R81BAA, R81JAA Type
Plug-In Electronic Board Kits
For Series M100 Motor Actuators

Application
R81 plug-in electronic board kits are used in Series M100X base motor actuators, and as replacement or conversion board kits in existing Series M100 proportional motor actuators (not applicable to the M100A). The R81BAA and R81JAA kits consist of a vertical plug-in board, a terminal board with a travel adjustment potentiometer, mounting screws, and an identification label.

The R81BAA is for 3-wire 135 to 1000 ohm potentiometer input. R81JAA accepts a Johnson Controls 0 to -2 VDC electronic controller input, or a 0 to +24 VDC input, or a 3-wire 135 to 1000 ohm potentiometer input.

When the R81JAA is installed in the M100 Series, an input to terminal X, with ground reference to terminal T1, yields approximately a 6 VDC zero with 4 VDC span.

All Series R81B and R81J electronic board kits are designed for use only as operating controls. Where an operating control failure would result in personal injury and/or loss of property, it is the responsibility of the installer to add devices (safety, limit controls) or systems (alarm, supervisory systems) that protect against, or warn of, control failure.

Installation
To install the R81 board kit in a Series M100X base motor actuator, proceed as follows:

1. Remove the motor actuator’s top cover by loosening the two cover screws.

2. Install the terminal board by carefully placing the terminal receptacle onto the pin terminals. (See Fig. 1, 1-A.)

3. Fasten the board in place using the terminal board screws that are supplied with the R81 kit.

4. Install the vertical board by carefully placing the terminal receptacles onto the pin terminals. (See Fig. 1, 1-B.)

\[ \text{CAUTION: Be sure that all the pins are aligned correctly within the receptacle.} \]
5. Place the bracket, supplied with the motor actuator, over the vertical board and fasten the bracket in place with the captive screw. (See Fig. 1, 1-C.)

6. **Important:** The adhesive backed label supplied in the R81 kit must be placed over the label located on the insulation barrier as shown in Fig. 2. The letter on the R81 label will complete the number which identifies the Series M100 with the R81 installed.

7. Install the motor actuator.

8. Make wiring connections. Turn On the power supply. Adjust and check operation.

9. Replace the motor actuator’s cover. Do not overtighten the cover screws.

**Replacement Installation**

To remove and replace the electronic circuit boards in an existing Series M100B or M100J motor actuator, proceed as follows:

**CAUTION:** Disconnect the electric power supply before attempting to remove the wiring connections and the boards to avoid possible electrical shock or damage to the equipment.

1. Remove the motor actuator’s top cover by loosening the two cover screws.

2. If the existing motor actuator is installed and wired, be sure the power supply is turned Off and then disconnect all wiring connections to the terminal board.

3. Loosen the bracket screw and remove the bracket. (See Fig. 1.)

4. Pull the vertical board straight up. Be careful not to bend or damage the pin terminals.

5. Remove the two screws from the terminal board. Remove the terminal board by lifting straight up. Be careful not to bend or damage the pin terminals.

6. Install the replacement terminal board by carefully placing the terminal receptacle onto the pin terminals. (See Fig. 1, 1-A.)

7. Fasten the board in place using the two terminal board screws.

8. Install the vertical board by carefully placing the terminal receptacles onto the pin terminals. (See Fig. 1, 1-B.)

9. **CAUTION:** Be sure that all pins are aligned correctly within the receptacle.

10. **Important:** The adhesive backed label supplied with the R81 kit must be placed over the label located on the insulation barrier as shown in Fig. 2. The letter on the R81 label will complete the number which identifies the Series M100 with the R81 installed.

11. Make wiring connections. Turn On power supply. Adjust and check operation.

12. Replace the motor actuator’s cover. Do not overtighten the cover screws.

**Wiring**

Make wiring connections using copper conductors only and in accordance with the National Electric Code and local regulations. Refer to the typical wiring diagram for selected hookup.

All splices are to be made in junction boxes using approved solderless connectors, or by soldering and then taping the connections. If desired, a standard electrical box can be added to the wiring compartment of the motor actuator. (See Fig. 3.)

To avoid potential miswiring,

**Fig. 3 — Wiring box shown ready to attach to the motor actuator’s wiring compartment.**

separate transformers are recommended. When slaving motor actuators with the number 10 terminals connected together, separate transformers must be used. (See Fig. 4.) Never parallel terminals 10 and T1 simultaneously.
If an existing 24 VAC power supply is available, Johnson Controls Y65 and Y68 isolation transformers are recommended. The R81J circuitry allows an alternate method of slaving actuators from the "X" terminal when precision slaving is not required. (See Fig. 5.)

Up to ten M100 motor actuators may be operated in parallel from one potentiometer controller. A retransmitting "slave" potentiometer is not required, and a separate master and/or slave model is also not required. This reduces field wiring between motor actuators.

**Travel Adjustment**

The rotational travel is field adjustable from 65 to 270 degrees rotation by turning the travel adjustment. Changing the travel adjustment effects the CW limit of the actuator’s rotation.

Run the motor actuator to its CW limit by jumpering terminals 8 and 9 (24 VAC must be applied to terminals T1 and T2). Turn the adjustment potentiometer clockwise to increase the travel, and counterclockwise to decrease the travel. For further information on travel adjustment, refer to the damper or valve linkage instruction sheet under linkage adjustment.

**Checkout Procedure**

Use the installation sheet with the motor actuator for installation, operation, and checkout.

To drive the motor actuator, with the R81BAA or R81JAA installed, to its full travel, proceed as follows:

1. Apply 24 VAC power to terminals T1 and T2.
2. Jumper the terminals for complete CCW and CW travel (viewed from the load end of the motor actuator), as directed in the Manual Override Table.

Observe at least three complete operating cycles to see that all components are functioning correctly. The motor actuator should not be stalled by the damper or valve. The motor actuator may be damaged if it is not allowed to complete its full stroke.

For applications which require repeated manual operation or manual overriding for a lengthy period, a 1000 ohm 1/2 watt resistor must be connected between terminals 8 and 10.

*Fig. 4 — Typical wiring of M100B, slaving motor actuators from terminals 8 and 10. Use separate transformers when the number 10 terminals are connected together. Note: Typical wiring hookup for "Precision Slaving" of the M100J. "Precision Slaving" can only be accomplished when using terminals 8 and 10.*

*Fig. 5 — Typical wiring hookup of three M100J motor actuators controlled by one potentiometer controller. This hookup requires only one transformer. Note: "Precision Slaving" cannot be accomplished when using the "X" terminal. See Application Up-Date M022 for more details.*
Repairs and Replacement

Field repairs must not be made. For a replacement plug-in electronic board kit, contact the nearest Johnson Controls Commercial Systems wholesaler or Systems and Services Division branch office.

Fig. 6 — Typical wiring hookup for the R81BAA installed in an M100 Series motor actuator.

Fig. 7 — Typical wiring hookup for the R81JAA installed in an M100 Series motor actuator.

Fig. 8 — Using an M100J actuator with 0 to —2 VDC controllers. Note: A separate 2.5 VDC power supply is required.