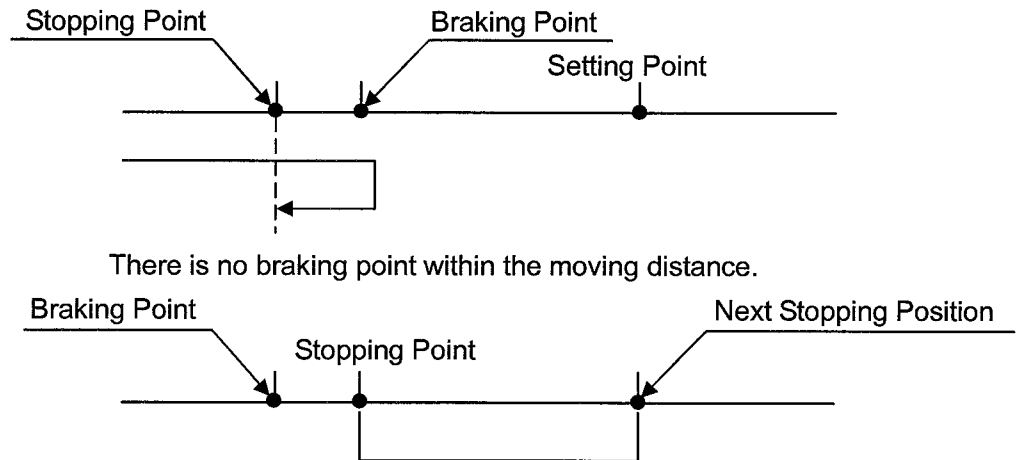
Solution : During programming, press ON (UP or DOWN).

During moving state, press either ON or RESET.

Countermeasure : If situation 1 and 2 occur, please change the program accordingly.

Err6: Learning Error

Content : The stopping position is before the braking position.



Solution : Reset or re-providing power supply.

Countermeasure : Verify air balancing.

Verify whether there is any impact or momentum acting upon cylinder during positioning.

Verify that there is no entanglement or twisting.

Due to the momentum at the stroke end, setting of "0.0" as origin will lead to high occurrence of errors. Therefore, set the origin within "1.0~5.0". Besides that, it is advisable to make sure that cylinder rod should return to origin at the end of operation.

For cylinder with cushion, due to drastical change of speed within the stroke, learning error may arise. Therefore, for the case of stopping position within 30mm from stroke end is required, it is advisable not to utilize cylinder with cushion.

Err7: No Program

Content : There is no program being selected.

Program NO., which does not have any contents, is selected.

Solution : Press ON or Reselect program.

Countermeasure : Verify input.

Verify selected program, wiring or sequence of program inputted.

Err8: Homing Error	
Content	: When dip switch No.1 is set ON, error will show if homing is not performed.
Solution	: Reset or Retry.
Countermeasure	: Ensure the origin detection switch is function (switch is on when cylinder rod is at origin). Ensure wiring is connected properly. Ensure input signal sent by autoswitch is fed to terminal 10 through input monitor (red LED). Ensure there is no twist at guide. During the movement of slider, ensure that it will not stop within origin detection time.
Err9: Positioning Error	
Content	: Accurate positioning was not performed within specified preset retries (Preset Data, P3) or preset tolerance (Preset Data, P2). When Err9 occurs, there are 2 possibilities of errors. First, error due to Err9. Secondly, it may due to abnormal stoppage position. Recognize the errors, so as to execute accurate remedy.
Solution	: Press either ON or RESET. When ON is used to remedy situation, next program step will be executed. However, Err5 will occur if the stopping position when Err9 occurs, is less than 5mm away from the next program step's specified value. In this case, homing should be done. Restart the program. When RESET is used, homing will be performed and operation will go back to initial state, program step No.1 and restart.
Countermeasure	: Ensure there is no variation on load or pressure. Ensure air balance state. Ensure there is no twist at guide. Ensure there is no momentum and impact acting on cylinder during positioning is performed.
Err10: Emergency Stop	
Content	: Display shows emergency stop.
Solution	: Disable the emergency stop signal.
Err11: Processing Error	
Content	: Processing error by Sub-CPU is detected.
Solution	: Reset or Retry.
Countermeasure	: If error re-occurs, change the controller.
Err12: Operating Error	
Content	: Press either ON or RESET.
Countermeasure	: Ensure there is no twist at guide. During the movement of cylinder rod, ensure that it will not stop within origin detection time. Re-adjust operating error detection's time.

13-2 Brake Unit's Life Span

Change the brake unit, when life span of 2 million cycles has been achieved. Check its life span through following method. Check through controller preset data (P6), which records brake's operation cycle no.

* Check the controller, when the value of 200.0 is reached, change brake unit.

PRG	STEP	P6
		200.0

The 2 million cycle life span assumes following conditions:

- a Piston speed: 300mm/sec
- b 50% load or less, when horizontally mounted.
- c 35% or less, when vertically mounted.

Chapter 14: Appendix

14-1 Data Sheet

●Parameter

Preset Data

No.	Data Name	
P1	Cylinder Stroke	
P2	Tolerance	
P3	Retries	
P4	Bore Size	
P5	Load Rate	
P6	No. of Brake Operation	
P7	Origin Confirmation Time	
P8	Err12's Confirmation Time	

Dip Switch Setting

No.	Setting	
No.1	OFF	ON
No.2	OFF	ON
No.3	OFF	ON
No.4	OFF	ON

●Program Data(Determined Position Data)

Program Step	1	2	3	4	5	6	7	8
1								
2								
3								
4								
5								
6								
7								
8								
9								
10								
11								
12								
13								
14								
15								
16								
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18								
19								
20								
21								
22								
23								
24								
25								
26								
27								
28								
29								
30								
31								
32								

Step \ Program	1	2	3	4	5	6	7	8
1								
2								
3								
4								
5								
6								
7								
8								
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10								
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