NIPPON VALVE CONTROLS, INC.

Instruction manual

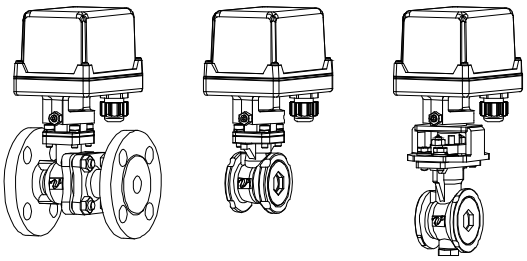
Electric Actuated Ball Valve BR BS GS VR

SP-1555

Please read this manual before installation and use.

GENERAL

Flange-end ball valve and compact electric actuator.



Actuator

- AM : For AC power.
- AH1 : For AC power. (High speed)
- DM : For DC power.
- PAX : Proportional control.

Valve

- BR type For various fluids and general use.
- BS type For Wafer
- VR type For control
- GS type For Wafer. (JIS 10K / 20K)

PRODUCT CODE

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)		(9)		(10)		(11)
BR type			B	R						-		-			
BS type			B	S			1			-		-			
VR type		P	A	X	V	R		1	U	U		-		-		-	
	(Standard port)	P	A	X	V	R		1	U	U		R	0 1 5	-		-	
GS type	(V-port)	P	A	X	G	S		3	U	U		V		-		-	
	(Full port)				G	S		3	U	U		-		-		-	
	(Standard port)				G	S		0	3	U	U	R	0 4 0	-			

(1) Actuator
AM1 AM2 AH1
DM0 DM2 PAX

(2) Valve
BR BS
VR
GS

(3) Voltage
1 : 100 / 110 V AC
2 : 200 / 220 V AC
0 : 24V DC

(4) Sizing code
0 : Standard
1 : Light
2 : Heavy

(5) Connection
1 : JIS 10K
3 : JIS 20K

(6) Body material
T : SCS13A
U : SCS14A

(7) Ball material
T : SCS13A / SUS304
U : SCS14A / SUS316

(8) Seat material
F : F-PTFE
G : R-PTFE
R : R-F-PTFE
K : PEEK
I : API
C : R-PEEK
M : SUS316 + Stellite

(9) Size [mm]
ex. 25 A → 025

(10) Option
AK : Aluminum alloy motor cover
M1 : Manual lever
C1 : Flexible cable

(11) Operation mode (PAX)
Nil : Mode A
J : Mode B

VALVES SPECIFICATIONS

Water Oil Air, Gas Steam Chemicals Sea water Slurry Negative pressure

BR BS Type

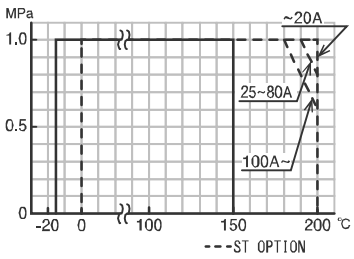
Valve type		BR			BS	
Design		2-way, Full port			2-way, Wafer (Full port)	
Connection		JIS10K Flanged-end		JIS20K Flanged-end	JIS Flanges 10K	
Fluid						
Max pressure		1 MPa		2 MPa	1 MPa	
Size [mm]		015 to 032		015 to 025	015 to 032	
Material	Body	SCS13A	SCS14A	SCS13A	SCS13A	SCS14A
	Ball	SCS13A SUS304	SCS14A SUS316	SCS13A	SCS13A	SCS14A
	Seat	F-PTFE R-PTFE R-F-PTFE			F-PTFE R-PTFE R-F-PTFE	
Stem seal	Packing	R-PTFE			R-PTFE	
	O-ring	FKM			FKM	

The optional for steam fluids.

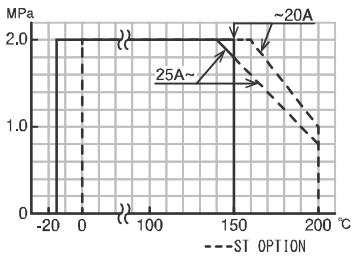
Valve type	Option code	O-ring
BR BS	ST	Replace (Steam resistant FKM)

PRESSURE & TEMPERATURE RATING

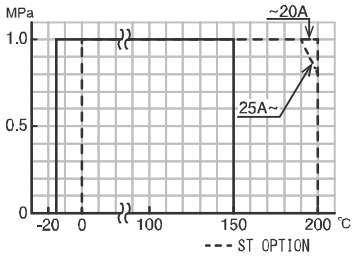
BR (JIS 10K)



BR (JIS 20K)



BS



Note) Insulation options are required for use with fluids more than 150 °C.

VALVES SPECIFICATIONS

Water Oil Air, Gas Steam Chemicals Sea water Slurry Negative pressure

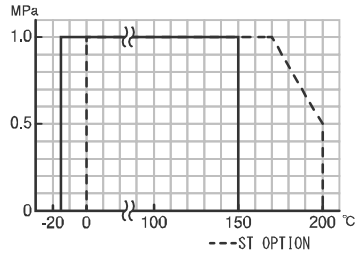
VR Type

Valve type		VR	
Design		2-way, V-port	
Connection		JIS10K Flanged-end	
Fluid			
Max pressure		1 MPa	
Size [mm]		R015	015 to 025
Material	Body	SCS14A	
	Ball	SUS316	SCS14A
	Seat	R-PTFE	R-F-PTFE
Stem seal	Packing	R-PTFE	
	O-ring	FKM	

The optional for steam fluids.

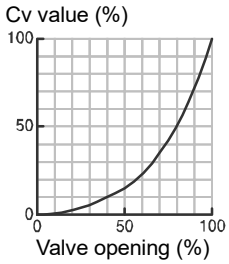
Valve type	Option code	O-ring
VR	ST	Replace (Steam resistant FKM)

PRESSURE & TEMPERATURE RATING



Note) Insulation options are required for use with fluids more than 150 °C.

INHERENT FLOW CHARACTERISTIC



Range ability

VR-1UUG R 015 100:1

VR-1UUG - 015 to 025 50:1

VALVES SPECIFICATIONS

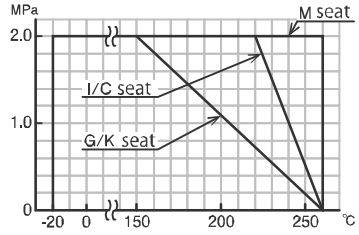
Water Oil Air, Gas Steam Chemicals Sea water Slurry Negative pressure

GS type

Valve type		GS		
Design		2-way, Wafer		
		V-port	Full port	Standard port
Connection		JIS Flanges 10K / 20K		
Fluid				
Max pressure		2 MPa		
Size [mm]		V015 to V032	015 to 080	R040 to R150
Material	Body	SCS14A		
	Ball	SCS14A (HCr plated)		
	Seat	R-PTFE PEEK API R-PEEK SUS316 + Stellite		
Stem seal	Packing	R-PTFE		

Note) API cannot be used with steam fluid.

PRESSURE & TEMPERATURE RATING

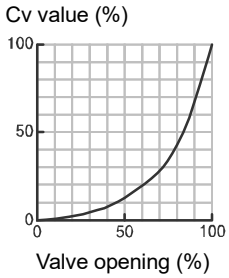


Note) • Option for use in fluid temperature more than 170 °C.
• We prefer to K seat depends on pressure or environmental conditions. Please consult us for your specifications.

SEAT LEAKAGE VOLUME (JIS B 2005-4)

	Seat material	Leakage rate	Remarks
G	R-PTFE	None	
K	PEEK		
I	API		
C	R-PEEK	10^{-4} × rated Cv value × 10^{-3} or less.	Class IV × 10^{-3} or less.
	R-PEEK (V-port)	10^{-4} × rated Cv value × 10^{-3} × 8 or less.	Class IV × 10^{-3} × 8 or less.
M	SUS316 + Stellite	10^{-4} × rated Cv value or less.	Class IV or less.
	SUS316 + Stellite (V-port)	10^{-4} × rated Cv value × 8 or less.	Class IV × 8 or less.

INHERENT FLOW CHARACTERISTIC



Range ability

GS-3UU□ V 015 to 032	50:1	(V-port)
GS-3UU□ - 015 to 080	200:1	(Full port)
GS-3UU□ R 040 to 150	100:1	(Standard port)

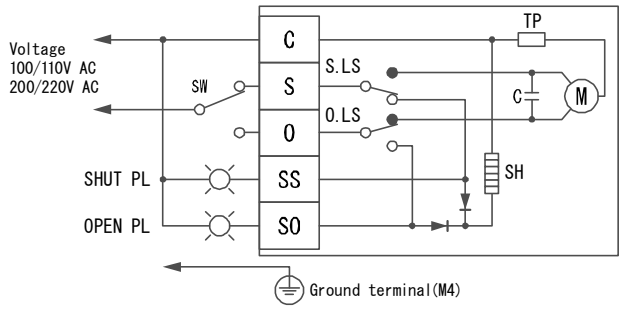
ELECTRIC ACTUATOR SPECIFICATIONS

AM1 AM2 type

Actuator type (☐:Voltage code)	AM1-030-☐	AM1-070-☐	AM1-180-☐	AM2-030-☐	AM2-070-☐	AM2-180-☐
Voltage	100 / 110 V AC ±10 % 50/60 Hz (Voltage code: 1) 200 / 220 V AC ±10 % 50/60 Hz (Voltage code: 2)					
Rated torque [N·m]	3	7	18	3	7	18
Operation time [s]	5.4 / 4.5 (50/60 Hz)	15.5 / 13 (50/60 Hz)	16 / 13.5 (50/60 Hz)	5.4 / 4.5 (50/60 Hz)	15.5 / 13 (50/60 Hz)	16 / 13.5 (50/60 Hz)
Power consumption [VA]	16		19	18		19
Motor	Synchronous motor					
Overload protection	Thermal protector					
Method of operation	Transfer input type			a-contact input type, with built-in relay		
Operation	Power to S → SHUT (SHUT PL is lit.) Power to O → OPEN (OPEN PL is lit.)			SW is OFF → SHUT (SHUT signal is output.) SW is ON → OPEN (OPEN signal is output.)		
Input signal current	Nil			9 mA (O-terminal) Leakage current in SW: less than 1 mA		
Output signal rating	Resistance load 3 A 250 V AC (Minimum 0.1 A)			Resistance load 0.5 A 125 V AC 2 A 30 V DC Micro load 1 mA 5 V DC		
Duty cycle	20 % 15 min.					
Ambient temperature	-20 to 55 ºC					
Space heater	1 W					
Manual operation	Direct operation of actuator by loosening lock screw					
Enclosure	Equivalent to IP65 (IEC 60529)					
Housing material	Aluminum alloy die cast + Polycarbonate resin cover					
Terminal block	For bare wire 0.14 to 1.5 mm² (AWG 26 to 14) Ground terminal: M4					
Conduct port	G3/8 Cable gland (for Φ5 to 10.5 mm cable)					

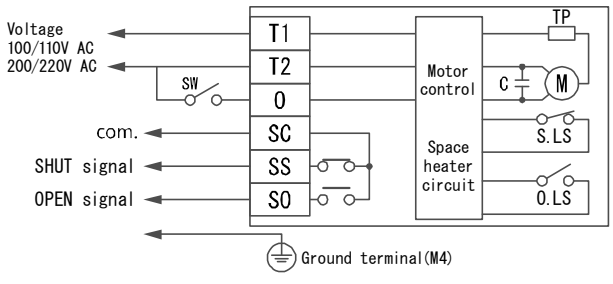
WIRING

AM1



- Control switch should be prepared one by one for actuator. Do not operate two or more actuator from one switch. It might malfunction.

AM2



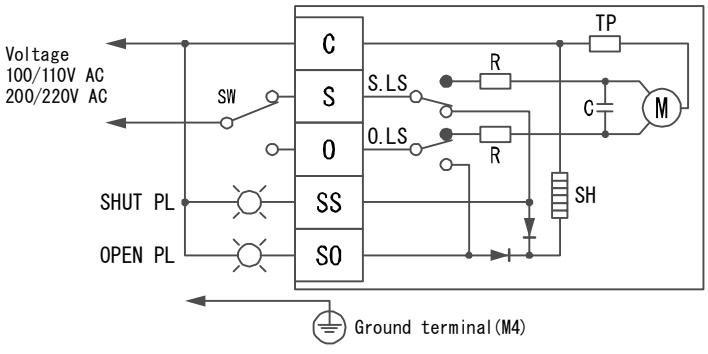
- Two or more actuators can be operated with one control switch.
- When using control switch with current leakage (more than 1 mA) such as TRIAC or relay with CR, it can cause malfunction.

ELECTRIC ACTUATOR SPECIFICATIONS

AH1 type

Actuator type (☐:Voltage code)	AH1-030-☐	AH1-070-☐	AH1-180-☐
Voltage	100 / 110 V AC ±10 % 50/60 Hz (Code: 1) 200 / 220 V AC ±10 % 50/60 Hz (Code: 2)		
Rated torque [N·m]	3	7	18
Operation time [s]	3 / 2.5 (50/60 Hz)		6 / 5 (50/60 Hz)
Power consumption [VA]	19	50	
Motor	Synchronous motor	Reversible motor	
Overload protection	Thermal protector		
Method of operation	Transfer input type		
Operation	Power to S → SHUT (SHUT PL is lit.) Power to O → OPEN (OPEN PL is lit.)		
Output signal rating	Resistance load 3 A 250 V AC (Minimum 0.1 A)		
Duty cycle	20 % 15 min.		
Ambient temperature	-20 to 55 ºC		
Space heater	0.5 W	1 W	
Manual operation	Direct operation of output shaft		
Enclosure	Equivalent to IP65 (IEC 60529)		
Housing material	Aluminum alloy die cast + Polycarbonate resin cover		
Terminal block	For bare wire 0.14 to 1.5 mm² (AWG 26 to 14) Ground terminal: M4		
Conduct port	G3/8 Cable gland (for Φ5 to 10.5 mm cable)		

WIRING



Note) Control switch should be prepared one by one for actuator.
Do not operate two or more actuator from one switch. It might malfunction.

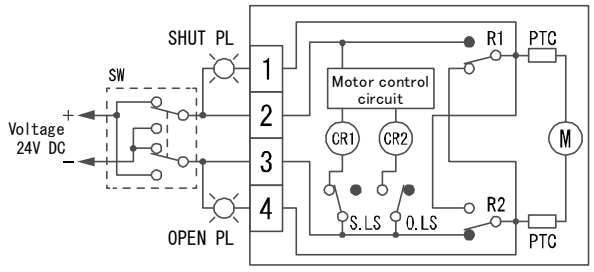
ELECTRIC ACTUATOR SPECIFICATIONS

DM0 DM2 type

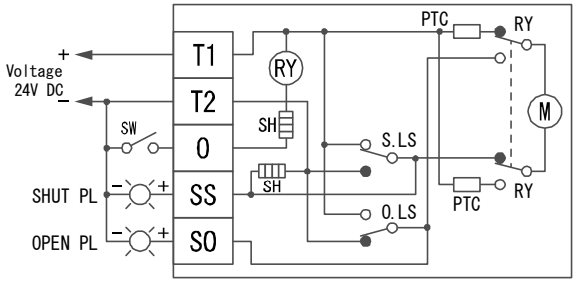
Actuator type	DM0-030-0	DM0-070-0	DM0-180-0	DM2-030-0	DM2-070-0	DM2-180-0
Voltage	24 V DC					
Rated torque [N·m]	3	7	18	3	7	18
Operation time [s]	0.8 to 1.5	2 to 3	4 to 6	2 to 3.5	2 to 3	4 to 6
Power consumption (Max) [VA]	24			10	24	
Motor	DC motor					
Overload protection	Thermistor					
Method of operation	Switching polarity type			a-contactinput type, with built-in relay		
Operation	[2] + [3] - → SHUT (SHUT PL is lit.) [3] + [2] - → OPEN (OPEN PL is lit.)			SW is OFF → SHUT (SHUT PL is lit.) SW is ON → OPEN (OPEN PL is lit.)		
Input signal current	Nil			16.2 mA (O-terminal)		
Output signal rating	Resistance load 2 A 30 A DC Micro load 1 mA 5 V DC			Resistance load : Less than 1 A 24 V DC		
Duty cycle	20 % 15 min.					
Ambient temperature	-20 to 55 ºC					
Space heater	1 W					
Manual operation	Direct operation of output shaft					
Enclosure	Equivalent to IP65 (IEC 60529)					
Housing material	Aluminum alloy die cast + Polycarbonate resin cover					
Terminal block	For bare wire 0.14 to 1.5 mm² (AWG 26 to 16)					
Conduct port	G3/8 Cable gland (for Φ5 to 10.5 mm cable)					

WIRING

DM0



DM2



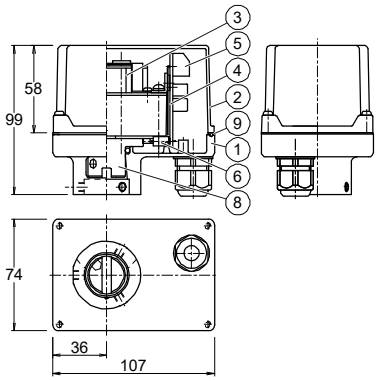
ELECTRIC ACTUATOR SPECIFICATIONS

OPTIONAL PARTS

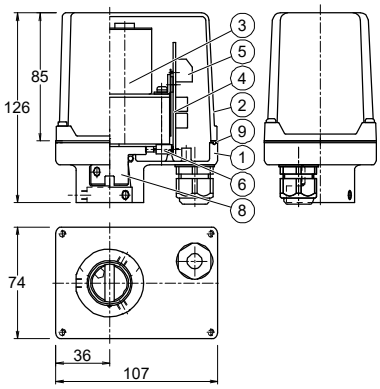
Specifications	Code No.	AM	AH1	DM	Remarks
Aluminum alloy motor cover	AK	○	○	○	
Manual lever	M1		○	○	Detachable lever
Flexible cable (Approx. 300 mm long)	C1	○	○	○	

DIMENSIONS

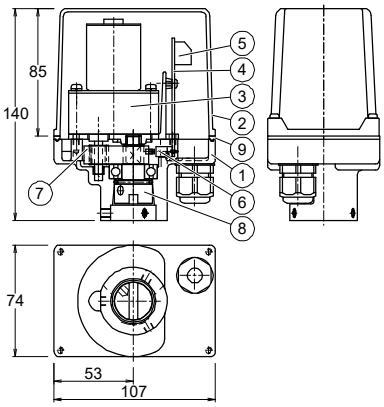
AM (030 / 070) DM2 (030)



DM0 (030) DM (070) AH1 (030 / 070)



AM (180) DM (180) AH1 (180)



Parts name

1	Body	4	Control board	7	Drive gear
2	Motor cover	5	Terminal block	8	Drive shaft
3	Motor	6	Limit switch	9	Rubber packing

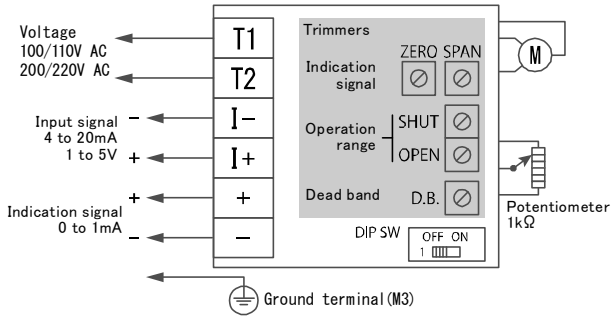
ELECTRIC ACTUATOR SPECIFICATIONS

PAX type

Actuator type (☐:Voltage code)	PAX-050-☐	PAX-120-☐
Voltage	100 / 110 V AC ±10 % 50/60 Hz (Code: 1) 200 / 220 V AC ±10 % 50/60 Hz (Code: 2)	
Rated torque [N·m]	5	12
Operation time [s]	14 / 12 (50/60 Hz)	30 / 25 (50/60 Hz)
Power consumption [VA]	9.5	
Motor	Synchronous motor (Triac control)	
Overload protection	Impedance protect	
Method of operation	Proportional control	
Input signal	4 to 20 mA / 1 to 5 V (Input resistance: 250 Ω)	
Operation *1	[Mode A] SHUT by decreased signal ↔ OPEN by increased signal (Standard) [Mode B] SHUT by increased signal ↔ OPEN by decreased signal (Option: J)	
Indication signal	0 mA : SHUT ↔ 1 mA : OPEN (External load resistance: less than 3 kΩ) Common in mode A / B	
Resolution	Less than 0.2 %	
Duty cycle	100 %	
Ambient temperature	-20 to 55 ºC	
Space heater	1 W	
Manual operation	Direct operation of actuator by loosening lock screw	
Enclosure	Equivalent to IP65 (IEC 60529)	
Housing material	Aluminum alloy die cast + Polycarbonate resin cover	
Terminal block	For bare wire 0.2 to 1.5 mm² (AWG 26 to 16) Ground terminal: M3	
Conduct port	G3/8 Cable gland (for Φ5 to 10.5 mm cable)	

*1 Change by DIP switch. (Standard → Mode B)

WIRING



Setting with DIP switch

Mode A / B is selected simply by setting the mode change DIP switch located on built-in control board.

Mode A

Mode B

Note) • Input signal circuit is non-isolated. Do not connect DC (-) wire to other DC (-) common.
• Do not adjust operating angle of a valve (OPEN/SHUT trimmer).
Please contact us if you need to adjust operating angle.

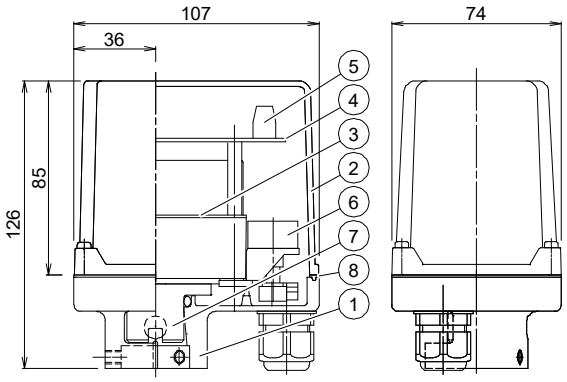
ELECTRIC ACTUATOR SPECIFICATIONS

OPTIONAL PARTS

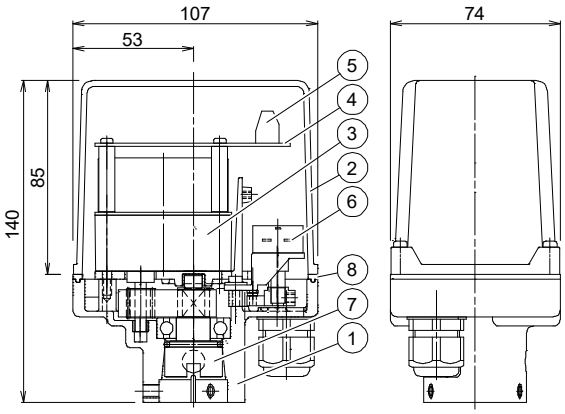
Specifications		Code No.	PAX	Remarks
Aluminum alloy motor cover		AK	○	
Flexible cable (Approx. 300 mm long)		C1	○	
Operation	SHUT by decreased signal ↔ OPEN by Increased signal	Nil	○	Mode A
	SHUT by increased signal ↔ OPEN by decreased signal	J	○	Mode B

DIMENSION

PAX (050)



PAX (120)



Parts name

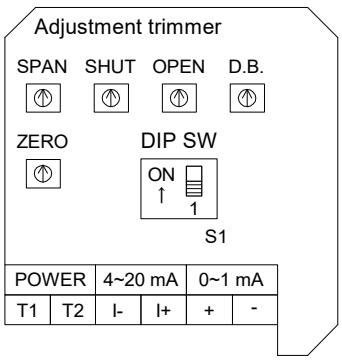
1	Body	4	Control board	7	Drive shaft
2	Motor cover	5	Terminal block	8	Rubber packing
3	Motor	6	Potentiometer		

ADJUSTMENT (PAX)

① Dead band
Turn the trimmer clockwise for wide the dead band as necessary.
It is useful to prevent the hunting reaction of actuator.
*Each trimmer on a built-in control board.

② Operating range
Do not adjust operating angle of a valve (OPEN, SHUT trimmer).
Please contact us if you need to adjust operating angle.

③ Operating speed (Speed control)
No adjustment required. (ZERO, SPAN trimmer)



HANDLING & STORAGE

①HANDLING

Do not drop or throw the product as it may break.

②STORAGE

- Store away from dust, moisture and direct sunlight. If possible, store in the original package.
- Do not remove a dust proof cap until the piping.

③CHECKING

- Check the product code, power supply, and voltage before installation.
- Make sure that the bolts are not loose.
- The DIP switch should be set up before the power is turned on. Do not touch unnecessary switches. (PAX)

INSTALLATION

①PRECAUTIONS

- Flush the pipeline carefully before installing the valve. Foreign particles, such as sand or pieces of welding electrode, will damage the ball and seats.
- For valves with specified flow direction (GS, VR) or with ST / SC option, check the arrows on the product before piping.

②PIPING FLANGES

- Gasket should be selected appropriately to suit the fluid, pressure and temperature.
  Use spring washer to prevent from decreasing surface pressure gasket when the temperature change happens frequently.
- Tighten all bolts using crossover method to load the joint evenly.
- Wafer type ball valve is put between two seats of flanged-end and tightened with long bolts. (BS, GS)

③ENVIRONMENT

- Do not install in place where corrosive gas is present or where vibration is heavy (0.5 G or more).
- When radiant heat causes the surface temperature of the control unit to exceed 55 °C, provide an appropriate shielding plate.
- If there is a possibility that the fluid and drive part freeze, please take measures to prevent freezing.

④POSITIONING

Should be positioned through 90° upward from horizontal. Provide space around the product to allow manual operation, inspection and replacement work.

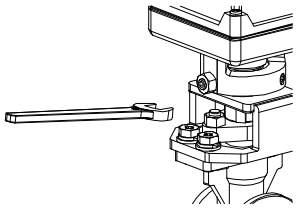
Margin required around the actuator for maintenance	
AM (030 / 070) DM2 (030)	More than 65 mm
AM AH1 DM PAX	More than 90 mm

⑤OTHER NOTES

Until the wiring is completed there must be no condensation or flooding in the interior of the actuator, after piping. Protective caps on the cable gland are not waterproof.

⑥CAUTIONS FOR MAINTENANCE (GS)

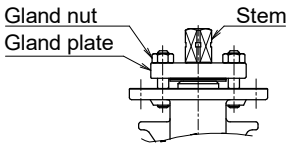
Do not keep warm for maintenance of the valve gland.



GS

TIGHTEN THE GLAND NUTS (GS)

- Check that there is no leakage from the gland packing.
- If it leakage, tighten gland nuts by alternately. Do not over-tighten the gland nuts.



GS

Valve size [mm]			Recommended torques [N·m]
V015 V020	015 020	-	2
V025 V032	025 032	R040	3.5

WIRING

- Do not wiring outdoors on a rainy day.
- Check the power supply and voltage.
  Connect the signal as shown in the wiring diagram.
- Do not connect unnecessarily terminal.
- Use suitable flexible cable (Φ5 to 10.5 mm).
  Lock and seal the cable completely to prevent condensation inside the actuator.
- Built-in terminal block can clamp up to 1.5 mm in diameter without using solderless terminal.
- Allow proper cable slack for maintenance.
- Actuator should be electrically grounded.
  Use the terminal marked (⏚) inside the actuator.

PREVENT DEW CONDENSATION

- When installing the cover after wiring, perform the bolt by the temporary tightening procedure and the permanent tightening procedure to tightly and securely tighten the rubber packing so that water does not enter from the outside.
- Tighten the cable gland nut so that there is no leakage from the wire entrance.

CONTROL

①AM1, AH1

Control switch should be prepared one by one for actuator. Do not operate two or more actuator from one switch. It might malfunction.

②AM2

- Two or more actuators can be operated with one control switch.
- When using control switch with current leakage (more than 1 mA) such as TRIAC or relay with CR, it can cause malfunction.
- When wiring is long distance or handling a weak current signal, it may be affected by induced voltage or noise. In this case, please use countermeasures such as using a shielded wire, separating it from other power cables.

③DC POWER SUPPLY (DM0, DM2)

- It is usable with a battery and full-wave rectification circuit.
- Consider an inrush current of motor. (It is 1.5 to 3 times of consumed current.)
- They may cause malfunction with decreasing voltage by the long wiring.
- Do not use power supply that require more than 1 second with rise and fall time.

④USE OF OPEN/SHUT SIGNALS (AM, AH1, DM)

Use signals within the capacity of output signal rating.

⑤PAX

- Use shielded wire for signal wiring where high level noise is generated or when the wiring distance is long.
- Control with a 1 to 5 V input signal becomes an input resistance 250 Ω. Provide a voltage that can safely 20 mA or more than.
- Check whether the MODE change DIP SW on a circuit board substrate is set up correctly. When wiring, if wiring of a signal is mistaken, it will not operate correctly. Contact us when you use two valve or more by one controller or indicator.
- Input signal circuit is non-isolated. Do not connect DC (-) wire to other DC (-) common.
- The input signal and operation mode are set as follows. (Factory shipped)

Input signal	4 to 20 mA / 1 to 5 V
Operation mode	Mode A
Operation	SHUT by decreased signal OPEN by increased signal

OPERATION

①TESTING

- Make sure that power supply voltage is correct. Also check operating position, wiring, speed and signals.
- During trial operation, check that valve movement and output signal are correct.

②DUTY CYCLE (AM, AH1, DM)

Confirm that the operation frequency is within the specified duty cycle.
Use beyond the load time rate range will affect product life. Also, it may cause burnout.

> Duty cycle is a value that regulates the opening / closing frequency of the actuator. The meaning of 20 % 15 minutes for Duty cycle is that 3 minutes (20 % of 15 minutes) operation is possible.
> The calculated value obtained by dividing 3 minutes by the operation time is the number of times of operation within 15 minutes.

③CONFIRM THE OPERATING CONDITION (PAX)

- Adjust fluid condition, controller setting, sensor etc. so that stable control is achieved.
- When used in an unstable control state, the life of the actuator and the valve will be shortened.
- The desired control state is stable at the target value. Adjust the PID setting value of the controller when overshooting the target value greatly, when not converging for a long time or hunting operation. Also, when the time delay is large, please consider the sensor position.

④ATTENTION

- Be sure to set the DIP-SW before turning on the power supply. (PAX)
- Keep power supplied for built-in space heater to prevent condensation inside actuator.
- Do not touch the moving parts of actuator in operation.
- Do not insert a reverse signal during operation. It may shorten the life of product. (AM, AH1, DM)
- Never put anything on the actuator or make it into a foothold.

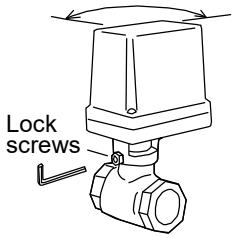
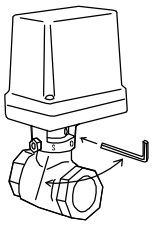
MANUAL OPERATION

①PRECAUTIONS

- Manual operation should be a temporary operation.
- Be sure to turn off the power before manual operation.

②NOTE

For manual operation, do not give more than the rated torque and make at a slow rate. Actuator might be damaged if excessive force is added.

AM PAX	AH1 DM
	
Actuator can be easily removed from the valve by loosing 3 lock screws, and that allows direct operation of the valve. After operation, be sure to put back the actuator to the original position and lock.	Put an allen wrench (5 mm) or a lever (Φ5.7) into the hole on drive shaft and turn slowly. Manual lever is optional.

MAINTENANCE

- To prevent electric shock, be sure to turn off the power when removing the actuator cover.
- Do the routine maintenance at least once in half a year.

Inspection items

- Confirm operation of opening and closing.
- Confirm that an actuator is not hot excessively.
- Confirm existence of abnormal noise and vibration during operation.
- Confirm whether screws are loose or not.
- Confirm that water or condensation no remains in the actuator.
- Confirm the fluid temperature or pressure.
- Confirm the leak from valve stem.
- Confirm the bolt tightening torque.

TROUBLE SHOOTING

Problem	Cause	Solution
Actuator does not move.	Faulty wiring.	Correct the wiring.
	No voltage is coming.	Check the voltage.
	Incorrect voltage.	When it's burned out by excess voltage, replace the actuator.
	Connection or wiring is not correct. PAX	Correct the miswiring and misconnection. Be careful not to mistake the plus and minus of wiring.
	Short the circuit, contact failure.	Review wires and connection.
	Motor is too old.	Replace the actuator.
Operation is unstable.	Excess surge or voltage was applied.	Replace the actuator.
	Rainwater entered the actuator.	
	Switch leakage current is large. AM2	Current leakage should be less than 1 mA.
Operation is unstable. PAX	Added high harmonics noise from an inverter.	Attachment a filter for each inverter maker option.
	Effect of high level noise.	Use the shielded wire and ground the wiring. Separate signal wire from power line.
Stop in the mid position. (Input signal's 1 to 5 V.) PAX	Signal voltage source capacity shortage.	Use a voltage source that can be made to flow more than 20 mA. Please contact us.
Stop in the mid position.	Continuous irregular stop will shorten the motor life and wear the gear. Turn off the power and check. AM1 AM2 AH1-030	

Problem	Cause	Solution
Stop in the mid position.	• Biting of valve seat. • The scale has adhered to the valve ball.	Remove a foreign object.
	Overload protector runs because of over-torque.	Turn off the power for about 3 minutes to remove a heat from motor protection circuit. AM1 AM2 AH1 DM2 DM0
		Motor protection circuit returns by the signal of operation of an opposite direction. Turn on the power again. PAX
Leakage from valve body	• Valve cap get loose. • Valve body is damaged.	Replace the valve.
Leakage from valve seat	Seat is worn or damaged.	Replace the valve.
		Replace the valve seat.
Leakage from valve stem	Stem packing is worn or distorted.	Replace the valve.
		Replace the packing.
Leakage from valve gland GS	Gland packing is worn or distorted.	Tighten the gland nut.
		Replace the gland packing.

For more information contact
NIPPON VALVE CONTROLS, INC. for consultation.

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