

## ELECTRONIC ACTUATOR

### STEP-TOP ELECTRONIC ACTUATOR

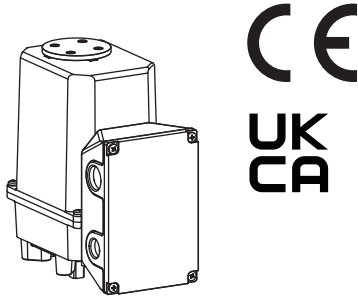
(Rotary type; Modbus communication)

#### Functions & Features

- Equipped stepping motor for drive motor.
- High-speed operation control (1/1000 high resolution)
- Output stem angle can be certainly adjusted in 0.1° increments
- Both Modbus-RTU communication and analog signal can use
- USB (CONFIG-Type-C), PU-2x jack, and DIP switches
- Equipped manual operation stem and indicator
- Equipped terminal box standardly (LEDs can be visually checked from outside)

#### Typical Applications

- Actuator for automatic control valve in various plants and industries
- Electronic actuator for fuel cell system and refrigerating machines



## MODEL: MRP10-[1][2][3]-[4]CR[5]

### ORDERING INFORMATION

- Code number: MRP10-[1][2][3]-[4]CR[5]  
Specify a code from below for each of [1] through [5].  
(e.g. MRP10-1AA-ACR/Q)
- Specify the specification for option code /Q  
(e.g. /C03/SET)

### FACTORY DEFAULT SETTINGS

ITEM	SETTING
Action	Reverse
Input signal	4 - 20 mA DC
Output signal	4 - 20 mA DC
20mA DC input (viewing from the top)	Output stem rotates left and stop at full-open position (Counterclockwise)
4mA DC input (viewing from the top)	Output stem rotates right and stop at full-close position (Clockwise)
Operation at abnormally low input	Stop
Full-open stop position	90°
Full-close stop position	0°
Deadband (%)	0.1
Restart limiting timer (sec.)	0.1
Full-open signal	98.0% (set 90° as 100%) Approx. 88.2°
Full-close signal	2.0% (set 90° as 100%) Approx. 1.8°
Input	Analog input

### [1] OUTPUT STEM OPERATIONAL ANGLE

1: 90 degrees

### [2] OPERATION TORQUE, OPERATION TIME (90 DEGREES), TORQUE AT LOCK (MAX. VALUE)

CODE	OPERATION TORQUE	OPERATION TIME (90 DEGREES)	TORQUE AT LOCK (APPROX.)
A	6N·m	2.5 sec.	8N·m
B	16N·m	3.5 sec.	18N·m
C	35N·m	7.5 sec.	44N·m
D	50N·m	9.5 sec.	55N·m

### [3] INPUT

Current

A: 4 - 20 mA DC (Input resistance 250 Ω)

Voltage

6: 1 - 5 V DC (Input resistance 200 kΩ min.)

### [4] OUTPUT

Current

A: 4 - 20 mA DC (Load resistance 300 Ω max.)

Voltage

6: 1 - 5 V DC (Load resistance 5 kΩ min.)

### CE & UKCA MARKING

C: With CE and UKCA

## POWER SUPPLY VOLTAGE

DC Power

R: 24 V DC

(Operational voltage range 24 V  $\pm$ 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-4889)

### RELATED PRODUCTS

- PC configurator software (model: STCFG)
- Programming Unit (model: PU-2x)

### GENERAL SPECIFICATIONS

**Degree of protection:** IP66

**Action:** "Reverse" action (switchable with DIP switch to "direct" action.)

**Operation at low input:**

- Stop at full-open position
- Stop at full-close position
- hold position (ex-factory setting)

**Low input signal level**

- Current input:  $\leq 1.48 (\pm 0.2)$  mA DC
- Voltage input:  $\leq 0.37 (\pm 0.05)$  V DC

**Wiring conduits:** G 1/2 female thread and G 3/4 female thread (total four)

Terminal block: 7.62 mm pitch; M3 screw terminals (torque 0.5 N·m)

**Screw terminal:** Nickel-plated brass (not magnet)

**Housing material:** Diecast aluminum (ADC12)

**Coating:** Thermosetting acrylic resin

**Coating:** Silver color

**Drive:** Stepping motor

**Insulation class:** E

**Position detection:** Conductive potentiometer

**Deadband adjustment:** 0.1 - 0.5 % (1/1000 to 1/200)

**Restart limiting timer adjustment:** 0.1 - 5.0 sec.

**Isolation:** Power voltage or I/O signal to full-open signal position to full-close signal position to alarm signal to Modbus communication to metallic housing

**Protective functions**

- Automatically stops when torque at lock
- Automatically stops when surface temperature of the

stepping motor is over 100°C (212°F) and automatically restarts under 95°C (203°F).

• Automatically heats to +2°C (35.6°F) when surface temperature of the stepping motor is under 0°C (32°F). The motor continues to run.

• A heater is incorporated to use under cold areas.

• Thermostat is incorporated to automatically heat when 27°C ( $\pm$ 5°C) (80.6°F ( $\pm$ 9°F)) or lower, and automatically stop heating when 39°C ( $\pm$ 4°C) (102.2°F ( $\pm$ 7.2°F)) or higher.

**Status Indicator LED**

- POWER: Green LED turns on when the power voltage is ON
- INPUT: Green LED turns on with normal input signal
- MOVING UP/CCW.: Green LED turns on when full-open
- MOVING DOWN/CW.: Green LED turns on when full-close
- COM: Green LED turns ON while Modbus communication
- ALARM: Red LED blinks when abnormal operation (For details, refer to users manual)

**User-configurable items:**

**Configurable with DIP switch**

- Stem operation at low input
- Switching direct/reverse
- Switching signal output
- Set full-open position
- Set full-close position

**Configurable with PC or PU-2x**

- Set full-open position
- Set full-closed position
- Deadband
- Restart limiting timer
- Full-open signal position
- Full-close signal position
- Output stem operation angle

**Configurable with Modbus communication**

- Input
- Node address
- Baud rate
- Parity bit
- Stop bit length
- Internal terminating resistor
- Loss of Modbus communication detection time

**Action:** Switching range of reverse/direct (following table)

- Increasing input signal, output stem moves to the full-open side (reverse)
- Increasing input signal, output stem moves to the full-close side (direct)

**· REVERSE (viewing from the top)**

INPUT SIGNAL (CURRENT/VOLTAGE)	OUTPUT STEM POSITION	OUTPUT SIGNAL (CURRENT/VOLTAGE)
4 mA DC / 1 V DC	Full-close (CW.)	4 mA DC / 1 V DC
		20 mA DC / 5 V DC
20 mA DC / 5 V DC	Full-open (CCW.)	20 mA DC / 5 V DC
		4 mA DC / 1 V DC

**· DIRECT**

INPUT SIGNAL (CURRENT/VOLTAGE)	OUTPUT STEM POSITION	OUTPUT SIGNAL (CURRENT/VOLTAGE)
20 mA DC / 5 V DC	Full-close (CW.)	20 mA DC / 5 V DC
		4 mA DC / 1 V DC
4 mA DC / 1 V DC	Full-open (CCW.)	20 mA DC / 5 V DC
		4 mA DC / 1 V DC

## 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:** None, Odd, Even

**Stop bit:** 1, 2

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

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

**Internal terminating resistor:** 120 Ω

## OUTPUT SPECIFICATIONS

**■ Output signal**

- 4-20 mA DC or 20-4 mA DC (non-isolated)  
Load resistance: 300 Ω max.

- 1-5 V DC or 5-1 V DC (non-isolated)  
Load resistance: 5 kΩ min.

**■ Full-open signal, full-close signal (CCW SIG., CW SIG.)**

- 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.

**■ 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.

## STROKE RATE

**Duty cycle = Within 50 %**

The unit must operate at an average duty cycle of 50% (ratio of operating time to standby time) or less.

**Operation rate:** Less than 13 strokes / min. (excepting momentary peak stroke rate)

## INSTALLATION (POWER VOLTAGE: @ 24 V DC)

**Operating temperature:** -25 to +66°C (-13 to 150.8°F) (No direct sunlight, radiant heat or heat transfer.)

**Storage temperature:** -29 to +70°C (-20.2 to 158°F)

**Operating humidity:** 30 to 90 %RH (non-condensing)

**Vibration resistance:**

- Sweep endurance test (IEC 61298-3 compliant)
- 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 orientation:**

DO NOT mount upside-down

**Weight:** Approx. 4.4 kg (8.820 lb)

**■ CURRENT VALUE (APPROX.)**

STATUS OF THE HEATER	AT HEATER ON	AT HEATER OFF
Standby current value	1A DC	0.14A DC
Current at no load	1A DC	0.33A DC
Current at load	1.3A DC	0.9A DC
Locked rotor current	1.3A DC	0.9A DC
Current in standby or non-operating state at -25°C	1A DC	-
Current at no load at -25°C	1A DC	-

## PERFORMANCE

**Resolution:** 0.1%

**Hysteresis:** 0.6%

**Linear characteristic:** 1%

**Backlash:** 0.3 degrees

**Insulation resistance:** ≥ 100 MΩ with 500 V DC

(Power voltage or I/O signal to full-open signal to full-close signal to alarm signal to Modbus communication to metallic housing)

**Dielectric strength:** 500 V AC @ 1 minute (or 600 V AC @ 1 second)

(Power voltage or I/O signal to full-open signal to full-close signal to alarm signal to communication to metallic housing)

## STANDARDS & APPROVALS

**■ EU conformity (CE marking)**

- EMC Directive  
EMI EN 61000-6-4  
EMS EN 61000-6-2
- RoHS Directive  
EN IEC 63000

## TERMINOLOGY

### • 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 angle of the output stem (counts full-open (-close) to full-close (-open) as 1)
- No. of times of restart when an excessive torque error occurs
- Excessive torque error

### • Excessive torque monitoring

Function to stop the stepping motor when an excessive torque 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 position detecting value of the potentiometer, tries to operate with set torque at lock. If the output stem does not follow the motor after two times, an error of excessive torque occurs and the stepping motor is stopped (alarm signal). Following methods can release the alarm signal.

- Turn DIP SW 1-8 OFF to ON (Be sure to turn ON to OFF again)
- Turn off the power voltage.
- Input opposite value of the current one
- Set via PU-2x or Modbus communication

### • Deadband

Linear resolution

### • Hysteresis

The output stem reciprocates i.e. opens and closes according to the input signal.

Hysteresis is the difference between the two curves of ascending and descending directions, which is expressed in percentage.

### • Linear Characteristics

The output stem reciprocates i.e. opens and closes according to the input signal. In the case of MRP, the difference between the theoretical value and the actual distance that the output stem actually moved is expressed in percentage.

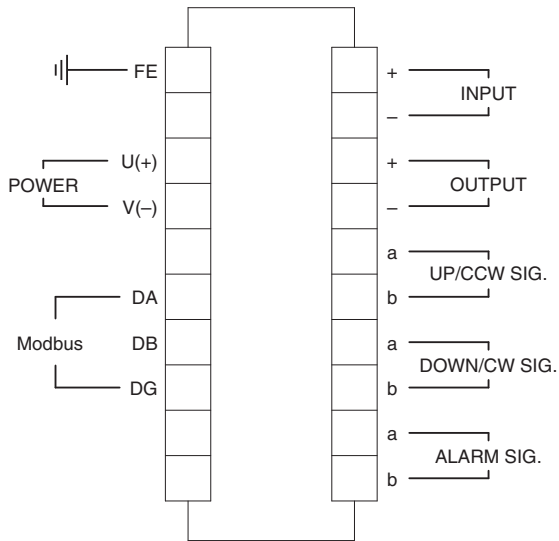
### • Restart Limiting Timer

This function prevents the output stem operates frequently

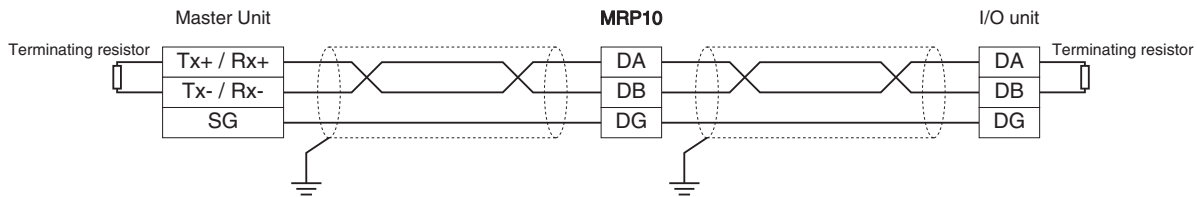
when the input signal is unstable.

To prevent the output stem operates frequently, it does not operate at the moment the input signal changes, but after a set period of time.

## TERMINAL CONNECTIONS

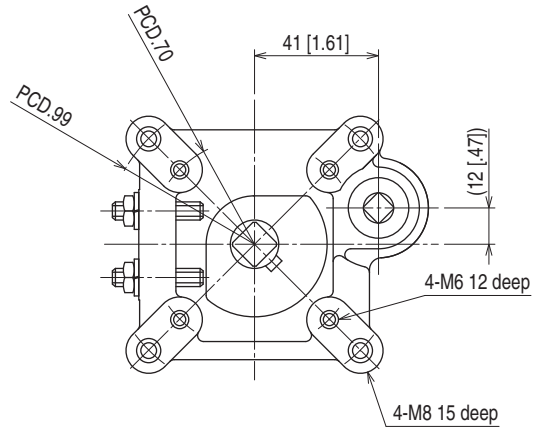
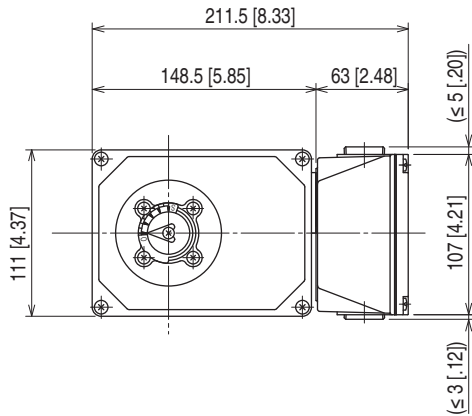


## COMMUNICATION CABLE CONNECTIONS



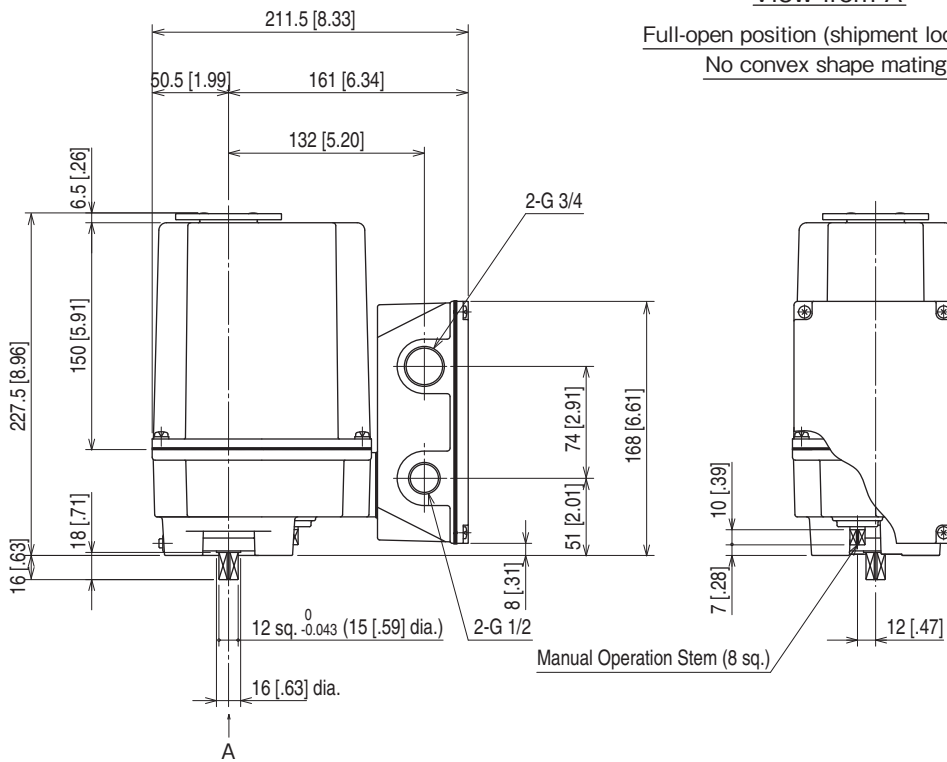
Terminating resistors can be turned ON/OFF on the PC configurator software (model: STCFG) or programming unit (model: PU-2x).

## EXTERNAL DIMENSIONS unit: mm [inch]

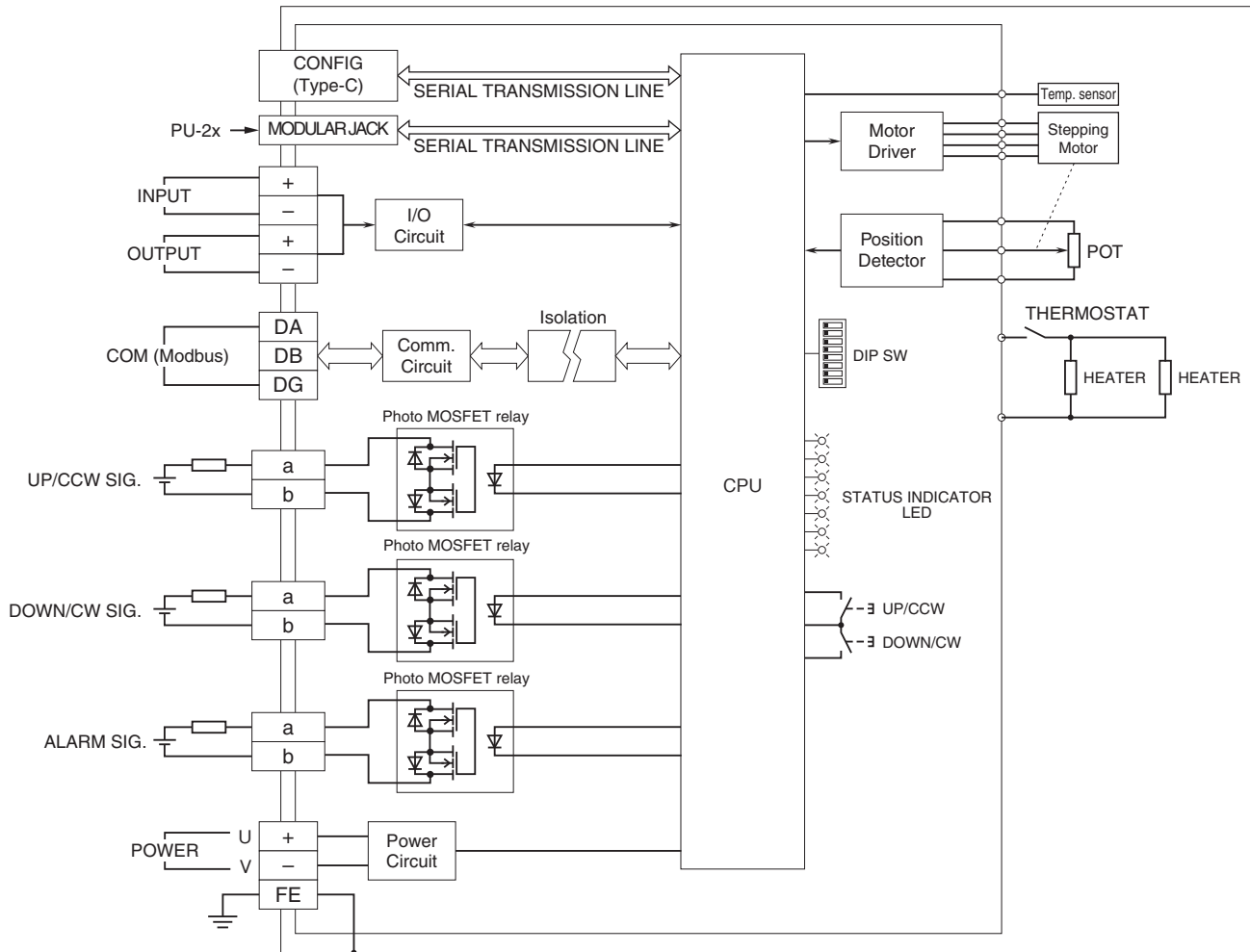


View from A

Full-open position (shipment location)  
No convex shape mating



## SCHEMATIC CIRCUITRY & CONNECTION DIAGRAM



Note1: No polarity between a and b.

Note2: About CW. and CCW.

Indicates the direction in which the output stem rotates when viewed from the top of the product cover.

CW.: Clock wise (right rotation)

CCW.: Counterclockwise (left rotation)



Specifications are subject to change without notice.