

## Final Control Elements

### MINI-TOP ELECTRONIC ACTUATOR

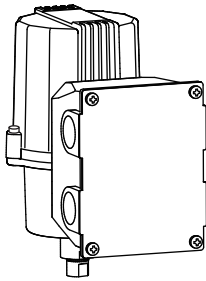
(Linear type with Auto-setup function; Modbus)

#### Functions & Features

- Auto set-up
- 1/1000 high resolution
- Operational status logging
- Seal-spring for the extending direction of the output stem

#### Typical Applications

- Actuator for automatic control valve in pilot plants
- Air-conditioning in buildings or plants
- Micro-flow control for pharmaceutical injection
- For small-size control valves



## MODEL: MSP40-[1][2][3]0-[4]0R[5]

### ORDERING INFORMATION

- Code number: MSP40-[1][2][3]0-[4]0R[5]  
Specify a code from below for each of [1] through [5].  
(e.g. MSP40-2710-A0R/Q)
- Specify the specification for option code /Q  
(e.g. /C03/SET)

#### ■ STANDARD EX-FACTORY SETTINGS (Field-configurable via Modbus or PU-2)

Parameter item	Setting value
Action	Reverse
Input signal	4 - 20 mA DC
Output signal	4 - 20 mA DC
Action control	Output stem goes UP with 20 mA DC input
Operation at abnormally low input	Stop
Deadband	0.3 %
Restart limiting timer	1.5 sec.

### [1] STROKE

- 1: 5 to 10 mm (.20" to .39")
- 2: 8 to 15 mm (.31" to .59")

### [2] OPERATION TIME, THRUST

- 3: 5 sec. / 10 mm, 150 N
- 4: 9 sec. / 10 mm, 300 N
- 7: 18 sec. / 10 mm, 700 N

### [3] OUTPUT STEM TYPE

- 6: M6 female thread, 0.75 pitch
- 8: M8 female thread, 1.0 pitch
- 1: M10 female thread, 1.25 pitch
- D: M6 female thread, 1.0 pitch
- E: M8 female thread, 1.25 pitch
- F: M10 female thread, 1.5 pitch

### SEQUENTIAL CONTROL SIGNALS

- 0: Without

### [4] INPUT

- Current
- A: 4 - 20 mA DC (Input resistance 250 Ω)
- Voltage
- 6: 1 - 5 V DC (Input resistance 200 kΩ min.)

### CE MARKING

- 0: Without

### POWER SUPPLY VOLTAGE

- DC Power
- R: 24 V DC  
(Operational voltage range 24 V ±10 %, ripple 10 %p-p max.)

### [5] OPTIONS

- blank: none
- /Q: With options (specify the specification)

### SPECIFICATIONS OF OPTION: Q (multiple selections)

- COATING (For the detail, refer to our web site.)
- /C03: Rubber coating
- EX-FACTORY SETTING
- /SET: Preset according to the Ordering Information Sheet  
(No. ESU-4883)

### GENERAL SPECIFICATIONS

- Degree of protection: IP66
- Operation at abnormally low input: Extend (DOWN), Retract (UP), or Stop; selectable with DIP switches
- Wiring conduit: 4-G 1/2
- Terminal block: 7.62 mm pitch; M3 screw terminals (torque 0.5 N·m)

**Housing material:** Aluminum alloy (type: ADC12)

- Terminal box: Aluminium casting (type: AC2A)

**Drive:** Stepping motor

**Position detection:** Conductive potentiometer

**Lower end position adjustment (zero):** 0 to 25%

**Upper end position adjustment (span):** 50 to 100%

**Deadband adjustment:** 0.1 – 5.0 %

**Restart limiting timer adjustment:** 0.0 – 30.0 sec.

**Isolation:** Power or I/O signal to Retract/UP signal to Extend/DOWN signal to alarm output to communication to housing

**Protective function:** Excessive thrust protection (functions e.g. when the output stem is locked)

**Status Indicator LEDs**

- PWR: Green LED turns on while power is supplied.
- INP: Green LED turns on while input signal is normally applied.
- STA: Green LED blinks while Auto-setup is performed.
- COM: Green LED blinks during Modbus communication
- ALM: Red LED turns on or blinks when an error occurs (refer to the Users Manual (EM-4883) for details)

■ ACTION MODE: Reverse / Direct

(Configured with Dip switches or PU-2x)

• Output stem moves toward the upper-end side as input signal increases, then stops (Reverse).

• Output stem moves toward the lower-end side as input signal increases, then stops (Direct).

Action	Input signal	Output signal
Reverse	4-20 mA DC	4-20 mA DC
	1-5 V DC	1-5 V DC
Direct	20-4 mA DC	20-4 mA DC
	5-1 V DC	5-1 V DC

■ Operation direction

Action	Input signal	Output stem operation direction
Reverse	4 mA DC	DOWN (extending)
	20 mA DC	UP (retracting)
Direct	20 mA DC	DOWN (extending)
	4 mA DC	UP (retracting)

## MODBUS COMMUNICATION

**Communication:** Half-duplex, asynchronous, no procedure

**Standard:** TIA/EIA-485-A compatible

**Transmission distance:** 500 meters max.

**Baud rate:** 4800, 9600, 19200, 38400 bps  
(ex-factory setting: 38400 bps)

**Protocol:** Modbus RTU

**Node address:** 1 to 247 (ex-factory setting: 1)

**Parity:** odd

**Stop bit:** 1

**Max. number of nodes:** 31 (excluding master)

**Transmission media:** Shielded twisted-pair cable (CPEV-S 0.9 dia.)

**Internal terminating resistor:** 120 Ω

## INPUT SPECIFICATIONS

■ DC Current: Input resistor incorporated (250 Ω)

■ DC Voltage

Input resistance: 200 kΩ min.

## OUTPUT SPECIFICATIONS

■ Operation Time & Thrust (at rated power voltage)

(Model: Operation Time: Thrust)

MSP40-x3: 5 sec. / 10 mm: 150 N (33.5 lbf)

MSP40-x4: 9 sec. / 10 mm: 300 N (67 lbf)

MSP40-x7: 18 sec. / 10 mm: 700 N (157 lbf)

■ Singal output

- 4-20 mA DC or 20-4 mA DC (non-isolated)

Load resistance: 550 Ω max.

- 1-5 V DC or 5-1 V DC (non-isolated)

Load resistance: 5000 Ω min.

■ Alarm output (triggered when the output stem is locked)

- Output type: Photo MOSFET relay

- Rated load: 160 V 150 mA AC/DC at peak

- ON resistance: 8 Ω max.

- Leakage current during opening/closing: 2 μA max.

■ Retract/UP signal and Extend/DOWN signal output

- Output type: Photo MOSFET relay

- Rated load: 160 V 150 mA AC/DC at peak

- ON resistance: 8 Ω max.

- Leakage current during opening/closing: 2 μA max.

## INSTALLATION

**Current consumption:** Approx. 0.6 A

**Operating temperature:** -5 to 55°C or 23 to 131°F (when operating at 50 % duty cycle or less; without considering direct sunlight, radiant heat, or heat transmission)

**Operating humidity:** 30 to 85 %RH (non-condensing)

**Vibration resistance**

- Sweep endurance test (according to IEC 61298-3)

**Acceleration:** 19.6 m/s<sup>2</sup> (2 G)

**Frequency:** 10 to 1000 Hz

**Cycle:** 20 cycles

**Sweep rate:** 1 oct./min.

**Testing time:** approx. 4 hr 30 min

**Direction:** X, Y, Z

**Mounting position:** All directions

Prevent water from accumulating around the output stem.

**Weight:** 1.9 kg (4.2 lb)

## PERFORMANCE

**Resolution:** 1/1000 of the output stem operation distance or 0.015 mm, whichever is greater, with the deadband set to 0.1 %

**Insulation resistance:** Power or I/O signal to Retract/UP signal to Extend/DOWN signal to alarm output to communication to housing  
≥ 100 MΩ with 500 V DC

**Dielectric strength:** 500 V AC @1 minute  
(Power or I/O signal to Retract/UP signal to Extend/DOWN signal to alarm output to communication to housing)

## STANDARDS & APPROVALS

RoHS Directive  
EN IEC 63000

## TERMINOLOGY

### •Auto-Setup function

Function to automatically adjust the Full-closed (lower-end) position and the Full-open (upper-end) position with simple operation.

### •Modbus communication

Operation status of the actuator can be monitored during normal operation for ensuring safe operation of the product and supporting equipment maintenance.

Via Modbus communication, the following data can be monitored to grasp the operation status of the actuator.

- No. of times of start actions of the stepping motor
- No. of times of reverse actions of the stepping motor
- Accumulated operating time of the stepping motor
- Accumulated operation distance of the output stem
- No. of times of restart when an excessive thrust error occurs
- Excessive thrust error

### •Excessive thrust monitoring

Function to stop the stepping motor when an excessive thrust is detected.

Specifically, the unit constantly monitors the position of the output stem while the stepping motor is driven.

When the unit detects that the output stem is not following the driving of the motor, the motor is paused, then restarted at a low speed.

If the output stem does not follow the motor after two times of restart, an error of excessive thrust occurs and the stepping motor is stopped.

### •Operation at abnormally low input

Function to drive the stepping motor before stopping it to operate the output stem to 'Retract (UP)', 'Extend (DOWN)', or 'Stop' according to the initial setting when the unit detects abnormally low input.

The unit detects an error when current input (4-20 mA DC)

is lower than 2.56mA DC±0.4mA DC) or voltage input (1-5V DC) is lower than 0.64V DC±0.1V DC).

### •Deadband

Linear resolution

### •Restart limiting Timer

The restart limiting timer is set for preventing frequent stop-and-restart operation of the motor.

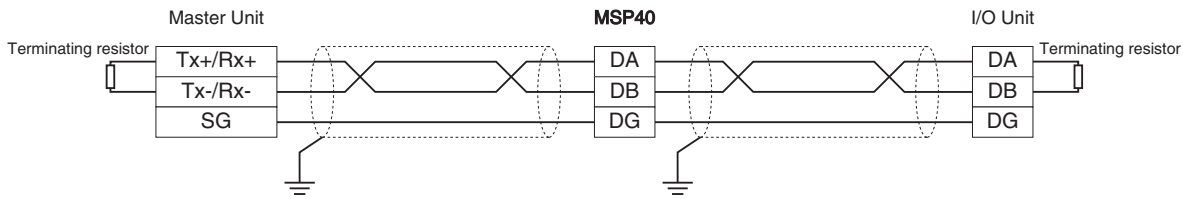
That is, when the motor stops, the motor waits for a set period of time instead of stopping and restarting immediately upon change in input signal.

### •Hunting

Hunting is a condition in which the output stem is oscillated repeatedly and persistently without settling at a single position.

The output stem operation at the frequency of roughly 13 strokes or less per minute (duty ratio: <50%) is regarded as normal.

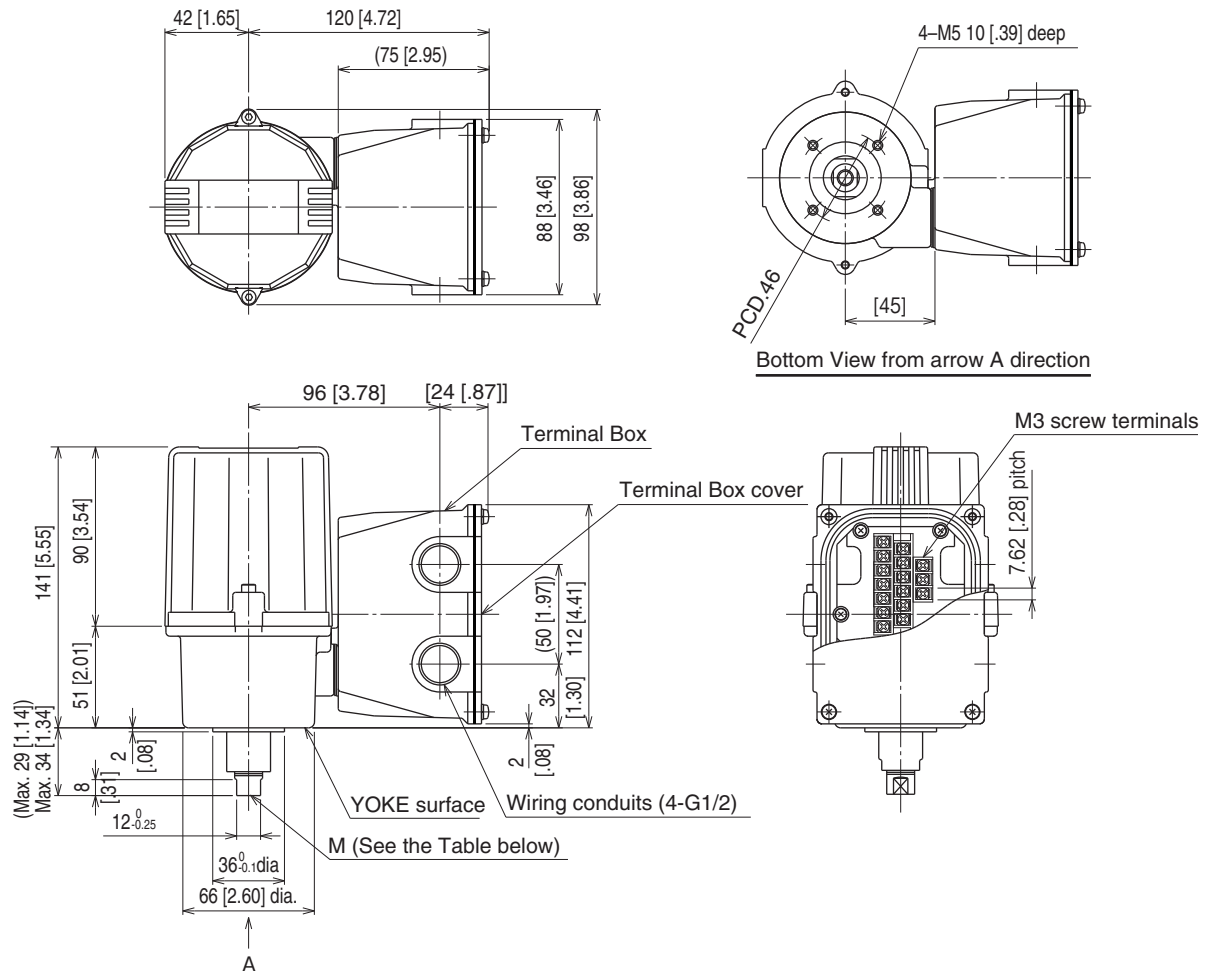
## COMMUNICATION CABLE CONNECTIONS



Terminating resistors can be turned ON/OFF on the programming unit (model: PU-2x).

## EXTERNAL DIMENSIONS unit: mm [inch]

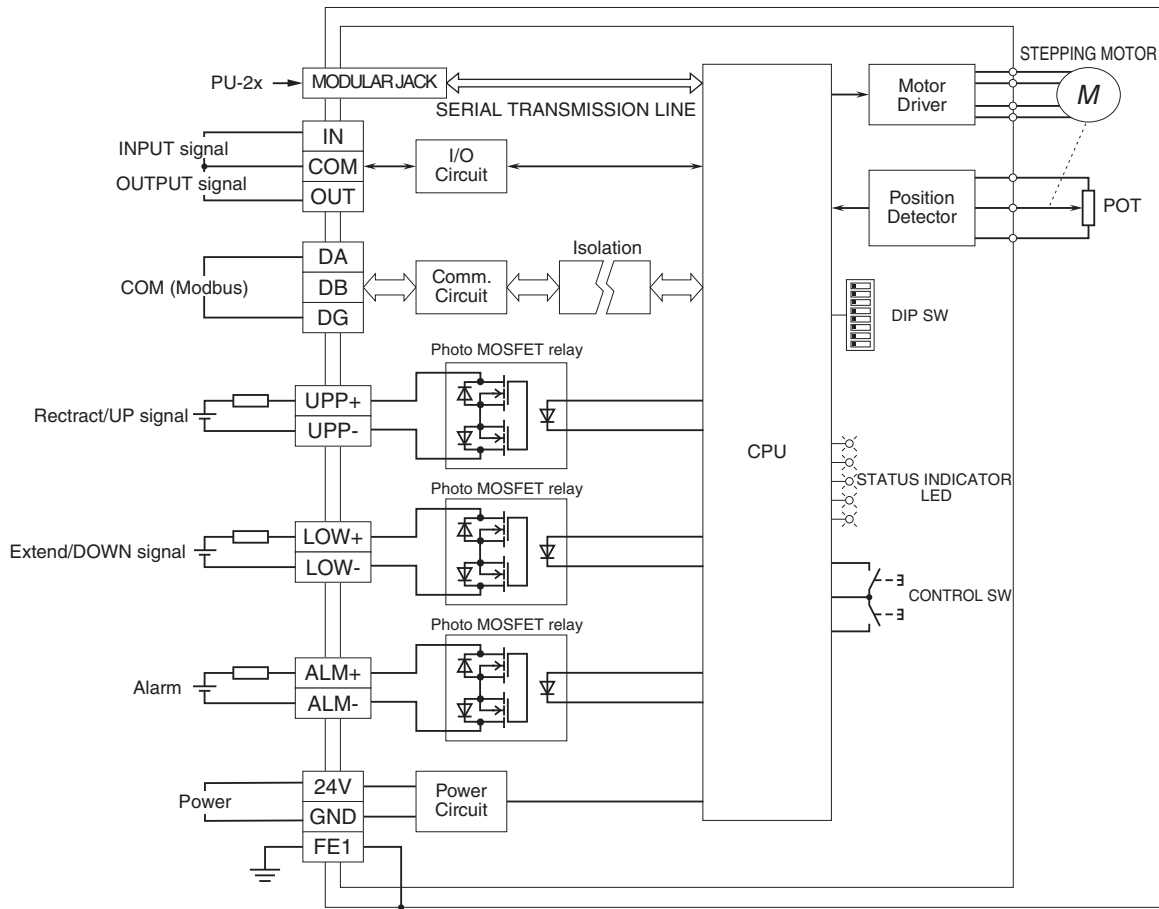
The dimension in ( ) is when the stroke is set to 5 to 10 mm



### OUTPUT STEM HOLE SIZE M

CODE	DIA.	PITCH	DEPTH
6	M 6	0.75	15
8	M 8	1.0	
1	M10	1.25	
D	M 6	1.0	
E	M 8	1.25	
F	M10	1.5	

**SCHEMATIC CIRCUITRY**



Specifications are subject to change without notice.