ECM3000
Control Motor
User's Manual

Thank you for purchasing the ECM3000 Control Motor.

This manual contains information for ensuring correct use of the ECM3000. It also provides necessary information for installation, maintenance, and troubleshooting.

This manual should be read by those who design and maintain equipment that uses the ECM3000. Be sure to keep this manual for ready reference.

Please read the "Terms and Conditions" from the following URL before ordering or use:

http://www.azbil.com/products/bi/order.html

NOTICE

Be sure that the user receives this manual before the product is used.

Copying or duplicating this user's manual in part or in whole is forbidden. The information and specifications in this manual are subject to change without notice.

Considerable effort has been made to ensure that this manual is free from inaccuracies and omissions. If you should find an error or omission, please contact the azbil Group.

In no event is Azbil Corporation liable to anyone for any indirect, special or consequential damages as a result of using this product.

SAFETY PRECAUTIONS

Safety precautions are for ensuring safe and correct use of this product, and for preventing injury to the operator and other people or damage to property. You must observe these safety precautions. Also, be sure to read and understand the contents of this user's manual.

⚠ WARNING

Warnings are indicated when mishandling this product might result in death or serious injury to the user.

⚠ CAUTION

Cautions are indicated when mishandling this product might result in minor injury to the user, or only physical damage to this product.

⚠ WARNING

- Be sure to turn the power OFF before mounting, removing, or wiring the ECM3000 or opening the cover. Touching electrically charged parts such as power terminals by mistake might cause electric shock.

⚠ CAUTION

- To ensure correct and safe operation of the ECM3000, always follow this user's manual, as well as user's manuals for equipment and system to be combined with the ECM3000.
- Installation, wiring, inspection, adjustment, and maintenance of the ECM3000 must be carried out only by authorized engineers who have the knowledge and technical skill regarding the customer's system and the ECM3000.
- Use the ECM3000 within the operating ranges recommended in the specifications of this manual. Otherwise device failure or faulty operation may occur.
- Do not install the ECM3000 at locations like those listed below. Doing so might cause faulty operation.
  - Locations with hazardous chemicals, corrosive gas or briny / salty air.
  - Locations where the ECM3000 is exposed to high temperatures.
  - Locations with moisture or water droplets.
  - Locations where the ECM3000 is exposed to vibration for a long period.
  - Locations where the ECM3000 is exposed to direct sunlight.
- Do not use the ECM3000 as a step. Doing so might cause damage to the ECM3000 or personal injury.
- Wire the ECM3000 according to electrical wiring standards. Also wire the ECM3000 using specified electric cables according to standard installation methods. Failure to do so might breakdown or faulty operation.
- The motor may become hot during operation. Do not touch the motor opening the cover immediately after turning the power OFF. Doing so might cause burn hazard.
- Do not touch any moving part when power is ON or during operation. Doing so might cause injury.
- To connect with linkage, use the 160˚ stroke motor. Failure to do so might cause faulty operation. The 90˚stroke motor, cannot be used to fully open or close.
- If it is predicted that the safety of the system cannot be kept, fail-safe design such as use of double controllers, installation of breaker or installation of limiter, or redundant design should be considered.
- When you discard the ECM3000, discard it as an industrial waste following local rules and regulations.

1. OVERVIEW

The ECM3000 is a control motor designed to control various equipment in the industrial application. Two kinds of models are available: one is a 90˚ stroke motor for burner control and the other is a 160˚ stroke motor for valve control of hot and cold water, and steam. Three kinds of control signal input type are available: relay contact, 4 to 20mAdc, and resistance. Three kinds of power supply voltage types are available, 24Vac, 100Vac, and 200Vac. Additionally, a power supply unit with a voltage range of 85 to 264Vac is also available for the 4 to 20mAdc input type. The ECM3000's bracket is compatible with Azbil Corporation's previous motors.

2. MODEL SELECTION GUIDE

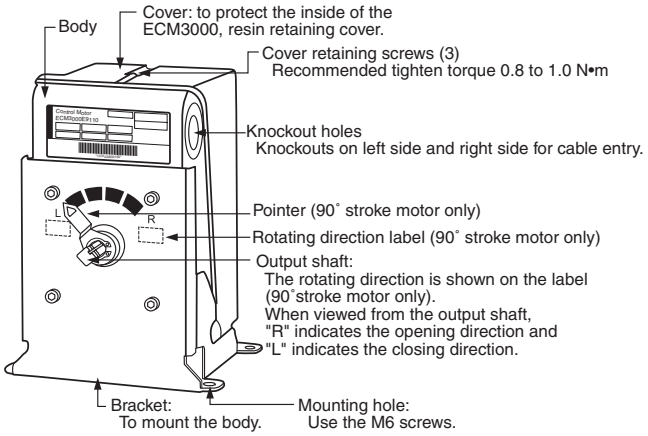
Model No.	Product specifications								Auxilary switch (option)
	Power supply voltage	Input signal	Degress of rotation	Stroke timing 50Hz	Stroke timing 60Hz	Output torque	Power consumption	Control method	
ECM3000D0100	24Vac	Relay contact	90˚	39s	33s	12.5N•m	9VA	ON-OFF control	None
ECM3000D0110									4 switches built-in
ECM3000D1100	100Vac								None
ECM3000D1110									4 switches built-in
ECM3000D2100	200Vac								None
ECM3000D2110									4 switches built-in
ECM3000E0100	24Vac	Potentiometer						Position proportional control (feedback potentiometer builtin)	None
ECM3000E0110									4 switches built-in
ECM3000F0100		Relay contact							None
ECM3000F0110									4 switches built-in
ECM3000F1100	100Vac								None
ECM3000F1110									4 switches built-in
ECM3000F2100	200Vac								None
ECM3000F2110									4 switches built-in
ECM3000G0100	24Vac	4 to 20mAdc *1							None
ECM3000G0110									4 switches built-in
ECM3000G0120							11VA		2 switches built-in with open/close override function
ECM3000G9100	85 to 264Vac			39s			14W		None
ECM3000G9110									4 switches built-in
ECM3000G9120							15W		2 switches built-in with open/close override function
ECM3000F0300 *3	24Vac	Relay contact		20s	16s	6N•m	14VA		None
ECM3000F0310 *3									4 switches built-in
ECM3000D0200			160˚	69s	58s	12.5N•m	9VA	ON-OFF control	None *2
ECM3000E0200		Potentiometer						Position proportional control (feedback potentiometer builtin)	
ECM3000F0200		Relay contact							
ECM3000F1200	100Vac								
ECM3000F2200	200Vac								
ECM3000G0200	24Vac	4 to 20mAdc *1							
ECM3000G0220							11VA		2 switches built-in with open/close override function
ECM3000G9200	85 to 264Vac			72s			14W		None *2
ECM3000G9220							15W		2 switches built-in with open/close override function
ECM3000F0400 *3	24Vac	Relay contact		35s	29s	6N•m	14VA		None *2

*1 Switching of direct/reverse control action and adjustment of zero/span and dead band are available.
*2 Extension unit can be mounted in the field.
*3 High-speed motor type

! Handling Precautions

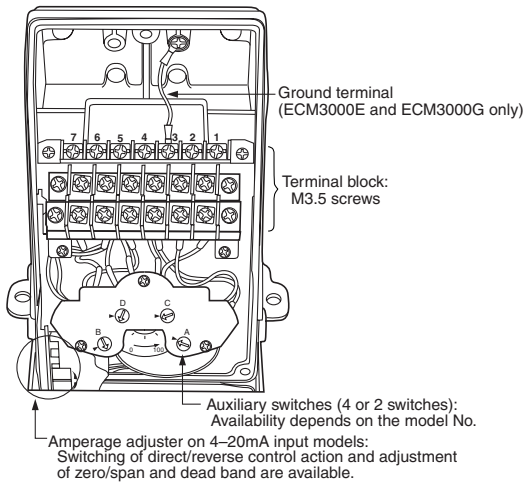
- The high-speed motor type must be used within a duty ratio (operation ratio) of 40%.
- Do not connect an ECM3000F (that is, type F) with a mechanical balancing relay such as R9107A or R927C. Doing so might damage the ECM3000F by applying excessive voltage to its potentiometer.
- If an ECM3000F controls the actuator on the basis of the resistance between T and G or between T and Y of the feedback potentiometer, it might not function normally, depending on the connected controller. For details contact the azbil Group.

3. PART NAMES AND FUNCTIONS



Handling Precautions

- Factory setting of the output shaft: 0% position
- L: counterclockwise (CCW) rotation
  R: clockwise (CW) rotation



● Terminal assignments

・Models with 4 built-in auxiliary switches

7	6	5	4	3	2	1	← Power and each input

D3	D2	D1	C3	C2	C1	← Auxiliary switches A-D
B3	B2	B1	A3	A2	A1	

・Models with 2 built-in auxiliary switches and open/close override function

7	6	5	4	3	2	1	← Power and each input

S	CONT	CW	CCW	unused	unused	← Open/close override function
B3	B2	B1	A3	A2	A1	← Auxiliary switches A and B

4. MOUNTING

■ Mounting locations

Do not install the ECM3000 at locations specified in the cautions.
Additionally, when installing the ECM3000 outdoors, an appropriate protective device, such as a protective cover, must be installed.

! Handling Precautions

- Pay special attention that no foreign matter or moisture enters from the output shaft.
- In an application where the ECM3000 is combined with a control valve, such as fluid control, condensed moisture content is transferred along the valve and might enter the interior of the motor when the control valve is located higher than ECM3000.

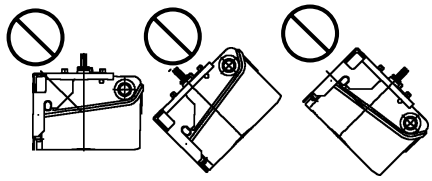
■ Mounting direction

● 90˚ stroke motor

This type can be mounted in the desired direction. However, do not mount in a way that allows water or foreign matter to enter from the output shaft.

● 160˚ stroke motor

This type can be mounted in the desired direction with the motor output shaft placed horizontally or vertically downward.
To prevent condensate water from entering the ECM3000, do not mount with the output shaft pointing upward.



● Maintaining splash-proof performance

Do not squeeze the packing or cable, and fasten the cover securely. Make the knockout hole watertight.

- Use waterproof connectors for cables coming from the ECM3000.
  Recommended waterproof connector: 83104346-003.
- Also when connecting electrical conduits, use a waterproof precut type or the like to maintain waterproofing.

5. WIRING

For wiring, open a knockout hole (22mm dia.) in the side panel. Wiring must be done according to the terminal label indicated on the respective terminals. Connect each core using M3.5 insulated crimp type terminal lugs.

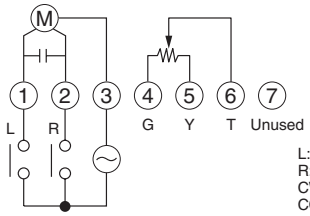
! Handling Precautions

- To remove the knockout, tap lightly around its edge using a flat-head screwdriver.
- Make sure that fragments do not enter the control motor when a knockout hole is opened.
- Do not use unused terminals as relay terminals.
- Always be sure to attach the cover after wiring.
- Do not lay the power and signal cables together in the same conduit.
- Keep the power line cables 50cm or more away from the signal cables.
- If routing, the power and signal cables together in the same conduit is unavoidable, it is recommended to use shielded signal cables as specified below.
- Connect the power supply voltage according with the model No.
- Be sure to install a circuit breaker for the electrical power.
- Set the parameters of the controller, so that the internal relay of the controller does not turn ON and OFF excessively due to hunting during motor operation. For example, set derivative time (D) to 0 seconds or widen the dead band.
  If the internal relay operates excessively, the life of the motor or the relay of the controller on the host side might be shortened. If the frequent operation cannot be avoided, an auxiliary relay should be installed between the motor and the controller.

● Cables to be used

Use JIS C3307 600V insulated wire or equivalent for the power line cables. For the signal cables, use JCS4364 instrument cable or equivalent.

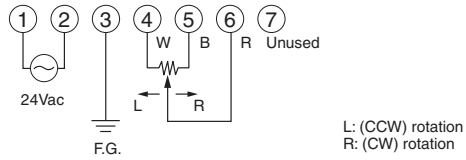
● Relay contact input (24Vac power supply) (nominal 135Ω feedback potentiometer)



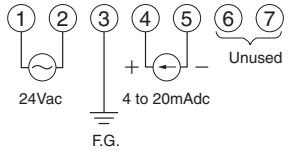
! Handling Precautions

- In case of ON-OFF control action type, terminal Nos. 4, 5 and 6 are not connected.
- The factory setting for the output shaft is the 0% open position.

● Resistance (nominal 135Ω) input (24Vac power supply)



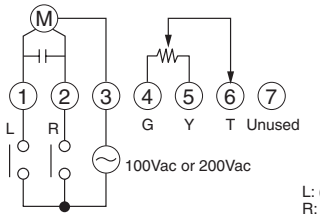
● 4 to 20mAdc input (24Vac power supply)



Note

- Terminals 2 and 5 are isolated from each other inside the motor.

● Relay contact input (100Vac/200Vac power supply) (nominal 135Ω feedback potentiometer)

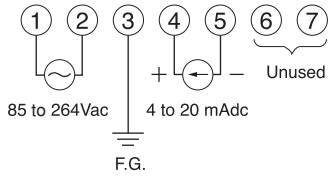


! Handling Precautions

- Set the parameters of the controller, so that the internal relay of the controller does not turn ON and OFF excessively due to hunting during motor operation. For example set derivative time (D) to 0 seconds or widen the dead band.

  If the internal relay operates excessively, the life of the motor or the relay of the controller on the host side might be shortened. If the frequent operation cannot be avoided, an auxiliary relay should be installed between the motor and the controller.

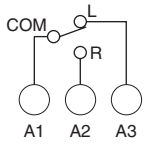
● 4 to 20mA input (85 to 264Vac power supply)



Note

- Terminals 2 and 5 are isolated from each other inside the motor.

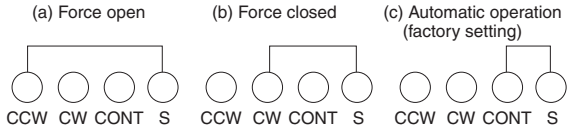
● Auxiliary switch (4 units)



L: (CCW) rotation
R: (CW) rotation

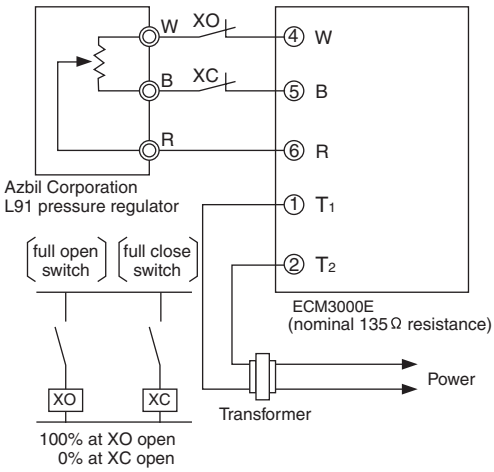
Note: The internal switch connections for B, C, and D have the same layout as for A. Models with open/close override function have only A and B switches.

● Open/close override input



Note: At any one time, terminal S may be connected to only one of CCW, CW or CONT.

● Full open/full close operation for ECM3000E



Note: Recommended contact rating for XO and XC

Material;	Gold plated
Rated voltage;	15Vdc or more
Rated current;	100mA

6. INSPECTION AND MAINTENANCE

■ Inspection method

Item	Cycle	Method
Appearance check	Once every 6 months	• Check for loose screws • Check motor for damage
Running condition	Once every 6 months	• Check for smooth motor operation • Check for any abnormal noise or vibrations
Daily inspection	As required	• Check for any abnormal noise or vibrations • Check for smooth motor operation • Check that no hunting occurs in the motor

■ Maintenance method

Visually check the motor operation once every six months. If any problem is found, take corrective actions appropriately.

Symptoms	Check item	Corrective action
• Does not rotate	• Wiring status, disconnections • Power supply voltage	• Check the wiring • Check the power supply voltage
• Stopped during operation	• Loose terminals	• Re-tighten the terminals
• Auxiliary switch does not operate (model with optional auxiliary switch)	• Auxiliary cam switch status • Wiring status, disconnections	• Redo the settings • Check the wiring
• Feedback potentiometer does not operate (model with optional feedback potentiometer)	• potentiometer resistance • Wiring status, disconnections • Loose terminals	• Redo the settings • Check the wiring • Re-tighten the terminals
• Control sensitivity drops • Motor torque drops	• Wiring status, disconnections • Loose terminals • Power supply voltage	• Check the wiring • Re-tighten the terminals • Check the power supply voltage

7. Auxiliary switches (optional)

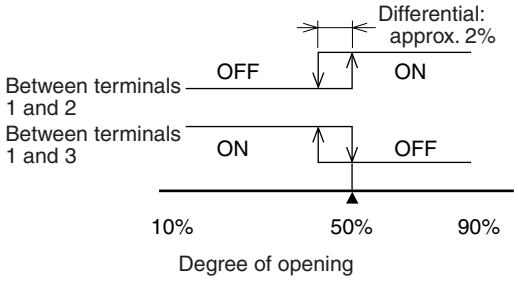
■ Adjustment

● Operating point

Auxiliary switches A, B, C and D turn on when the arrow is at the ▶ mark. The operating point can be set in the 5–95% of output opening range and its repeatability is within ±3%. The differential is approximately 2%. After changing the setting, be sure to test that the switch operates between the motor's fully open and fully closed positions.

● Working type

If the output position exceeds the set position, the contact between terminals 1 and 2 (COM-NO) makes and the contact between terminals 1 and 3 (COM-NC) breaks. The example below shows this happening at the 50% position while opening.

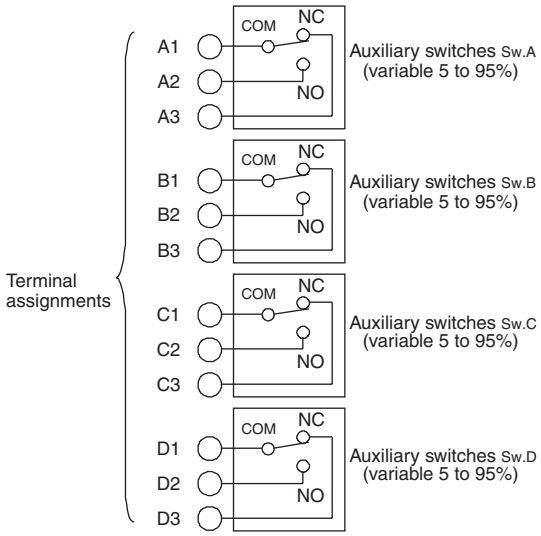


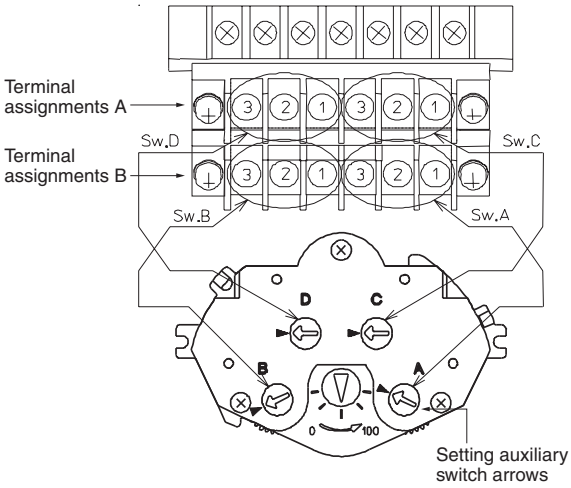
● How to set the operating point

(1) After moving the output shaft to the desired position electrically, set the arrow to the ▶ mark with a screwdriver.

(2) Move the motor around electrically to the various set positions and check that the switches work normally.

In the example below the setting is at the 50% position.





🕮 Note

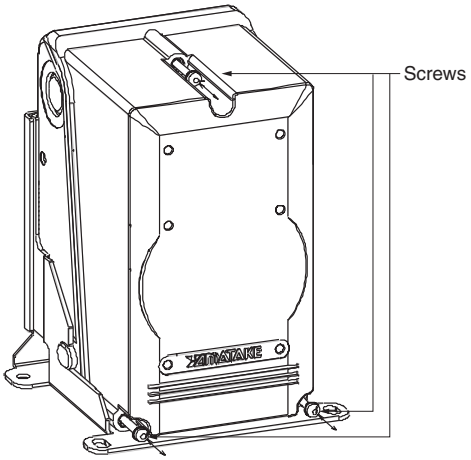
- Use a screwdriver with a 6mm wide blade (JIS B 4609).

■ Mounting and removing

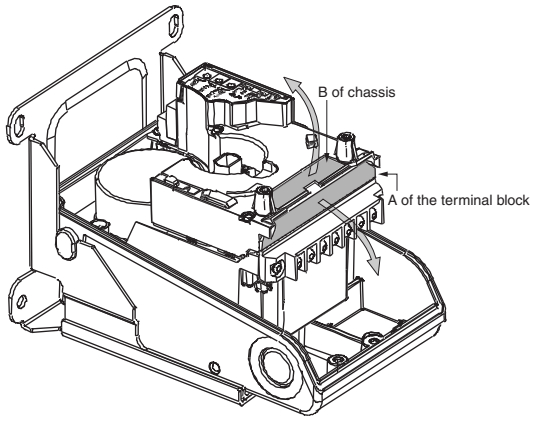
● Mounting

(1) Turn the power off.

(2) Loosen the 3 screws, remove the cover, and put it in a safe place.



(3) Lift off part B of the chassis, and then pull out part A of the terminal block.

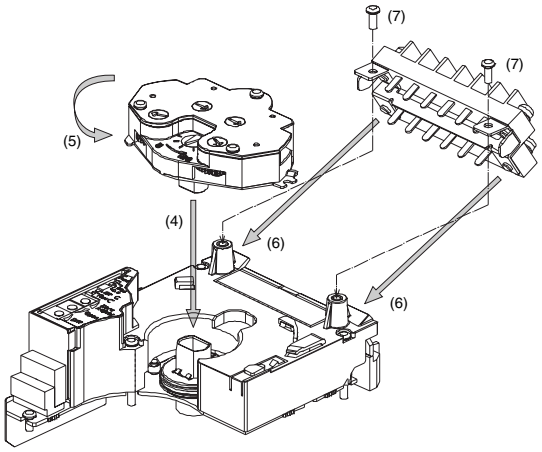


(4) Insert the shaft of the auxiliary switch into the center of the actuator. The triangular arrow should be pointed toward the scale.

(5) Turn the auxiliary switch counterclockwise until it clicks.

(6) Align the holes on the terminal block bracket with the holes in the chassis.

(7) Insert and tighten the 2 screws.



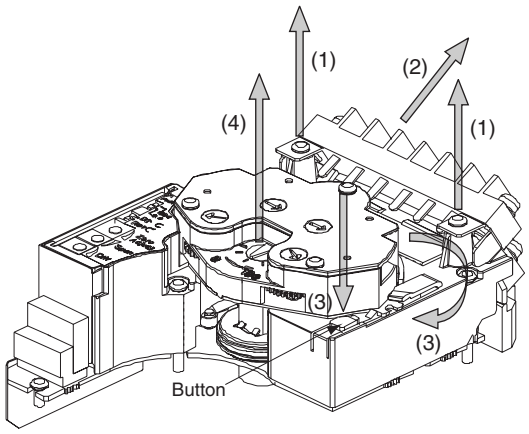
● Removing

(1) Remove the 2 screws.

(2) Remove the terminal block. The bracket is part of the terminal block.

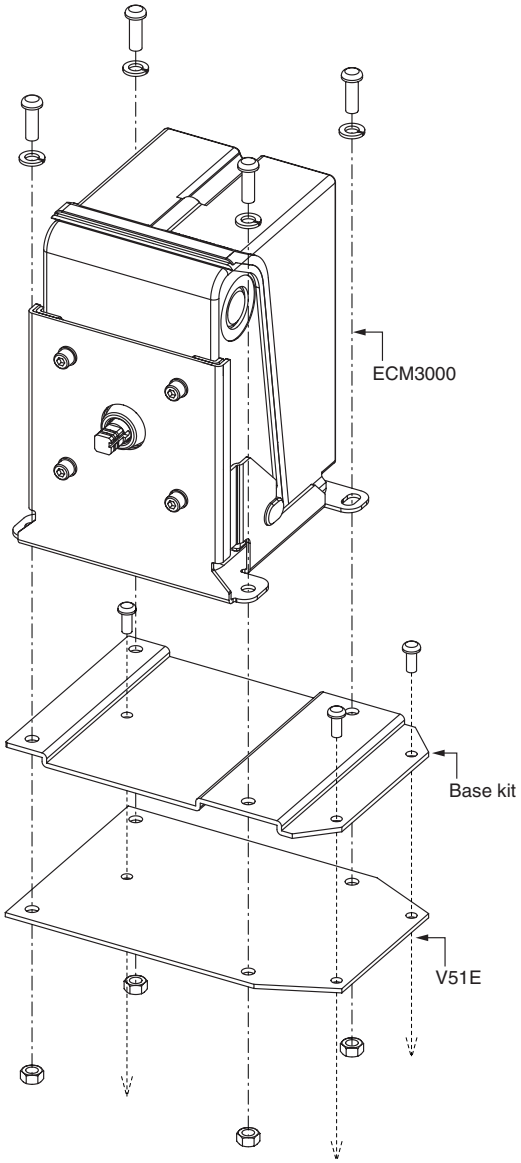
(3) While pushing the release button, turn the auxiliary switch clockwise.

(4) Remove the auxiliary switch by pulling it toward you.



8. Using a butterfly valve (V51E)

If the ECM3000 is used with the V51E, mount the base kit (83165292-001, sold separately) between the V51E and the ECM3000.



9. SPECIFICATIONS

■ Specifications

Item		Specifications
Operation mode		ON-OFF or position proportioning (determined by model No.)
Control signal input		Relay contact, 4 to 20mAdc, Nominal 135Ω resistance (determined by to model No.)
Nominal value of feedback potentiometer		135Ω, 0.5W
Max. applied voltage of potentiometer		5Vdc
Input impedance		45Ω ± 5% (for 4-20mAdc input signal)
Degress of rotation		90˚ or 160˚(determined by model No.)
Motor timing	90˚ stroke model	•39/33s (relay contact, no-load, 50/60Hz) •39s (power supply voltage 85Vac to 264Vac, no-load, 50/60Hz) •20/16s (relay contact, no-load, 50/60Hz,high-speed motor type)
	160˚ stroke model	•69/58s (relay contact, no-load, 50/60Hz) •72s (power supply voltage 85Vac to 264Vac, no-load, 50/60Hz) •35/29s (relay contact, no-load, 50/60Hz,High-speed motor type)
Output torque		12.5N•m (high-speed motor type: 6N•m)
Power supply voltage		24Vac±15% (50/60Hz) 100Vac±10% (50/60Hz) 200Vac±10% (50/60Hz) 85 to 264Vac (50/60Hz)
Power consumption (during operation)		See MODEL SELECTION GUIDE page 2
Standard operating conditions		23± 2˚C, 50± 10% RH
Ambient temperature		-20 to +60˚C
Ambient humidity		5 to 95% RH (non-condensing)
Vibration resistance		4.9m/s²
Insulation resistance		Between power supply terminals and casing, between input terminals and casing: 5MΩ or more by 500Vdc megger
		Between auxiliary switch terminals and casing: 20MΩ or more by 500Vdc megger
Dielectric strength		Between power supply terminals and casing, between input terminals and casing: 500Vac for 60s (24Vac type), 1200Vac for 60s (100Vac type), 1500Vac for 60s (200Vac type, 85 to 264Vac type).
		Between auxiliary switch terminals and casing: 1500Vac for 60s.
		Between power supply terminals and casing, between open/close override input terminals and casing: 500Vac for 60s (24Vac type), 1500Vac for 60s (85 to 264Vac type).
Open/close override input		No-voltage contact Rating: 15Vdc or more, 100mA or more Resistance: 10MΩ or less (1mAdc)
Protection		Splash-proof structure IP54 or equivalent (waterproof cable gland must be used.)
Materials		Case: Die-cast aluminium Cover: Polycarbonate resin with GF Bracket: Steel
Mass		Approx. 3kg

■ Optional parts

Name		Part No.
Crank arm		N-3128
Damper arm		J-26026G-ARM
Ball joint		J-27518-JOINT
Valve linkage		Q455C, D
Damper linkage		Q605A, D, E
Base kit for V51E		83165292-001
Waterproof connector		83104346-003
Power transformer for 24Vac		AT72-J1
Extension unit*	Auxiliary switches (4 units built-in)	83165271-004
	Auxiliary potentiometer for 90˚ type	83165272-001
	Auxiliary potentiometer for 160˚ type	83165272-002

* Only one type of extension unit can be mounted on the model without internal auxiliary switch.

⚠ Handling Precautions

- The output of the auxiliary potentiometer cannot be connected to an M904E Modutrol motor and to an ECM3000E Modutrol motor. Use the potentiometer for output to an external degree of opening indicator or the like.

● Auxiliary switch

Item		Specifications
Auxiliary switches		4 units (2 units)
Contact rating		250Vac, 5A (resistive load)
Auxiliary switch position factory setting *1		A, C: Position of 9˚± 5˚ B, D: Position of 81˚± 5˚
Setting range		Variable 5 to 95%
Terminal (4 units or 2 units) *2	1	Common
	2	NO (Normally Open)
	3	NC (Normally Close)

*1 For the 90° stroke model with auxiliary switches at factory settings.

*2 Models with open/close override function have only A and B switches.

● Auxiliary potentiometer

Resistance	1kΩ ±10%
Accuracy	±8%FS
Hysteresis	±5%FS
Voltage variation of terminal Y	14% ±6% (0% open) to 86% ±6% (100% open)
Max. applied voltage	5Vdc

■ Applicable standards

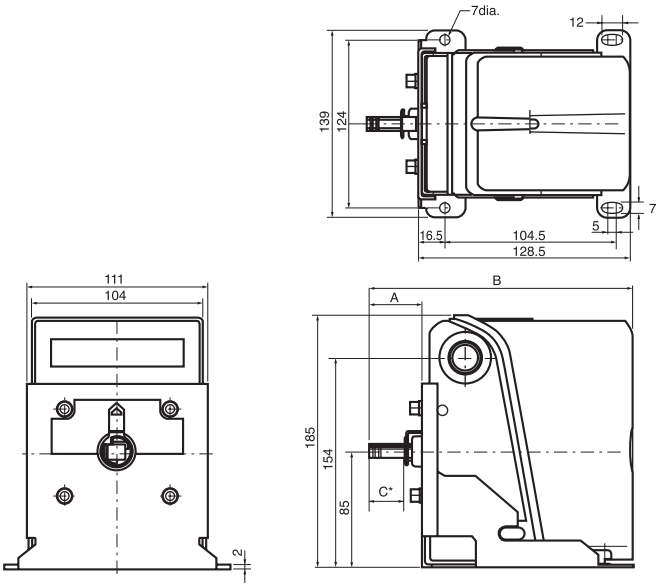
EN55011 classA, EN61000-6-2, UL873 class2
24Vdc model only, except for the following model nos.

- ECM3000F0300
- ECM3000F0310
- ECM3000F0400

■ External dimensions

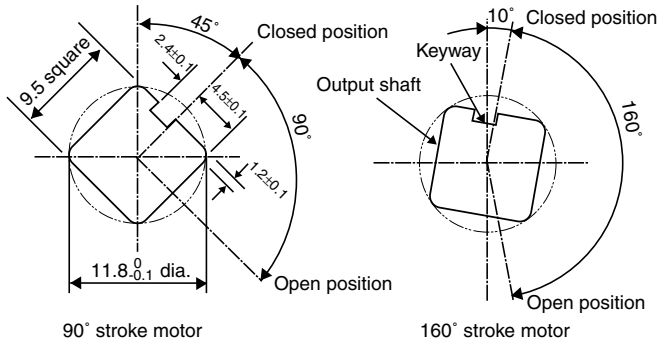
Unit: mm

Degress of rotation	A	B	C
90˚ type	32.5	161.6	22
160˚ type	20.5	149.6	12



* Size C shows the length of the output shaft (9.5 square).

● 0% position of the output shaft (view from the output shaft)



90˚ stroke motor　　160˚ stroke motor

! Handling Precautions

- The length of the output shaft may vary depending on the model No.
- Only the 90˚ stroke motor has a pointer.

azbil　*Specifications are subject to change without notice.* (09)

Azbil Corporation
Advanced Automation Company

1-12-2 Kawana, Fujisawa
Kanagawa 251-8522 Japan

URL: http://www.azbil.com

1st edition: Dec. 2003 (E)
7th edition: Feb. 2013 (F)