INSTRUCTION MANUAL

MINI-TOP ELECTRONIC ACTUATOR (linear type; DeviceNet)	MODEL	**MSP4D/MSP5D /MSP6D**

CONTENTS

1. BEFORE USE ....

Thank you for choosing us. Before use, please check contents of the package you received as outlined below.
If you have any problems or questions with the product, please contact our sales office or representatives.

■ PACKAGE INCLUDES:

Mini-Top ....(1)
The Mini-Top is not provided with a yoke or other components required for mounting it to a valve. They are to be provided by the user.

■ MODEL NO.

Confirm Model No. marking on the product to be exactly what you ordered.

■ SAFETY PRECAUTIONS

Before use, please read all the following precautions carefully to ensure the safety. These safety precautions, classified into "WARNING" and "CAUTION" according to the degree of damage that may be caused by improper use of the product, are imperative to prevent an accident. After reading, be sure to keep this manual always in a visible and accessible place for the user.
⚠ WARNING Suggesting that failure to observe the precautions could result in death or serious personal injury.
⚠ CAUTION Suggesting that failure to observe the precautions could result in personal injury or damage to the property.

⚠ WARNING
Remove power supply to the actuator before wiring to the unit. It could cause electric shock.
Do not disassemble or modify the unit in any way. It could cause electric shock, burn, or injury.
DO NOT step onto the actuator unit. DO NOT rest a heavy object on or against the unit. It could cause personal injury.
When installing the actuator unit outdoor or where it is exposed to rain or water drops, adequate precautions must be taken for preventing water from entering inside through wiring conduits. It could cause electric shock.

⚠ CAUTION
DO NOT remove the cover of the actuator. It may cause electric shock or injury.
The adjusters which are paint-sealed are for factory use only and should be changed only by qualified our personnel. Otherwise it could cause breakdown. We are not liable for any malfunction or inconvenience caused by unauthorized changes made by the user.

■ EDS FILE

EDS files are downloadable at our web site:

2. POINTS OF CAUTION

■ POWER INPUT RATING & OPERATIONAL RANGE

- Locate the power input rating marked on the product and confirm its operational range as indicated below:
  24V DC: 24V rating ±10%, approx. 0.5A

■ GENERAL PRECAUTIONS

- Remove the power supply to the actuator before wiring to it.

■ INSTALLATION

- Indoor, or outdoor where the MSP×D is NOT exposed to direct sunlight
- Ambient temperature: -5 to +55°C (23 to 131°F)
- Operating humidity 30 to 85% RH (non-condensing)
- Vibration: 0.5 G (4.9 m/s²) max.
- Install the MSP×D where you can reach for maintenance. Observe at the minimum of 15 centimeters (6 inches) above the cover.

■ ELECTRICAL CONNECTION

- Separate the cables (power supply and communications) from other cables to prevent surge or inductive interference.
- Do not bind these cables together with mains supply cables or high-voltage cables. Do not install them in the same duct.

■ OUTDOOR USE

- When installing the MSP×D outdoor or where it is exposed to rain or water drops, be sure to fasten the cable connector tightly and leave a slack of the cable.
- Do not mount the MSP×D in such direction that the output stem is at the top of the Mini-Top unit.

■ O-RING, GASKET

- When replacing the actuator cover after adjustments, check that the O-ring is securely placed in the groove.
- When replacing the communication box cover, check that the gasket is in place.

■ YOKE DESIGN

- When a foreign object is caught in the valve, a thrust four times greater than the maximum rating could be generated. Leave enough strength for mechanical components such like the yoke and stem.
- If the MSP×D is used on a steam line in temperature control, it is possible that the MSP×D temperature rises higher than the ambient temperature due to transmission or radiation via the steam piping, even when the ambient temperature is within allowable range.
  Use a longer yoke to increase heat dissipation and apply insulating material.

■ AND ....

- DO NOT loosen the screw fixing the potentiometer stem. Loosening it could cause a malfunction.
- DO NOT step onto the actuator. DO NOT rest a heavy object on or against it.

3. COMPONENT IDENTIFICATION
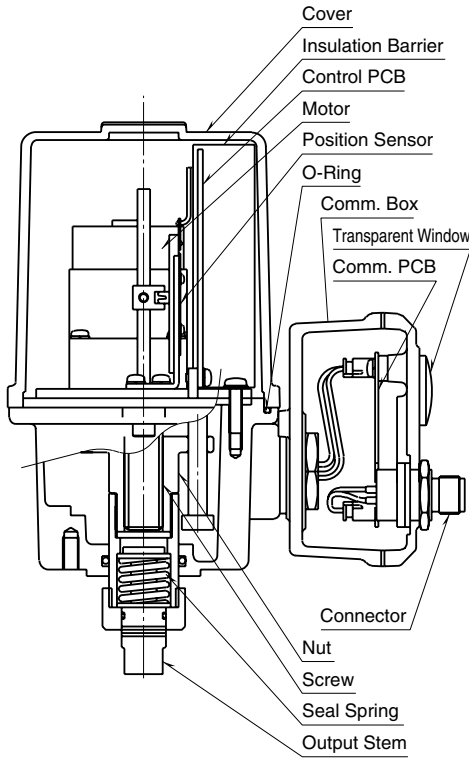
Figure 1. Component identification, MSP4D, MSP5D

Note: Construction of the MSP4D is partly different from the
       above figure.
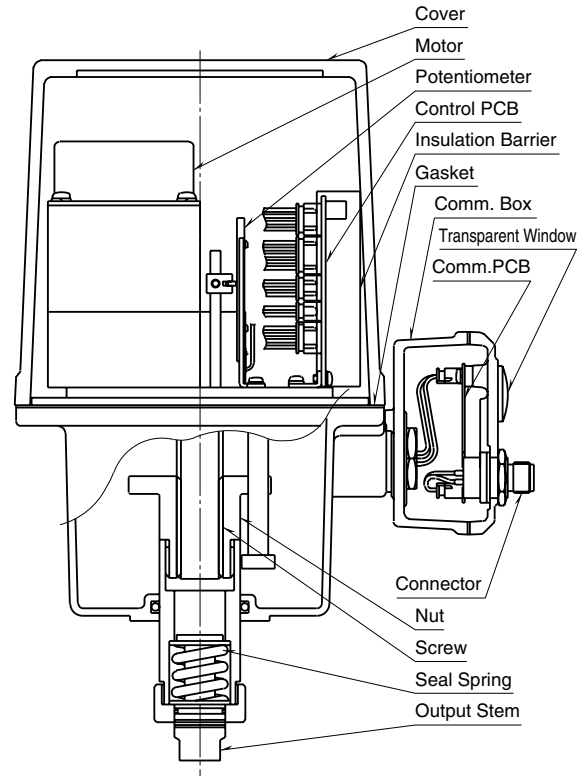
Figure 2. Component identification, MSP6D

■ DeviceNet CONNECTOR:

5-core micro-style connector, male

PIN ASSIGNMENT

1	Drain
2	V +
3	V −
4	CAN_H
5	CAN_L

■ POWER INPUT CONNECTOR:

4-core micro-style connector, male

PIN ASSIGNMENT

1	24 V
2	24 V
3	GND
4	GND
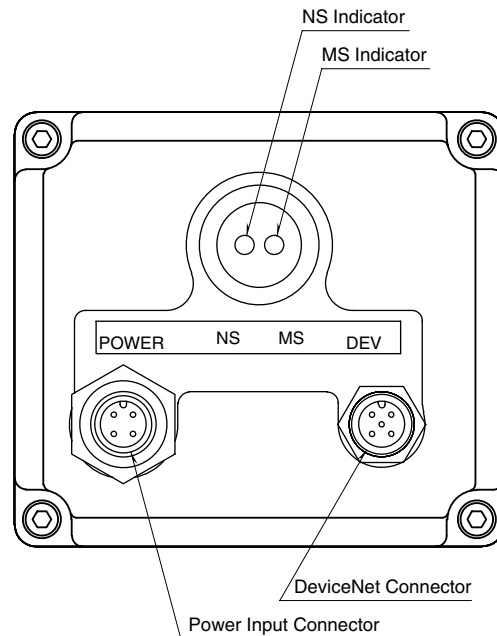
Figure 3. Component identification, Communication Box
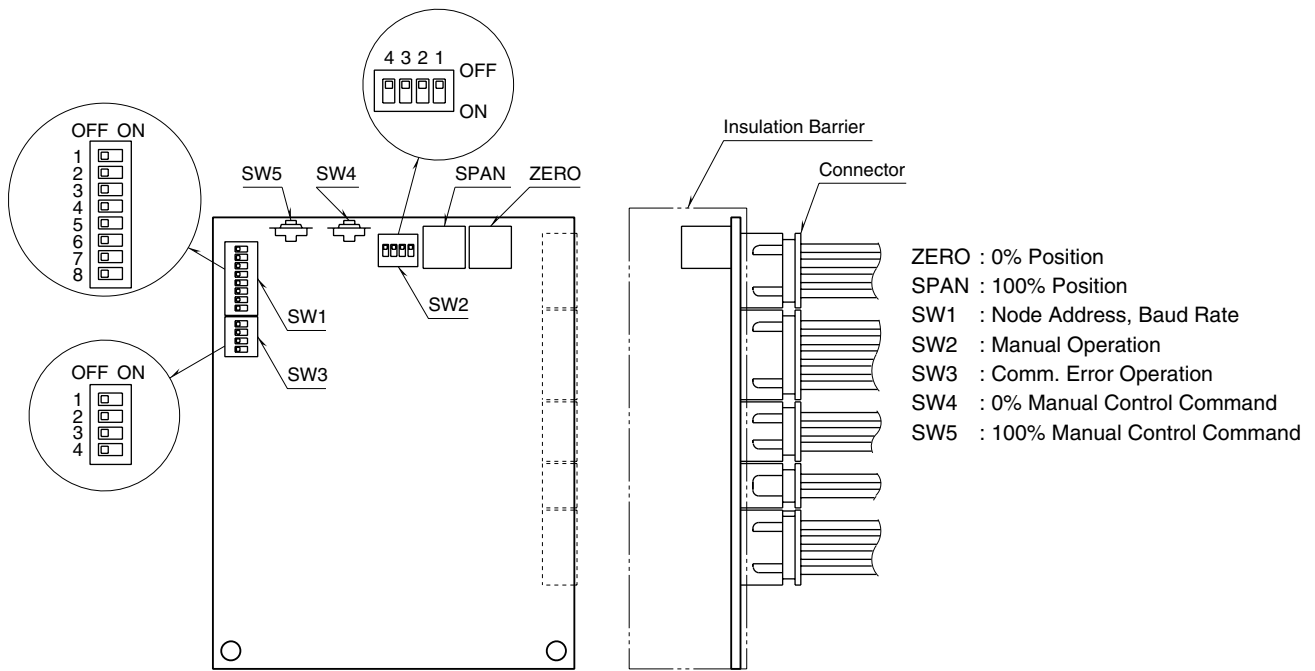
Figure 4. Component identification, Control PCB

ZERO : 0% Position
SPAN : 100% Position
SW1 : Node Address, Baud Rate
SW2 : Manual Operation
SW3 : Comm. Error Operation
SW4 : 0% Manual Control Command
SW5 : 100% Manual Control Command

Note 1: Applying excessive torque on potentiometers and switches may destroy the stoppers of these adjustments. Turn them gently and stop immediately where the controls hit the stopper.

Note 2: Press vertically the center of the SW4 or SW5 within the maximum strength of 9.8 N. Pushing these switches in slanted angles or at the edge may lead to unexpected failures.

4. OUTPUT SPAN ADJUSTABILITY

The servo-control circuit compares and amplifies "Input as Target" (position setpoint) signal and the feedback signal from the potentiometer, and drives the motor to such direction to minimize difference of the two signals.
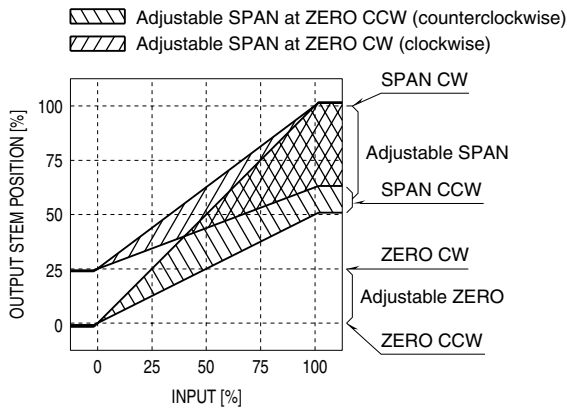
Figure 5. I/O characteristics (adjustable range)

The Span, with the Zero turned fully counterclockwise, is adjustable from 50% to 100%. With the Zero turned gradually clockwise, the Span's adjustable range become narrower, down to 62.5 – 100%. The Span is adjustable to 50 – 100% of the remaining total stroke after the Zero adjustment.
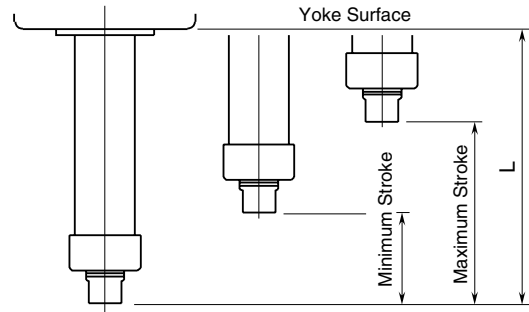
Figure 6. Definition of the minimum and maximum strokes

Table 1. Available Stroke Range for Each Model

MODEL	L	MIN. STROKE	MAX. STROKE
MSP4D-1	29	5	10
MSP4D-2	34	8	15
MSP5D-1	40	5	10
MSP5D-3	50	10	20
MSP6D-3	58	10	20
MSP6D-4	78	20	40

5. INSTALLATION

The following is a general procedure for mounting the MSP×D to a valve with a yoke.

Be sure NOT TO CHANGE factory adjusted setting of the MSP×D.

Remove power supply during the procedure unless otherwise specified.

1) Supply power to the actuator and manually control the actuator stem to the longest position.

2) Push in the valve stem at the lowest position.

3) Set the yoke to the actuator.

4) Push the valve stem into the actuator stem until there is no gap between them.

   If you need to seal the valve, leave a spring contraction shown in Table 3 (for example, 0.5 mm for MSP4D-x6).

5) Fix the actuator stem and valve stem with a lock nut.

6) Supply power to the actuator again and raise (retract) the actuator stem by several millimeters. Check that the opening between the yoke and valve bonnet is closed. Fix the yoke and valve.
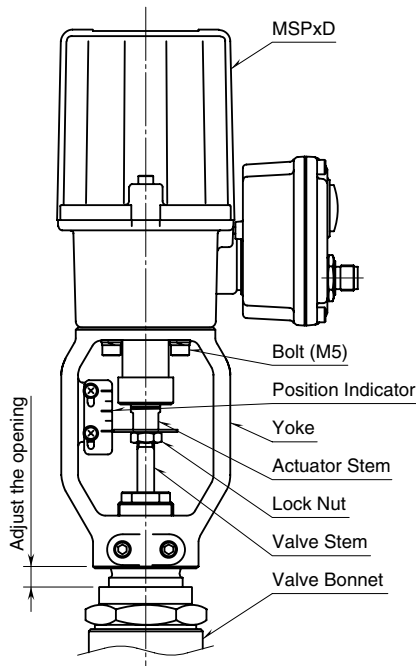
7) Attach the position indicator if required.

Figure 7. MSP×D mounted onto a valve (example)

6. WIRING CONNECTION

■ DeviceNet CONNECTOR

Use a 5-core micro-style connector, female, and cable approved for DeviceNet.

■ POWER INPUT CONNECTOR

Use a 4-core micro-style connector, female.

7. ADJUSTMENT PROCEDURE

7.1. MANUAL OPERATION

The MSP×D can be manually controlled regardless of the communications status. Turn the SW2-1 ON to enable the manual operation mode. The SW2, SW4 and SW5 are used for control.

In the following explanations, "0%" refers to the most extended stem position adjusted with the Zero; while "100%" refers to the most retracted stem position adjusted with the Span.

Table 2. SW2 setting, manual operation

SW2	OFF	ON
1	Control via communications	Manual operation
2	Invalid	0% manual control command
3	Invalid	100% manual control command
4	Unused	

Turning both SW2-2 and -3 is invalid. The actuator operation stops.

SW4: The stem moved toward 0% position while pressing this switch.

SW5: The stem moved toward 100% position while pressing this switch.

7.1.1. GENERAL PROCEDURE

After installing the valve and actuator, go to adjustments in order of Zero, Span, and the seal-spring.

7.1.2. ZERO & SPAN

1) Zero Adjustment: Turn the power supply on and set the SW2-1 and -2 ON (OFF for the others on the SW2). This turns the actuator into the manual operation mode and automatically controls the stem toward the 0% position.

   Once the stem reaches the position, adjust either the actuator with the Zero potentiometer or the mechanical position of the valve stem connection so that the actuator's extended position (valve's retracted position) is adequate.

   If extra sealing pressure by the seal-spring is required, push in the actuator stem referring to Table 3.

2) Span Adjustment: Turn the power supply on and set the SW2-1 and -3 ON (OFF for the others on the SW2). This turns the actuator into the manual operation mode and automatically controls the stem toward the 100% position.

   Once the stem reaches the position, adjust either the actuator with the Span potentiometer or the mechanical position of the valve stem connection so that the actuator's retracted position (valve's extended position) is adequate.

   For three-way valves, the sealing pressure can be adjusted to be applied in the direction where the output stem is fully retracted (not available for the MSP4D). Adjustment procedure is the same for Zero.

3) With 0% input again, check that the Mini-Top is at the fully extended position. If the position is shifted, go through the above procedure again.

Note 1: There is only minimal effect of span adjustment to zero point, thus the stem position shifts very little at the extended side when the span potentiometer is turned.

Note 2: With the stroke narrower, hunting (the motor repeats changing direction) can happen more often. Adjust Deadband in such cases.
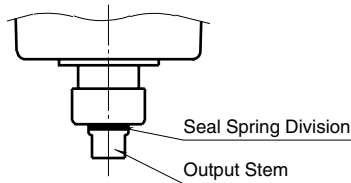
Figure 8. Seal-spring

Table 3. Seal-spring pressure

MODEL	SPRING CONTRACTION (mm)	CONTACT* PRESSURE (N / lbs)	SEALING PRESSURE (N / lbs)
MSP4D-x6	0.5	294 / 66	490 / 110
MSP4D-x7	1.0	294 / 66	686 / 154
MSP5D-x4	1.0	216 / 49	294 / 66
MSP5D-x6	0.5	294 / 66	490 / 110
MSP5D-x7	1.0	294 / 66	686 / 154
MSP6D-x3	1.0	441 / 99	588 / 132
MSP6D-x4	1.0	882 / 198	1170 / 263
MSP6D-x5	0.75	1170 / 263	1760 / 396
MSP6D-x6	1.5	1170 / 263	2350 / 529

* The minimum pressure required to contract the spring.
Note: Graduations by 1 millimeter increments are marked on the stem. For example, with MSP4D-x7, the sealing pressure reaches approx. 490 N at 0.5 mm, 686 N at 1 mm.

7.2. HARDWARE CONFIGURATION
7.2.1. MAC ID
Each bit of SW1-1 through -6 is assigned respectively to each digit of binary system. "1" = ON, "0" = OFF.

Table 4. SW1 assignment

SW1	1	2	3	4	5	6
Digit	2^0	2^1	2^2	2^3	2^4	2^5

Table 5. Node address setting

SW1						NODE ADDRESS
6	5	4	3	2	1	
0	0	0	0	0	0	0
0	0	0	0	0	1	1
0	0	0	0	1	0	2
0	0	0	0	1	1	3
:	:	:	:	:	:	:
1	1	1	1	0	0	60
1	1	1	1	0	1	61

0 : OFF   1 : ON

7.2.2. BAUD RATE
The baud rate is selected with the SW1-7 and -8.

Table 6. Baud rate setting (* : Ex-factory setting)

SW1		BAUD RATE
7	8	
OFF	OFF	125 kbps*
ON	OFF	250 kbps
OFF	ON	500 kbps
ON	ON	Invalid

7.2.3. COMMUNICATION ERROR OPERATION
The SW3 is used to specify the actuator's operation in case of communications error or no communication for certain time period after the power is turned on.
The stand-by time period, factory set to 10 seconds, can be changed via the communications. Refer to the Attribute ID128, M-Actuator Object, Device Profile for detailed explanations.

Table 7. Comm. error operation setting (* : Ex-factory setting)

SW3				COMM. ERROR OPERATION
1	2	3	4	
OFF	OFF	OFF	OFF	Stop*
ON	OFF	OFF	OFF	0% position
OFF	ON	OFF	OFF	100% position

The actuator stops with all other switch settings.

■ MS & NS INDICATOR LED
Table 8. Indicator LED.

ID	STATE	TO INDICATE
MS	Green	Operating in a normal condition
	Red	Critical failure
	Blinking Red	Minor failure
	OFF	No power supplied
NS	Green	Link on-line and connections in the established state
	Blinking Green	Link on-line but no connections in the established state
	Red	Critical link failure
	Blinking Red	Minor link failure
	OFF	No power supplied

7.3. I/O POLLING
7.3.1. BASIC OPERATION PROCEDURE
Basic attributes among the application objects are included in the assembly object. This make it possible to run the actuator's basic operation only by I/O polling.
Refer to 'Assembly Object Data Format' for I/O data assignments.

Adjust ZERO and SPAN on the PCB with a manual control.
↓
Set SW1 for MAC ID and Baud Rate.
↓
Turn SW2-1 (Comm/Man SW) to OFF (Comm) position.
↓
Turn the power suppy on.
↓
Communication Established.
↓
Enter the target position (signed 16-bit; 0.01% increments) to "Input as Target." Resolution 0.1%.
Example:

50% = 5000 (1388 hex)

Byte 0	Byte 1
88(hex)	13(hex)

-0.1% = -10 (FFF6 hex)

Byte 0	Byte 1
F6(hex)	FF(hex)

↓
Set "RunEnable" to "1." "Input as Target" Enabled.
↓
Control Started

Once the communication is established, the actuator can be operated only by setting "RunEnable" and providing "Input as Target."

The actuator is factory set with no input scaling. "Input as Target" therefore equals the position setpoint and "Present-Position."

For detailed information about the scaling, refer to "7.3.4. INPUT SCALING".

7.3.2. FUNCTIONS AVAILABLE TO THE POLLING
(1) Position Feedback

The actuator's output stem position is given by "PresentPosition" in the form of singed 16-bit in 0.01% increments just as "Input as Target."

(2) Forced Commands
• ForcedRetracting

While "RunEnable" is set to "1" with this bit turned also to "1," "ForcedRETREnd" * (default 100%) overrides "Input as Target" to position the output stem.

• ForcedExtending

While "RunEnable" is set to "1" with this bit turned also to "1," "ForcedEXTNDEnd" * (default 0%) overrides "Input as Target" to position the output stem.

(3) Output Signals
• Signal at RETR

Set to "1" when "PresentPosition" is above "RETR SIG POSN" * (default 98%); set to "0" with "PresentPosition" is below that.

• Signal at EXTND

Set to "1" when "PresentPosition" is below "EXTND SIG POSN" * (default 2%); set to "0" with "PresentPosition" is above that.

• Remote / Local

Shows the status of Communication/Manual selector switch on the control PCB of the actuator.

0 = Communication, 1 = Manual. The signal must be turned to "0" to control the actuator via communications.

• AllowableDEVN

Set to "1" when "PresentPosition" is within the range specified by "DeadBand" * (default 0.5%), that is while the target position is achieved.

(4) Error Output
• Error

Set to "1" when one or more items among "MotorDeadLock," "IllegalTarget" and "MemoryFault," is true. (Logical Addition)

• MotorDeadlock

This unit detects it when the motor is overloaded or stuck with a foreign object.

The actuator restarts, but if it cannot restart after trying continuously the number of times specified by "Retry" * (default 5 times), it outputs this signal and stops.

• Illegal Input

Set to "1" when the target input signal is below -0.5% or above 100.5%.

"IllegalTargetOperation" * (default 0; See the Profile) determines the actuator's operation in such case.

• MemoryFault

"MemoryFault" is output when there is an error in the internal controller. The actuator operation stops in this case. If the actuator does not restart after the power is turned off and on, the controller may be destroyed.

(5) Cancelling Error
• ClearDeadlockSIG

Only "MotorDeadlock" can be cancelled by using "Clear-DeadlockSIG." Set the signal to "1."

Be sure to reset "ClearDeadlockSIG" to "0" once the error signal is canceled, otherwise "MotorDeadlock" remains invalid.

* Use Explicit Message to change the settings. May be easily configured by the EDS file and the configurator.

7.3.3. DEADBAND

Because "PresentPosition" (actuator's output stem position) is provided in 0.1% increments, "Deadband" is provided in 0.2% increments from 0.1%, 0.3%, 0.5%, ... with the fractions dropped. When you set it to 0.2%, it is actually used as 0.1%.

-0.3%	-0.2%	-0.1%	TARGET	+0.1%	+0.2%	+0.3%

0.1%

0.3%

0.5%

Figure 9. Deadband

When the actuator stem is within the deadband, "AllowableDeviation" signal is set to "1."

7.3.4. INPUT SCALING

Change the following parameters in order to switch the direct /reverse actions or to set split controls.

Use Explicit Message to change the settings. May be easily configured by the EDS file and the configurator.

(1) DIRECT / REVERSE ACTION
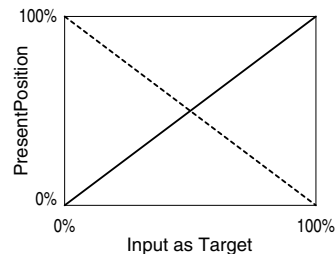
Figure 10. Direct / reverse action

Set "Direction" signal as shown in the following table.

DIRECTION	ACTION
0	Reverse (solid line in the above graph)
1	Direct (broken line in the above graph)

Switching the action does not affect the relations in physical positions between "PresentPosition" signal and the stem (Extended side = 0%, Retracted side = 100%).

(2) SPLIT CONTROL
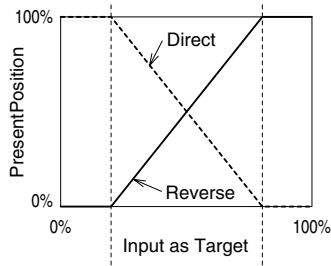
Figure 11. Split control

PARAMETER	FUNCTION
Input as Zero	"Input as Target" value for 0% "Present-Position" Default: 0%, Range: -0.5 to +100%
Input as Full	"Input as Target" value for 100% "PresentPosition" Default: 100%, Range: 0 to 100.5%

Input as Zero < Input as Full

(3) INPUT LIMIT
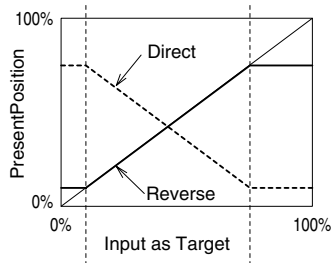
Figure 12. Input limit

PARAMETER	FUNCTION
MIN Input	"Input as Target" value below this setting is clamped to the value. Default: -0.5%, Range: -0.5 to +100%
MAX Input	"Input as Target" value above this setting is clamped to the value. Default: 100.5%, Range: 0 to 100.5%

MIN Input < MAX Input

7.3.5. AMS FUNCTIONS

The following parameters can be useful for maintenance of the valve and the actuator. Refer to M-Actuator Object for details.

■ DeadlockCNTR

Shows the totalized number of Retries at a deadlock.

■ LastDeadlockPOSN

Shows the output stem position at the last deadlock.
Factory default: invalid data = 327.67%

■ StartingCNTR

Shows the totalized number of starting the motor.

■ TurnOverCNTR

Shows the totalized number of reversing the motor direction.

■ Accumulated MVT

Shows the accumulated running distance. 100% stroke defined with Zero and Span adjustments on the PCB.

8. DEVICE PROFILE
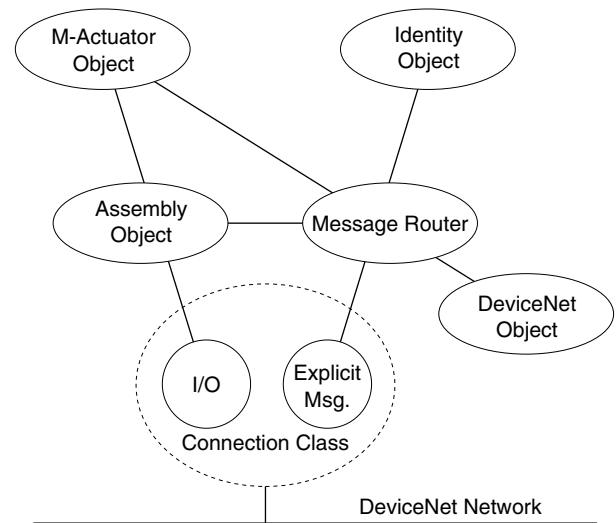
8.1. DEVICE PROFILE & OBJECT IMPLEMENTATION

8.1.1. SLAVE DEVICE PROFILE

General Device Data	Conform to DeviceNet Specification	Volume I - Release 2.0 Volume II - Release 2.0	
	Vendor Name	M-SYSTEM CO., LTD.	Vendor ID = 184
	Device Profile Name	Slave: Generic	Profile No. = 0
	Device Type	0	
Physical Conformance Data	Network Power Consumption	60mA	
	Connector Style	Micro-style	
	Isolated Physical Layer	Yes	
	LEDs Supported	Module Network	
	MAC ID Setting	DIP Switch	
	Default MAC ID	0	
	Communication Rate Setting	DIP Switch	
	Communication Rates Supported	125k bit/s, 250k bit/s, 500k bit/s	
Communication Data	Predefined Master/Slave Connection Set	Group Only 2 Server	
	Dynamic Connections Supported (UCMM)	No	
	Fragmented Explicit Message Implemented	Yes	

8.1.2. OBJECT IMPLEMENTATION
**(1) Identity Object (01H)**

Object Instance 1	Attributes	ID	Description	Get	Set	Value Limit
		1	Revision	Yes	No	01H
	Services		DeviceNet Services	Parameter Options		
		0EH	Get_Attribute_Single	No		

Object Instance 1	Attributes	ID	Description	Get	Set	Value Limit
		1	Vendor	Yes	No	184
		2	Device type	Yes	No	0
		3	Product code	Yes	No	19
		4	Revision	Yes	No	1.001
		5	Status (bits supported)	Yes	No	
		6	Serial number	Yes	No	Each unit
		7	Product name	Yes	No	MINI-TOP
		8	State	No	No	
		9	Configuration Consistency Value	No	No	
		10	Heartbeat Interval	No	No	
	Services		DeviceNet Services	Parameter Options		
		05H	Reset	No : Reset 1 : Reset after factory default setting		
		0EH	Get_Attribute_Single	No		

(2) Message Router Object (02H)

Object Class	Attributes	None Supported
	Services	None Supported
Object Instance	Attributes	None Supported
	Services	None Supported
Vendor Specific Additions		None

(3) DeviceNet Object (03H)

Object Class	Attributes	ID	Description	Get	Set	Value Limit
		1	Revision	Yes	No	02H
	Services		DeviceNet Services	Parameter Options		
		0EH	Get_Attribute_Single	No		

Object Instance	Attributes	ID	Description	Get	Set	Value Limit
		1	MAC ID	Yes	No	
		2	Baud rate	Yes	No	
		3	BOI	Yes	No	00H
		4	Bus-off counter	Yes	No	
		5	Allocation information	Yes	No	
		6	MAC ID switch changed	No	No	
		7	Baud rate switch changed	No	No	
		8	MAC ID switch value	No	No	
		9	Baud rate switch value	No	No	
	Services		DeviceNet Services	Parameter Options		
		0EH	Get_Attribute_Single	No		
		4BH	Allocate Master/Slave connection set	No		
		4CH	Release Master/Slave connection set	No		

(4) Assembly Object (04H)

Object Class	Attributes	None Supported
	Services	None Supported

Object Instance 1	Section	Information		Max Instance		
	Instance Type	Static I/O		1		
	Attributes	ID	Description	Get	Set	Value Limit
		1	Number of members in list	No	No	
		2	Member List	No	No	
		3	Data	Yes	Yes	
	Services		DeviceNet Services	Parameter Options		
		0EH	Get_Attribute_Single	No		
		10H	Set_Attribute_Single	No		

■ Assembly Object Instance 1 OUTPUT Data Format

Byte 0	Bit 0	Input as Target LOW
	Bit 1	
	Bit 2	
	Bit 3	
	Bit 4	
	Bit 5	
	Bit 6	
	Bit 7	
Byte 1	Bit 0	Input as Target HIGH
	Bit 1	
	Bit 2	
	Bit 3	
	Bit 4	
	Bit 5	
	Bit 6	
	Bit 7	

Byte 2	Bit 0	RunEnable
	Bit 1	ClearDeadlockSIG
	Bit 2	
	Bit 3	
	Bit 4	
	Bit 5	
	Bit 6	
	Bit 7	
Byte 3	Bit 0	Forced Retracting
	Bit 1	Forced Extending
	Bit 2	
	Bit 3	
	Bit 4	
	Bit 5	
	Bit 6	
	Bit 7	

• Attribute Data MAP

Name	Class Name	Class No.	Instance	Attribute Name	Attribute No.
Input as Target	M_Actuator	0x64	1	Input as Target	102
RunEnable	M_Actuator	0x64	1	RunEnable	101
ClearDeadlockSIG	M_Actuator	0x64	1	ClearDeadlockSIG	123
Forced Retracting	M_Actuator	0x64	1	Forced Retracting	109
Forced Extending	M_Actuator	0x64	1	Forced Extending	110

■ Assembly Object Instance 2 INPUT Data Format

Byte 0	Bit 0	Present Position LOW		Byte 2	Bit 0	Remote / Local
	Bit 1				Bit 1	Error
	Bit 2				Bit 2	Motor Deadlock
	Bit 3				Bit 3	Illegal Input
	Bit 4				Bit 4	Memory Fault
	Bit 5				Bit 5	
	Bit 6				Bit 6	
	Bit 7				Bit 7	
Byte 1	Bit 0	Present Position HIGH		Byte 3	Bit 0	Signal at RETR
	Bit 1				Bit 1	Signal at EXTND
	Bit 2				Bit 2	Allowable DEVN
	Bit 3				Bit 3	
	Bit 4				Bit 4	
	Bit 5				Bit 5	
	Bit 6				Bit 6	
	Bit 7				Bit 7	

• Attribute Data MAP

Name	Class Name	Class No.	Instance	Attribute Name	Attribute No.
Present Position	M_Actuator	0x64	1	Present Position	103
Manual Online	M_Actuator	0x64	1	Manual Online	100
Error	M_Actuator	0x64	1	Error	117
Motor Deadlock	M_Actuator	0x64	1	Motor Deadlock	118
Illegal Input	M_Actuator	0x64	1	Illegal Input	120
Memory Fault	M_Actuator	0x64	1	Memory Fault	121
Signal at RETR	M_Actuator	0x64	1	Signal at RETR	113
Signal at EXTND	M_Actuator	0x64	1	Signal at EXTND	114
Allowable DEVN	M_Actuator	0x64	1	Allowable DEVN	104

(5) Connection Object (05H)

Object Class	Attributes	None Supported	
	Services	None Supported	
	Total Active Connections Possible	1	

Object Instance 1	Section	Information		Max Instance		
	Instance Type	Explicit Message		1		
	Production Trigger	Cyclic				
	Transport Type	Server				
	Transport Class	3				
	Attributes	ID	Description	Get	Set	Value Limit
		1	State	Yes	No	
		2	Instance type	Yes	No	00H
		3	Transport class trigger	Yes	No	83H
		4	Produced connection ID	Yes	No	
		5	Consumed connection ID	Yes	No	
		6	Initial comm. characteristics	Yes	No	21H
		7	Produced connection size	Yes	No	0020H
		8	Consumed connection size	Yes	No	0020H
		9	Expected packet rate	Yes	Yes	
		12	Watchdog time-out action	Yes	Yes	One of 01, 03
		13	Produced connection path length	Yes	No	0000
		14	Produced connection path	Yes	No	
		15	Consumed connection path length	Yes	No	0000
		16	Consumed connection path	Yes	No	
	Services	DeviceNet Services		Parameter Options		
		05H	Reset	No		
		0EH	Get_Attribute_Single	No		
		10H	Set_Attribute_Single	No		
Object Instance 2	Section	Information		Max Instance		
	Instance Type	Polled I/O		1		
	Production Trigger	Cyclic				
	Transport Type	Server				
	Transport Class	2				
	Attributes	ID	Description	Get	Set	Value Limit
		1	State	Yes	No	
		2	Instance type	Yes	No	01H
		3	Transport class trigger	Yes	No	82H
		4	Produced connection ID	Yes	No	
		5	Consumed connection ID	Yes	No	
		6	Initial comm. characteristics	Yes	No	01H
		7	Produced connection size	Yes	No	04H
		8	Consumed connection size	Yes	No	04H
		9	Expected packet rate	Yes	Yes	
		12	Watchdog time-out action	Yes	No	00
		13	Produced connection path length	Yes	No	06H (IN)
		14	Produced connection path	Yes	No	20_04_24_02_30_03 (IN)
		15	Consumed connection path length	Yes	No	06H (OUT)
		16	Consumed connection path	Yes	No	20_04_24_01_30_03 (OUT)
		17	Production inhibit time	Yes	No	00
	Services	DeviceNet Services		Parameter Options		
		05H	Reset	No		
		0EH	Get_Attribute_Single	No		
		10H	Set_Attribute_Single	No		

(6) M-Actuator Object (64H)

■ **Class Attribute**

Attribute ID	Access	Name	Data Type	Value Limit
1	Get	Revision	UINT	01H

■ **Class Service**

Name	Code	Parameter Options
Get_Attribute_Single	03 (hex)	None

■ **Instance Attribute**

Instance	ID	Access	Item	Data Type	Function	Range
1	100	Get	Remote/Local	BOOL	Confirm Communication/Manual SW Setting Shows the switch position on the control circuit board of the actuator. No control over the communications network available when the switch is set to Manual.	0 : Remote (communication) 1 : Local (manual)
	101	Set / Get	RunEnable	BOOL	Start Running "Input as Target," "ForcedRetracting" and "ForcedExtending" enabled when this signal is set to "1."	0 : Stop 1 : Start
	102	Set / Get	Input as Target	INT	Target Position Input The set value equal to the output stem position setpoint if no scaling is performed. The setting is overridden if "ForcedRetracting" or "ForcedExtending" is ON.	Range: -50 to +10050 (×0.01%); 0.1% resolution; lesser digits are disregarded.
	103	Get	Present Position	INT	Position Output 0% = CW; 100% = CCW (seen from the cover) These relations do not change by "Direction" setting.	Range: -50 to +10050 (×0.01%)
	104	Get	Allowable DEVN	BOOL	Position Achieved "1" is output when the output stem is inside the deadband.	0 : Out of deadband 1 : Stable within deadband
	105	Set / Get	DeadBand	UINT	Set Deadband Deadband is adjustable from 0.1 to 9.9%, in 0.2% increments such as 0.1, 0.3, 0.5, ... 9.7 and 9.9%. Fractions are dropped.	Range: 10 to 1000 Default: 50 (×0.01%)
	106	Set / Get	RestartLMTG TMR	USINT	Restart Limiting Timer The output stem does not restart before the set time once it is stopped.	Range: 0 to 255 Default: 0 (×0.1 sec.)
	109	Set	Forced Retracting	BOOL	Forced Positioning Input Output stem forced to the position specified with "ForcedRETR End." "Input as Target" setting is overridden.	0 : OFF 1 : ON Default: 0
	110	Set	Forced Extending	BOOL	Forced Positioning Input Output stem forced to the position specified with "ForcedEXTND End." "Input as Target" setting is overridden.	0 : OFF 1 : ON Default: 0
	111	Set / Get	ForcedRETR End	INT	Set Forced Position The targeted output stem position when "ForcedRetracting" is ON.	Range: 0 to 10050 Default: 10000 (×0.01%)
	112	Set / Get	ForcedEXTND End	INT	Set Forced Position The targeted output stem position when "ForcedExtending" is ON.	Range: -50 to +10000 Default: 0 (×0.01%)
	113	Get	Signal at RETR	BOOL	Full Open / Close Signal ON when the stem position is over "RETR SIG POSN" setting.	0 : OFF 1 : ON
	114	Get	Signal at EXTND	BOOL	Full Open / Close Signal ON when the stem position is below "EXTND SIG POSN" setting.	0 : OFF 1 :ON
	115	Set / Get	RETR SIG POSN	INT	Set Full Open / Close Position "Signal at RETR" turns ON when the stem position is over this setting.	Range: 0 to 10050 Default: 9800 (×0.01%)
	116	Set / Get	EXTND SIG POSN	INT	Set Full Open / Close Position "Signal at EXTND" turns ON when the stem position is below this setting.	Range: -50 to +10000 Default: 200 (×0.01%)
	117	Get	Error	BOOL	Confirm Error One or more items among "Motor Deadlock", "Illegal Input" and "Memory Fault" are true.	0 : Normal 1 : Error

Instance	ID	Access	Item	Data Type	Function	Range
1	118	Get	Motor Deadlock	BOOL	Motor Deadlock Error The actuator stops power supply to the motor if the motor cannot be restarted after it tries to for the number of preset "Retry" times in series. Reset by "ClearDeadlockSIG."	0 : Normal 1 : Error
	120	Get	Illegal Input	BOOL	Illegal Target Position Input The target position set to a value out of the range from -50 to +10050.	0 : Normal 1 : Error
	121	Get	Memory Fault	BOOL	Memory Fault The memory on the actuator control circuit board is in error. The actuator operation is disabled.	0 : Normal 1 : Error
	123	Set	ClearDeadlockSIG	BOOL	Clear Deadlock Signal Reset "Motor Deadlock." Return the signal to "0" after this operation, otherwise "Motor Deadlock" remains disabled and the actuator retries to drive the motor until the cause of deadlock is removed.	0 : Disabled 1 : Clear Default: 0
	124	Set / Get	Retry	USINT	Set Retry Times The actuator tries to restart for the number of preset "Retry" times.	Range: 1 to 255 Default: 5
	125	Set / Get	IllegalInputOPN	USINT	Illegal Input Operation Set the actuator's operation in case of an illegal input.	0 : Input limit position 1 : Stop 2 : 0% position 3 : 100% position Default: 0
	127	Get	COMM ErrorOPN	USINT	Confirm Communication Error Operation Setting Shows the communication error operation setting on the control circuit board of the actuator.	0 : Stop 1 : 0% position 2 : 100% position
	128	Set / Get	COMM FaultTime	USINT	Set Stand-by Time Before Starting Communication Error Operation The time to wait in case of an communication error before starting the pre-designated operation.	Range: 10 to 255 Default: 10 (sec.)
	129	Set / Get	Direction	BOOL	Set Input Action Direct action: 100% output at 0% input Reverse action: 0% output at 0% input Not related to relations between Present Position (position output) and actual stem position.	0 : Reverse 1 : Direct Default: 0
	132	Set / Get	MIN input	INT	Position Target Input Limit Set the lower limit of "Input as Target." Any input below the setpoint is clamped to the set value.	Range: -50 to +10000 Default: -50 (×0.01%)
	133	Set / Get	MAX input	INT	Position Target Input Limit Set the upper limit of "Input as Target." Any input above the setpoint is clamped to the set value.	Range: 0 to 10050 Default: 10050 (×0.01%)
	134	Set / Get	Input as Zero	INT	Input Scaling (such as for Split Control) "Input as Target" value for 0% output stem position setpoint.	Range: -50 to +10000 Default: 0 (×0.01%)
	135	Set / Get	Input as Full	INT	Input Scaling (such as for Split Control) "Input as Target" value for 100% output stem position setpoint.	Range: 0 to 10050 Default: 10000 (×0.01%)
	138	Set / Get	DeadlockCNTR	UINT	Deadlock Counter Shows the totalized number of Retries at a deadlock.	Range: 0 to 65535 (×1)
	139	Get	LastDeadlockPOSN	INT	Confirm Motor Deadlock Position Shows the output stem position at the last deadlock.	Range: -50 to +10050 (×0.01%) Default: 32767 (invalid data)
	140	Set / Get	StartingCNTR [1]	UDINT	Motor Starting Counter Shows the totalized number of starting the motor.	Range: 0 to 4294967295 (×1)
	141	Set / Get	TurnOverCNTR [1]	UDINT	Motor Reversing Counter Shows the totalized number of reversing the motor direction.	Range: 0 to 4294967295 (×1)
	143	Set / Get	Accumulated MVT [1]	UDINT	Accumulated Running Distance Shows the accumulated running distance. 100% span defined with Zero and Span adjustments on the PCB.	Range: 0 to 4294967295 (×0.1%)

[1]. Data stored every 10 minutes.

■ **Instance Service**

Name	Code	Parameter Options
Get_Attribute_Single	0E (hex)	None
Set_Attribute_Single	10 (hex)	None

9. MAINTENANCE

For effective use and longer life of the MSPxD, regular checking appropriate for its operating conditions are recommended. Refer to the following table.

ITEM	CHECKING POINT	HOW TO PROCEED
Functioning	Apply input 0%, 50%, 100%, then back to 50%, 0%. Check the actuator operations and positions at each input value.	Repair or calibration
Abnormal sound	No abnormal sound is heard during operation.	Repair or calibration
Connector Leadwire	The connector is firmly connected. No breakdown of leadwires. The insulation covers are not torn, not bruised.	Repair or calibration
Inside humidity, rust	No condensation. No rust. If there is water inside, check the packing.	Remove water, dry the case and inside parts. Replace rusted parts. Calibration. If the packing is damaged, replace it.
Screws	Check that screws and bolts are securely fastened.	Re-tighten them.
Nut	Check that the nut at the valve stem is not loose.	Re-tighten it and calibrate.

For repair or parts replacement, contact us or representatives.

■ LUBRICATION

There is no need of oiling the MSPxD in normal operating conditions.

■ REGULAR TEST RUNNING

If the valve is not frequently operated, run a test operation regularly (once a week, for example) to check proper functions.

10. TROUBLESHOOTING

TROUBLE	MS LED	NS LED	POSSIBLE CAUSE	HOW TO PROCEED
No function	OFF	OFF	No power supply	Check the power supply.
	----	Green blink	OnLine but No connection established.	Check the Master setting.
	----	Red blink	I/O connection time out	Check the following and restart.
	----	Red ON	Duplicated MAC ID or Bus-off	• MAC ID and Baud Rate settings • Connector length • Wire breakdown and/or loose connector • Terminating resistor • Noise
	Red blink	----	Motor deadlock or Input as Target value error	Check for overload and/or foreign object stuck in the valve. Check Input as Target value.
	Red ON	----	CPU or memory error	Restart the power supply. If normal operation is not recovered, repair may be needed.
	Green ON	Green ON	Manual operation mode	Set the SW1 to "Communication" side.
			Input limit value error	Check the input limit values.
			Abnormally wide deadband	Set an appropriate deadband.
Unstable functioning			Power voltage is low or fluctuating.	Check the power supply.
			Position sensor damaged.	Replace the position sensor.
Stops in the middle of span Slows down in the middle of span			Actuator mechanism is damaged.	Repair
			Overload cause by a foreign object caught in the valve.	Check the valve.

For repair or parts replacement, contact us or representatives.

11. LIGHTNING SURGE PROTECTION

Install lightning surge protectors for those wires connected to remote locations. For the power supply line, choose a surge protector with its maximum surge voltage 40V or less between lines. Recommended model: MDP-D24.