CKD

SM－249189－A

INSTRUCTION MANUAL

MAGNET TYPE
SUPER RODLESS CYLINDER

MRL2 SERIES

- Please read this instruction manual carefully before using this product, particularly the section describing safety.
- Retain this instruction manual with the product for further consultation whenever necessary.

CKD Corporation

The 4th edition

For Safety Use

To use this product safety, basic knowledge of pneumatic equipment, including materials, piping, electrical system and mechanism, is required (ISO4414 *1 JIS B 8370 *2).

We do not bear any responsibility for accidents caused by any person without such knowledge or arising from improper operation.

Our customers use this product for a very wide range of applications, and we cannot keep track of all of them. Depending on operating conditions, the product may fail to operate to maximum performance, or cause an accident. Thus, before placing an order, examine whether the product meets your applications, requirements, and how to use it.

This product incorporates many functions and mechanisms to ensure safety. However, improper operation could result in an accident. To prevent such accidents, **read this operation manual carefully for proper operation.**

In this instruction manual, the probable hazards are classified into three ranks, “DANGER”, ”WARNING”, and “CAUTION” as described in the following in order to easily understand the degree of danger or damage.

⚠ DANGER: Failure to pay attention to DANGER notices may cause a situation that results in a fatality or serious injury and that requires urgent addressing.

⚠ WARNING: Failure to pay attention to WARNING notices may result in a fatality or serious injury.

⚠ CAUTION: Failure to pay attention to CAUTION notices may result in minor injury or damage to equipment or facilities.

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

*2) JIS B 8370 : Pneumatic fluid power — General rules relating to systems

⚠ WARNING

Lead wire connections

a) Comply with the color coding specified on the illustrations. Be sure to turn the power off before starting connecting work.
An erroneous wiring or short circuiting of load causes damage to not only switches, but also load side circuit. Wiring work without shutting electricity off may cause damage to the load side circuit.

b) Do not connect the lead wires of the switch to the power supply directly. Always connect the loads in series.

Protection of output circuit

Install some protective circuit as illustrated in Fig.7 when inducing type load (Relay or solenoid valve) are to be used because those types apt to generate surge current switch off.

Install some protective circuit as illustrated in Fig.8 when capacitor type load (Capacitor type) are to be used, because these types apt to generate a dash current when turning the switch ON.

Install some protective circuit as illustrated in Fig.9 or 10 (in case of model T2) and Fig.11 (in case of model T3).

Never attempt to disassemble this cylinder since it uses the strong magnet. If any fault, such as air leak occurs, replace the complete cylinder with a new one.

⚠ CAUTION

- Do not unpack the cylinder and remove the dust preventive port seal from the piping port until the piping work is started.
- Doing so may cause foreign matter to enter the inside of the cylinder through the piping port, resulting in damage or malfunction.

a) Do not operate the cylinder with the slider fixed.

b) Pay special attention so that your finger is not caught in a clearance between the end plate and slider.

a) The supply pressure to the cylinder is described in the section 7.1, Cylinder Specifications. Always operate the cylinder within this pressure range.

b) Do not operate the cylinder at an energy level exceeding the allowable energy absorption range. If the kinetic energy is large, install an external absorbing unit.

c) Install an appropriate speed controller to adjust the working piston speed.

a) Protection of lead wire
Pay consideration to eliminate repeating bending stress or stretching of lead wire while laying the cord.
To the moving portion, use such cord of flexibility as for building a robot.

b) Operating temperature
Do not operate the product at a high temperature(60℃).
Always avoid operation of the product in a hot place due to temperature characteristics of magnetic and electronics parts.

c) Impact
Do not apply a large vibration or impact to the product when transporting the cylinder, or mounting or adjusting the switch.

In order to upkeep the cylinder in optimum condition, carry out periodic inspection once or twice a year.

INDEX

MRL2 SERIES

Magnet Type
Super Rodless Cylinder

Manual No. SM-249189-A

1. UNPACKING

1) Make sure that the type No. on the nameplate of the delivered Super Rodless Cylinder matches the type No. you ordered.
2) Check the appearance for any damage.

⚠ CAUTION:

- Do not unpack the cylinder and remove the dust preventive port seal from the piping port until the piping work is started.
- Doing so may cause foreign matter to enter the inside of the cylinder through the piping port, resulting in damage or malfunction.

2. INSTALLATION

2.1 Installation

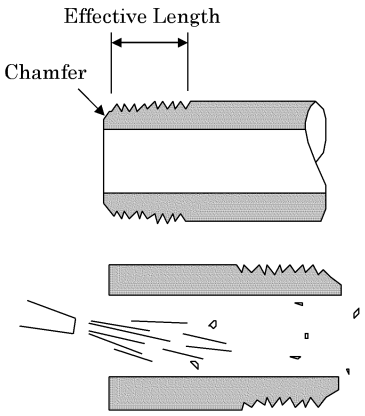
1) Install cylinder body with a hexagon socket head cap screw directly.
2) When using the basic type, install an external guide since the slider may rotate. When using the guide, design a structure that absorbs any misalignment between the cylinder and guide. If the cylinder is secured directly, an excessive force is applied to the cylinder due to misalignment, causing a malfunction.
3) When securing the basic type with the switch to the guide, make the slider rotation angle to 1° or less.
4) Mount the end plate on a surface having a high flatness. Failure to do so may cause a malfunction.
   (Mount the end plate so that the full-stroke of the slider is operated at its minimum operating pressure level.)
5) If the direction, in which the load moves, is not parallel to the center of the slider shaft, the slider and tube may be entangled, causing the slider to jump-up. Additionally, the entanglement may cause seizure or breakage.
   Always make the center of the slider shaft matched with the load movement direction.

⚠ CAUTION:

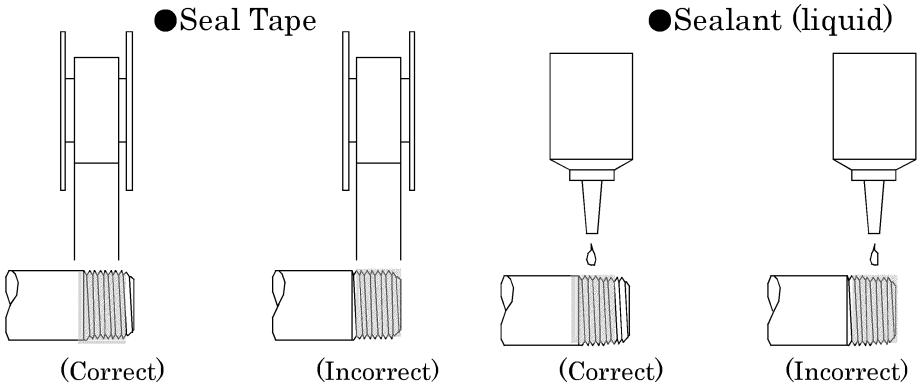
a) Do not operate the cylinder with the slider fixed.
b) Pay special attention so that your finger is not caught in a clearance between the end plate and slider.

2.2 Piping

1) For piping beyond the filter, use pipes that are tough against corrosion such as galvanized pipes, nylon tubes, rubber tubes, etc.
2) See to it that the pipe connecting cylinder and solenoid valve has effective cross-sectional area, which is needed for the cylinder to drive at the specified speed.
3) Install filter preferably adjacent to the upper-stream to the solenoid valve for eliminating rust, foreign substance in the drain of the pipe.
4) Be sure observe the effective thread length of gas pipe and give a chamfer of approx. 1/2 pitch from the threaded end.
5) Flush air into the pipe to blow out foreign substances and chips before pip-ing.



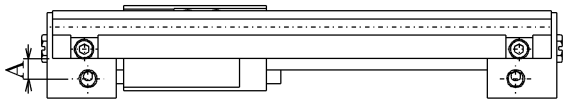
6) Refrain from mapplying sealant or sealing tape approx. Two pitches of thread off the tip of pipe to avoid residual substances from falling into piping system.



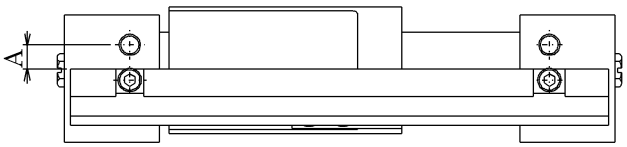
7) Because the usable piping joint has limitations, for using cylinder with the switch, see the note below.

With the switch

ϕ 10

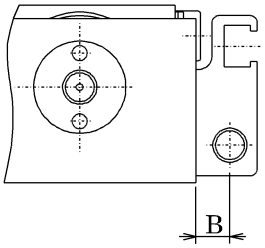


ϕ 16～ϕ 32

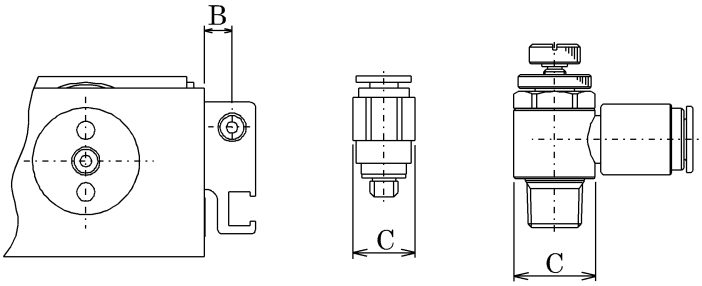


Centralized piping with the switch

ϕ 10



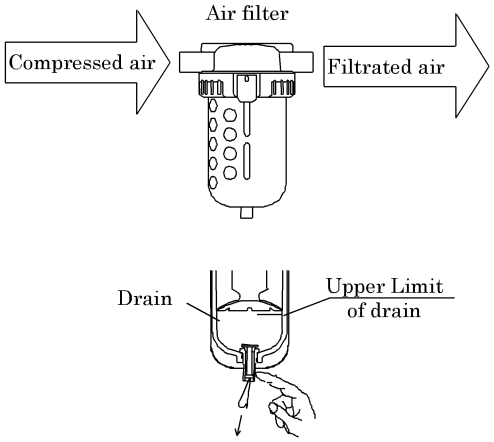
ϕ 16～ϕ 32



Item / Bore size (mm)	Port diam.	Port dimension A	Port dimension B	Available joints	Joint outer diam. ϕ C
ϕ 6	M5	—		SC3W-M5-4, SC3W-M5-6 SC3WU-M5-4, SC3WU-M5-6 GWS6-M5-S, GWS4-M5 etc.	ϕ 11 or less
ϕ 10		5.5	5		
ϕ 16		5.5	5		
ϕ 20		5.5	5		
ϕ 25	Rc1/8	7.5	7.5	SC3W-6-4･6･8 GWS4-6, GWS6-6, GWS8-6 etc.	ϕ 15 or less
ϕ 32		7.5	7.5		

Note) A and B show distances to the closest interference parts of the ports. "−"shows that no interference parts exist.
The model having ϕ 6-tube diameter does not have any dimension A since the port in the side surface is located on the opposite side of the switch rail.
(No parts interfere with the switch rail.)
Additionally, this model does not also have any dimension B (port) since the centralized piping with the switch cannot be performed.

2.3 Fluid



1) It is necessary to use dehumidified air that has been filtered from compressed air. Carefully select an adequate filter that has an adequate filtration rate (preferably 5 μ m or less), flow rate and its mounting location (as nearest to the directional control valve as possible).

2) Be sure to drain out the accumulation in the filter periodically.

3) Note that the intrusion of carbide for the compressor oil (such as carbon or tarry substance) into the circuit causes malfunction of the solenoid valve and the cylinder. Be sure to carry out thorough inspection and maintenance of the compressor.

4) This cylinder does not require lubrication. It is recommended, however, to use Turbine oil Grade 1, ISO VG32 as a lubricant, if and when lubrication is needed. Once the cylinder has been lubricated, it should be lubricated periodically.

2.4 Location of mounting Switches on a Cylinder

1) Location of mounting switches on a cylinder.

(1) At the stroke end
Refer the illustration above. Mount switches within the rod side dimension RD as well as the head side dimension HD for the purpose of having switches function at the points of the maximum sensitive position.
(See the figure and table of page eight)

(2) Intermediate of stroke
To detect a position of the piston on the way of the stroke, secure the piston at the detection position and move the switch above the position in the back and forth direction to find a position where each switch is turned ON first. The middle position between these two positions is the maximum sensitivity position at this piston position and is used as mounting position.

(3) Relocation of switch
Slide switch body along cylinder tube after loosening mounting screws or cross recessed head screws and tightens screws when located the maximum sensitive position.

(4) Replacing switch
Take out switch out of groove after loosening mounting screws or cross recessed head screws. Slide new replacing switch into groove and tighten screws upon placing the switch at the maximum sensitive position. (Mounting screws apply tightening torque of 0.1 to 0.2N・m and cross recessed head screws apply tightening torque of 0.5 to 0.7 N・m.)

5) Operating range

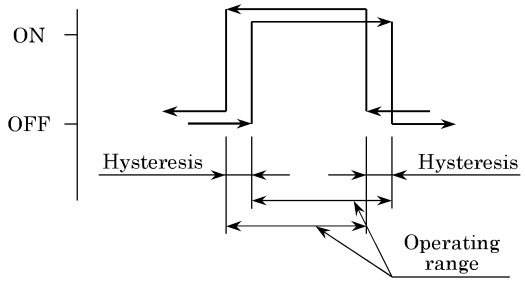
The switch turns on first and turns off as the piston moves along its stroke. Precise operating range deviate slightly depending upon the direction of piston movement as shown right.

The center of the range is the mostly sensitive position. Setting switch at this point eliminates majority of external disturbance and provides the most stabile actuation of switch.

6) Hysteresis

(1) Precise operating range deviate slightly depending upon the dir-ection of piston movement as shown right.

(2) Switch is apt to be disturbed its accuracy by external effect when piston stops within this range. Carefully avoid designing stop-ping location of piston.



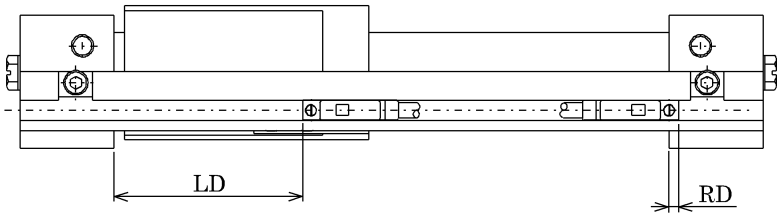


Table of maximum sensitive position (LD･RD), Operating range and Hysteresis (mm)

Item / Bore size (mm)	Solid state type (T2H/V、T3H/V)			
	Maximum sensitive position		Operating range	Hysteresis
	LD	RD		
φ6	27	2.5	2～6	1.5 or less
φ10	27	2.5	2～5	
φ16	42.5	2	3～8	
φ20	62	1.5	3～9	
φ25	58	1.5	3～8	
φ32	66	1.5	3～9	

Table of maximum sensitive position (LD･RD), Operating range and Hysteresis (mm)

Item / Bore size (mm)	Solid state type (T2YH/V、T3YHV)			
	Maximum sensitive position		Operating range	Hysteresis
	LD	RD		
φ6	26	3.5	5.3～6.1	1.5 or less
φ10	26	3.5	6.5～7.3	
φ16	41.5	3	5.3～6.7	
φ20	61	2.5	5.7～6.5	
φ25	57	2.5	5.7～6.5	
φ32	65	2.5	5.2～6.1	

※ Switches at ex-factory shipment are positioned at the maximum sensitive position (LD and HD).

3. OPERATION

3.1 Operating the Cylinder

3.1.1 Checking before starting operation

1) Before starting operation, make sure that any load and/or cylinder mounting and tightening parts are not loose or faulty.
2) Do not start operation until it is confirmed that the cylinder functions correctly. After the cylinder has been mounted, connect the compressed air and electric power, and then perform the functional check and air leak check that the cylinder is mounted correctly.

3.1.2 Starting procedures

1) Gradually increase the air pressure while carefully observing that the equipment operation is correct.
2) When starting the operation with the cylinder chamber on the exhaust side put in the atmospheric state, the slider may jump-up, causing a serious accident. Always start the operation with the cylinder chamber on the exhaust side pressurized.
3) When adjusting the speed using the speed controller, gradually open the needle from its close position. If the speed adjustment is started with the needle opened, the slider may jump-up, causing a serious accident.

⚠ CAUTION:

a) The supply pressure to the cylinder is described in the section 7.1, Cylinder Specifications. Always operate the cylinder within this pressure range.

b) Do not operate the cylinder at an energy level exceeding the allowable energy absorption range. If the kinetic energy is large, install an external absorbing unit.

c) Install an appropriate speed controller to adjust the working piston speed.

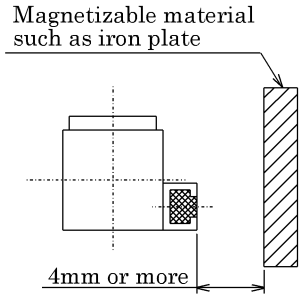
3.2 How to use the Switches

3.2.1 Common items

1) Magnetic environment
Do not operate this product in a place where a strong magnetic field or large current (large magnet or spot welder, etc.) exists. If a cylinder with the switch is installed in parallel to this product or the magnetic substance moves near the cylinder, the mutual interference may occur and affect the detection accuracy.

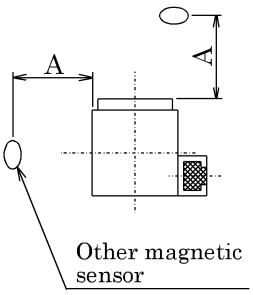
2) Intermediate position detection
When activating the switch halfway of the stroke, the relay may not respond if the working piston speed is too fast.
The maximum speed (v), which can be detected, is checked using the following formula.

$$V(mm/s) = \frac{\text{Cylinder switch operating range (mm)}}{\text{Load operating time(s)}}$$



Additionally, the operating range of the cylinder switch is determined to the mini-mum value stated in the table on page 8.

Tube bore (mm)	A (mm)
ϕ 6	10
ϕ 10	20
ϕ 16	20
ϕ 20	37
ϕ 25	50
ϕ 32	80



3) Magnetizable material such as ironplate near by cylinder switch is apt tocause malfunction of cylinder switches. Keep it from cylinder surface at least 4mm away (This is applicable for allbore sizes of tube).

4) When using the cylinder or other magnetic sensor adjacent to the switch, put other magnetic sensor at a distance away from the slider surface stated in the table on the right to prevent malfunction caused by the leak magnetic field of the magnet inside the cylinder.

⚠ CAUTION:

a) Protection of lead wire
Pay consideration to eliminate rapeating bending stress or stretching of lead wire while laying the cord.
To the moving portion, use such cord of flexi-bility as for building a robot.

b) Operating temperature
Do not operate the product at a high tempe-rature(60℃).
Always avoid operation of the product in a hot place due to temperature characteristics of magnetic and electronics parts.

c) Impact
Do not apply a large vibration or impact to the product when transporting the cylinder, or mounting or adjusting the switch.

⚠ WARNING:

Lead wire connections

a) Comply with the color coding specified on the illustrations. Be sure to turn the power off before starting connecting work.
An erroneous wiring or short circuiting of load causes damage to not only switches, but also load side circuit. Wiring work without shutting ele-ctricity off may cause damage to the load side circuit.

b) Do not connect the lead wires of the switch to the power supply directly. Always connect the loads in series.

3.2.2 Operational Cautions, Solid state switch (T2, T3)

⚠WARNING:

Protection of output circuit

Install some protective circuit as illustrated in Fig.7 when inducing type load (Relay or solenoid valve) are to be used because those types apt to generate surge current switch off.

Install some protective circuit as illustrated in Fig.8 when capacitor type load (Capacitor type) are to be used, because these types apt to generate a dash current when turning the switch ON.

Install some protective circuit as illustrated in Fig.9 or 10 (in case of model T2) and Fig.11 (in case of model T3).

1) How to connection of lead cord (Fundamental circuit Example)

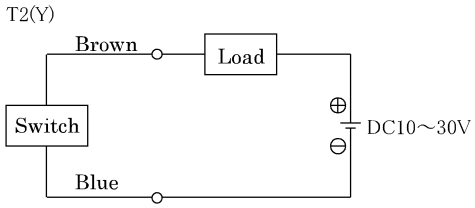


Fig.1 T2(Y) Fundamental circuit Example

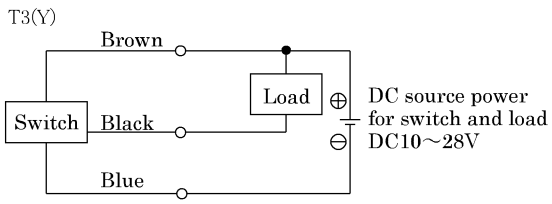


Fig.3 T3(Y) Fundamental circuit Example(1)
(In case the same source of power is used.)

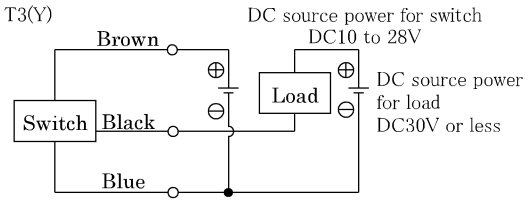


Fig.4 T3(Y) Fundamental circuit Example(2)
(In case individual sources of power are used.)

2) Protection of output circuit

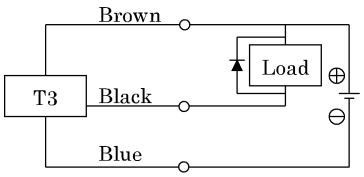


Fig.7 An example of using inducing load together with surge absorptive element (diode). (Hitach Mfg. made diode). (Hitach Mfg. made diode V06C or equivalent is recommended.)

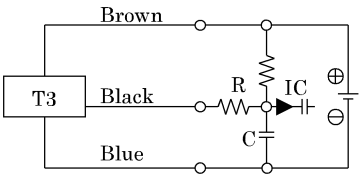


Fig.8 An example of using capacitor type load together with current regulating resister R. Comply with the following formula to figure out required R.

$$\frac{V}{0.05} = R(\Omega)$$

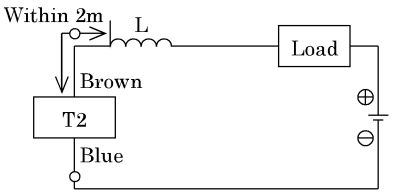


Fig.9 Choke coil
L = a couple hundred μH to a couple mH surpassing high frequency characteristic.
・Install it near by a switch (within 2m).

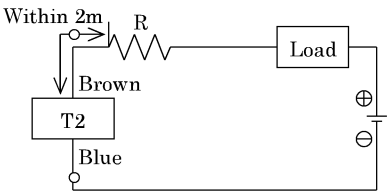


Fig.10 ・Dash current restriction resister.
R= As much large resister as the load circuit can afford.
・Install it near by a switch (With in 2m).

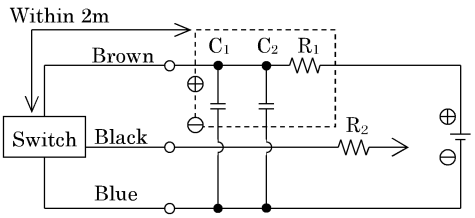


Fig.11 ・Electric power noise absorptive circuit.
C_1= 20 to 50 μF electrolytic capacitor (Withstand voltage 50V or more)
C_2= 0.01 to 0.1 μF ceramic capacitor
・Dash current restriction resister.
R_1 = 20 to 30 Ω
R_2 = As much large resister as the load circuit can afford.
・Install it near by a switch. (Within 2m)

3) Connection to a programmable controller (Sequencer).

Type of connection varies depending upon the model of the programmable controller. Refer to the following Fig. 12 to 18 respectively.

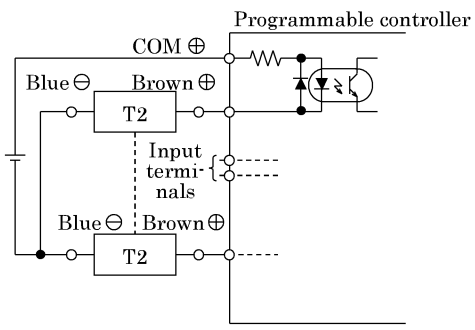


Fig.12 An example of T2 connection to source input type (an external power source)

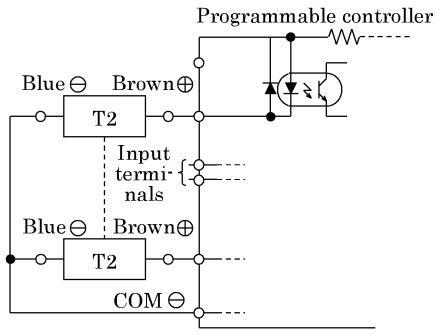


Fig.13 An example of T2 connection to source input type (an internal power source)

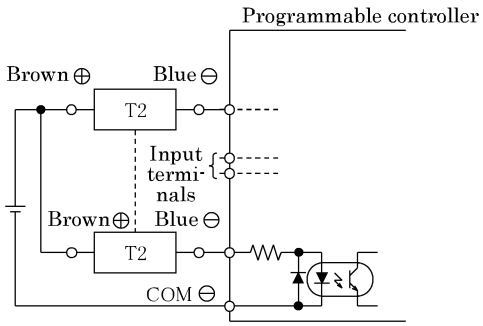


Fig.14 An example of T2 connection to sink input type (an external power source)

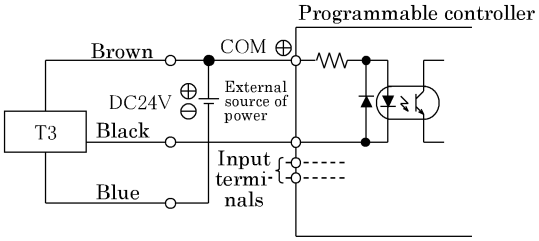


Fig.15 An example of T3 connection to source input type (an external power source)

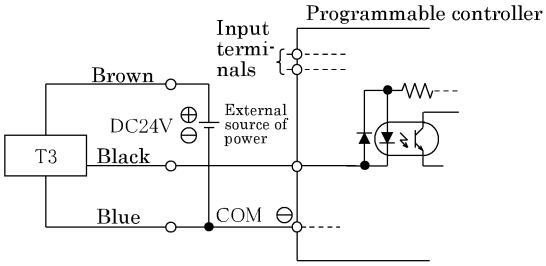


Fig.16 An example of T3 connection to source input type (an internal power source)

4) Series connection

The total voltage will decrease when the T2 switches connections have a leak. Therefore, confirm the input specifications for the programmable controllers, which are the connecting load. However, dimming or total failure of the indicator light may exist.

T3 switches hardly ever leak. When less than 10 μ A, then leakage may occur. Usually dimming and failure of the indicator light do not occur

4. MAINTENANCE

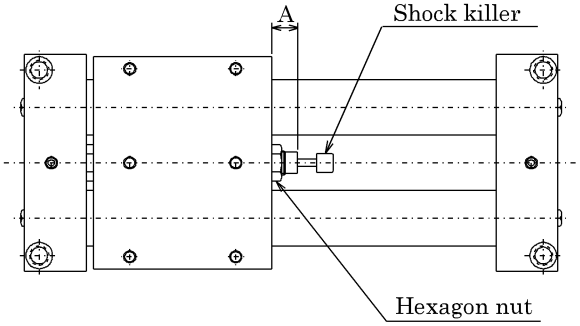
4.1 Periodical Inspection

> **⚠ CAUTION:** In order to upkeep the cylinder in optimum condition, carry out periodic inspection once or twice a year.

1) Inspection items
   (1) Check the bolts and nuts fitting the piston rod end brackets and mounting brackets for slackening.
   (2) Check to see that the cylinder operates smoothly.
   (3) Check any change of the working piston speed and cycle time.
   (4) Check for internal and/or external leakage.
   (5) Check the piston rod for flaw (scratch) and deformation.
   (6) Check the stroke for abnormality.
   (7) Check that the play of the slider is not changed.
   (8) Check if the shock killer functions incorrectly.

   See "Trouble shooting", 5 should there be any trouble found, also carry out additional tightening if bolts, nuts, etc. are slackened.

2) Replacing the shock killer
   If the shock killer does not function correctly, replace the shock killer with a new one. To replace the shock killer, follow the steps below.



＜Removal＞

① Remove the main unit and loosen the hexagon nut through the rear using a box-ended combination wrench.
② Loosen the shock killer to remove it.

＜Mounting＞

③ Screw-in the shock killer to adjust the dimension A to its specified level.
④ Screw-in the hexagon nut into the shock killer. At this time, apply the glue to a position where the hexagon nut is secured finally in order to adhere only the hexagon nut.
⑤ Tighten the hexagon nut with its specified tightening torque.

Dimension A and tightening torque

Bore size	Dimension A (mm)	Tightening torque (N·cm)
ϕ 6	9.5	180～220
ϕ 10	9.5	180～220
ϕ 16	11.5	180～220
ϕ 20	10.5	360～440
ϕ 25	12.5	540～660
ϕ 32	12.5	540～660

4.2 Disassembly

⚠WARNING: Never attempt to disassemble this cylinder since it uses the strong magnet. If any fault, such as air leak occurs, replace the complete cylinder with a new one.

5. TROUBLE SHOOTING

1) Cylinder

Trouble	Causes	Remedies
Does not operate.	No pressure or inadequate pressure.	Provide an adequate pressure source.
	Signal is not transmitted to direction control valve.	Correct the control circuit.
	Improper or misalignment of installation.	Correct the installation state.
	Broken piston packing	Replace the cylinder.
Does not function smoothly.	Speed is below the low speed limit	Turn the speed up and/or limit the load variation.
	Improper or misalignment of installation.	Correct the installation state.
	Exertion of transverse load.	Install a guide. Correct the installation state
	Excessive load.	Increase the pressure itself and/or the inner diameter of the tube.
	Speed control valve is built in the way of "Meter in" circuit.	Change the meter-out circuit of the speed control valve.
Breakage and / or deformation.	Impact force due to high speed operation	Turn the speed down. Reduce the load and/or exchange for the cylinder with shock absorber. (e.g. MRL2-G or MRL2-W).
	Exertion of transverse load.	Install a guide and/or reverse the installation
Piston comes off.	The pressure is too high.	Decrease the pressure itself.
	The speed is too fast.	Turn the speed down. Install the shock absorber the outside.
	Excessive load.	Install the shock absorber the outside.

2) Switch

Troubles	Causes	Remedies
Indicator light is not lit.	Deposited contact point	Replace the switch.
	Excessive load than rated capacity	Replace the relay with a recommended one or replace the switch.
	Damaged indicator light	Replace the switch.
	Inadequate incoming signal	Review the external signal circuit and remove the causes.
Switch does not function right.	Broken circuit	Replace the switch.
	Inadequate incoming signal	Review the external signal circuit and remove the causes.
	Improper voltage	Correct voltage to specified.
	Incorrect location of switch	Correct its location.
	Aberrant position of switch	Set it back to original position and tighten the mounting device.
	Incorrect direction of switch mounting	Correct the direction of the switch mounting.
	Relay is unable to respond properly	Turn the speed down. Replace the relay with a recommended one.
	Excessive load than rated capacity	Replace the relay with a recommended one or replace the switch.
Switch does not return.	Piston is not moving	Make the piston move.
	Deposited contact point	Replace the switch
	Excessive load (relay) than rated capacity	Replace the relay with a recommended one or replace the switch.
	The ambient temperature is out of the specification range	Adjust the ambient temperature within the range of -10 to 60℃
	Existence of a foreign magnetic field	Shield the magnetic field.
	Inadequate incoming signal	Review the external signal circuit and remove the causes.

6. HOW TO ORDER

6.1 Product Number Coding

Example of model code designation

● Without switch

MRL2 - 16 C — 50 ——————— N

● With switch

MRL2-L - 16 C — 50 - T2H - R - N

(a) (b) (c) (d) (e) (f) (g)

(a) Type & Model			(b) Bore size (mm)		(c) Cushion	
Basic type	MRL2	Without switch	6	ϕ6	No code	Rubber cushion
	MRL2-L	With switch	10	ϕ10	C	Rubber and air cushion
	MRL2-F	Micro speed type	16	ϕ16		
	MRL2-LF	Micro speed type, with switch	20	ϕ20		
			25	ϕ25		
Simple guide type one piston type	MRL2-G	Without switch	32	ϕ32		
	MRL2-GL	With switch				
	MRL2-GF	Micro speed type				
	MRL2-GLF	Micro speed type, With switch				
Simple guide type Two piston type	MRL2-W	Without switch				
	MRL2-WL	With switch				
	MRL2-WF	Micro speed type				
	MRL2-WLF	Micro speed type, with switch				

Bore size / (d) Stroke		ϕ6	ϕ10	ϕ16	ϕ20	ϕ25	ϕ32
50	50	●	●	—	—	—	—
100	100	●	●	●	—	—	—
150	150	●	●	●	—	—	—
200	200	●	●	●	●	●	●
250	250	—	●	●	●	●	●
300	300	—	●	●	●	●	●
350	350	—	—	—	●	●	●
400	400	—	—	●	●	●	●
500	500	—	—	●	●	●	●
600	600	—	—	—	●	●	●
700	700	—	—	—	●	●	●

(e) Switch model code				
Lead wire		Switch type	Indicator light	
Straight type	L-shaped type			
T2H※	T2H※	Solid state	1-color	2-wire
T3H※	T3H※			3-wire
T2YH※	T2YH※		2-color	2-wire
T3YH※	T3YH※			3-wire

※ Lead wire length	
No code	1m (Standard)
3	3m (Optional)
5	5m (Optional)

(f) Qty. of switch	
R	R side, 1 ea.
L	L side, 1 ea.
D	2 ea.
T	3 ea.
4	4 ea.

(g) Option	
C	With shock killer (Basic type cannot select this option.)
S	With dust wiper (Micro speed type cannot select this option.)
R	Central piping (Basic type and ϕ6 cannot select this option.)
P72	Low-dust production specification (Micro speed type can not select this option)

6.2 Component parts Model coding

Switch unit

SW – T2H

Switch model code item (e) above

Shock killer unit

MRL2- – 16 – C

Type & Model item (a) above

Bore size item (b) above

7. SPECIFICATION

7.1 Cylinder Specifications

Model / Item			MRL2 (-L,F), MRL2-G (-L,F), MRL2-W (-L,F)					
Bore size		mm	φ6	φ10	φ16	φ20	φ25	φ30
Actuation			Double-acting type					
Working fluid			Compressed Air					
Max. working pressure		MPa	0.7					
Min. working pressure		MPa	0.3 (Note1)		0.2			
Proof pressure		MPa	1.05					
Ambient temperature		℃	-10～60 (No freezing), (Micro speed type:5～60)					
Port size			M5				Rc1/8	
Stroke tolerance		mm	$^{+1.5}_{0}$ (～1000), $^{+2.0}_{0}$ (1001～1500)					
Working piston speed		mm/s	50～500 (Micro speed type: 1～200)					
Cushion			Cushion rubber					
Lubrication			Not required (Use Grade 1 ISO VG 32 Turbine oil, if lubrication is Preferred)					
Holding force (Note2)		N	19	63	166	294	350	574
Allowable energy absorption	MRL2	J	0.006	0.028	0.100	0.265	0.283	0.523
	MRL2-$^{G}_{W}$	J	0.12	0.12	0.25	0.58	0.74	0.74
	With shock killer (C)	J	0.24	0.24	0.80	2.11	3.88	3.88
Adjustable stroke range (Note3)		mm	3	4	6	8.5	10	10

Note1. The value of the model GL-6-C (with shock killer) becomes 0.4.

Note2. A value multiplied by 2 applies to the simple guide 2-piston type (W).

Note3. The stroke of the model MRL2 (basic type) cannot be adjusted.

7.2 Switch Specifications

Type & Model / Item	Solid state type switch			
	T2H, T2V	T2YH, T2YV	T3H, T3V	T3YH, T3YV
Applications	For use with programmable controller		For use with programmable controller, relay	
Power supply voltage	—		DC10 to 28V	
Load voltage, current	DC10V to 30V 5～20mA (Note2)		DC30V or less 100mA or less	
Current consumption	—		10mA or less at DC24V (ON lighting)	
Internal voltage drop	4V or less		0.5V or less at 100mA	
Indicator light	LED (Lights while power is ON)	LED (Red/Green) (Lights while power is ON)	LED (Lights while power is ON)	LED (Red/Green) (Lights while power is ON)
Leakage current	1mA or less		10μA or less	
Lead wire length (Note1)	Standard 1m (Oil-proof vinyl cabtyre code, 2-wire, 0.2mm^2)	Standard 1m (Oil-proof vinyl cabtyre code, 2-wire, 0.3mm^2)	Standard 1m (Oil-proof vinyl cabtyre code, 3-wire, 0.2mm^2)	
Shock resistance	980m/s^2			
Insulation resistance	20MΩ or more measuring with DC500V megger tester	10MΩ or more measuring with DC500V megger tester	20MΩ or more measuring with DC500V megger tester	10MΩ or more measuring with DC500V megger tester
Withstand voltage	No abnormalities should occur after applying AC1000V for 1 minute			
Ambient temperature	−10 to 60℃			
Degree of protection	IEC Standard IP67, JIS C 0920 (water tight type), Oil resistance			

Note1 : 3m or 5m long lead wire is optionally available.

Note2 : Maximum value, 25mA is at 25℃ of ambient temperature. Load current decreases less than 25mA when the ambient temperature exceeds 25℃. For example: it may be 5 to 10mA at 60℃