

Series F75 Fail-Safe Module

Installation, Operation and Maintenance Instructions

CAUTION: Flowserve recommends that all products that must be stored prior to installation be stored indoors, in an environment suitable for human occupancy. Do not store product in areas where exposure to: relative humidity above 85%, acid or alkali fumes, radiation above normal background, ultraviolet light, or temperatures above 120°F or below 40°F may occur. Do not store within 50 feet of any source of ozone.

1. DESCRIPTION

The Series F75 Fail-Safe Module is designed to be coupled with Worcester/McCANNAs Series 75 electric actuators:

- Series 20 F75 Module with Size 10 to 23 Series 75, 24 VDC Actuator.

Normal operation is accomplished utilizing a 120 or 240 VAC supply voltage to power the Series F75 module. The module converts the AC power to 24 VDC power, which is used to power the Series 75 actuator.

Upon loss of supply voltage, the Series F75 module latches out the supply side circuitry and switches over to battery power to drive the valve to the predetermined failure position. When the supply voltage is returned, the Series F75 module can be returned to normal operation by depressing the “RESET” switch on the face of the module’s enclosure.

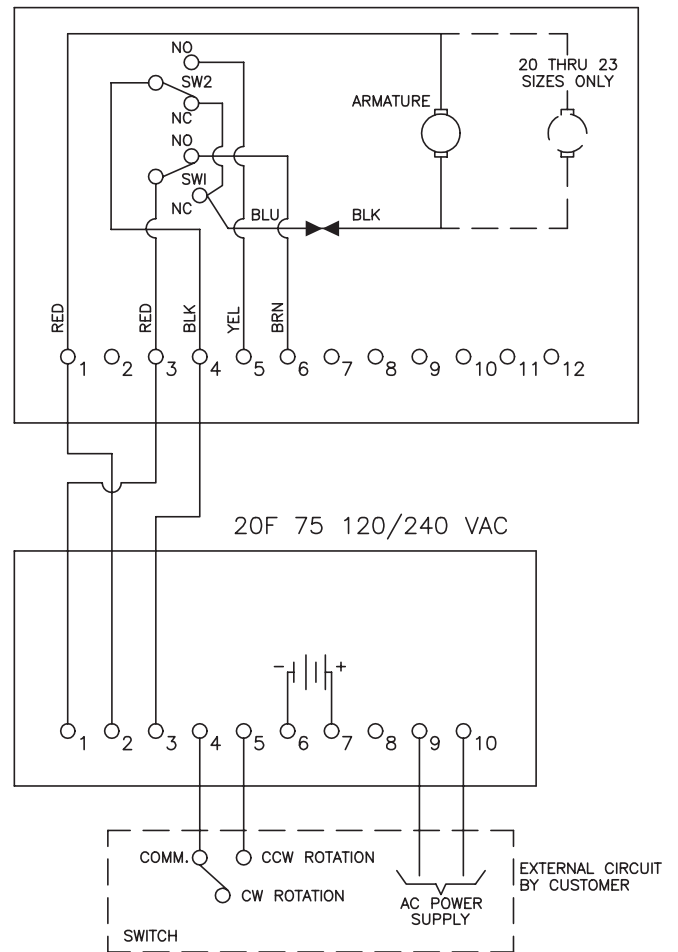
2. INSTALLATION AND WIRING

2.1 The Series F75 Module can be installed adjacent to or remote from the actuator depending on requirements of the application. It should be suitably mounted by the user in a well-ventilated area. A small vent is located in the base of the enclosure to allow venting of any battery gases should they occur. Batteries are of the sealed type and, under normal charge/discharge usage, no outgassing should occur. Replacement batteries should be of the same or equivalent type.

IMPORTANT: If actuator is located in a hazardous location, the F75 module must be remotely located away from this area.

Proper, standard industry practices should be used in wiring Series F75 Module to actuator. Consult Figure 1 and Figure 3.

Figure 1 – Worcester/McCANNAs 10-23/75 24 VDC Actuator



Wiring is shown for fail-safe close, fast mode. For other failure modes, consult page 2.

2.2 Proper wire size should be selected from the table below for DC power wiring between Series F75 Module and actuator to ensure proper operation.

Cable Distance From Module to Actuator	Wire Size for 10-23 75 Actuator
Up to 50 Feet	14 AWG
100 Feet	12 AWG
200 Feet	10 AWG*

For longer distances consult factory.

* Because actuator strip wire size is limited to 12 AWG, 10 AWG wires will have to be run to an appropriate NEMA rated box located close to actuator and 12 AWG wire run from junction box to actuator.

2.3 Wire Series F75 Module to actuator as shown in Figure 1. AC power input can be either 120 VAC or 240 VAC, single-phase 50/60 Hz (see Figure 2 for the 120/240 connections).

CAUTION: Internal batteries should not be connected until actuator operation verification procedure 2.3.1 through 2.3.5 is accomplished. Note that one lead is disconnected and insulated.

NOTE: All wiring to terminal strips should be inserted only to mid-point of terminal strips.

See 75 Actuator Installation, Operation and Maintenance Instruction Manual for proper actuator grounding procedure.

Procedure to be followed:

- 2.3.1 Connect the proper single-phase AC power to the module at terminals 9-10. Fuse protection on this line should be no less than two amps. This AC power should be extended from the F75 Module to the actuator terminals 11 and 12 to be used for heater if the actuator is so equipped.
- 2.3.2 Customer-provided external circuit for controlling the open and closed function of the actuator/valve assembly is to be wired between terminals 4 and 5.
- 2.3.3 Apply AC power to the module.
Press the "Reset" switch on the module's front panel.
- 2.3.4 Close contacts between terminals 4 and 5 of the external control circuit. The actuator will operate CCW. (For standard fail-closed operation, the actuator/valve assembly will be moving CCW to open.)
- 2.3.5 Open the contacts between terminals 4 and 5 of the external control circuit. The actuator/valve assembly will now move clockwise to the fail-safe position.

Leave the actuator/valve assembly in the fail-safe (closed) position, and disconnect the module from AC power.
- 2.3.6 Having verified proper actuator operation under normal line power conditions, the fail safe module's batteries may now be connected. AC power should be disconnected.

If two 12-volt batteries are shipped and not installed, they have to be installed and wired as shown in Figure 3 and 4. Before placing batteries into position inside the enclosure, attach the black, red, and brown connector wires to the battery terminals as shown in Figure 4.

- 2.3.7 Slide the batteries into position and secure with the battery retention clamps 15 and 21 as shown in Figure 3 and 4.
- 2.3.8 After all battery wires are connected, verify that a minimum of 24 VDC is available at terminals 6 and 7 and terminals 2 and 3 of the F75 Module. See note after paragraph 2.3.10. If voltage is lower, allow at least 4 hours of operation on the charger before operating the actuator.
- 2.3.9 Reapply AC power to the F75 Module.
- 2.3.10 Standard failure mode of operation is fail-close (clockwise). For other failure modes see wiring per paragraph 2.4 "Wiring for different failure modes".

NOTE: Voltage for fully charged batteries with the F75 AC input power off should be a minimum of 24 VDC ± .5 volts. When power is applied, this voltage should increase by a minimum of .5 volts within the first few hours of operation, indicating proper charging action. When first installed, the batteries should be allowed to reach the fully charged condition before the F75 module is put into service. The full-charge condition is indicated when the green panel indicator is lighted and terminals 6 and 7 voltage is between 27 and 28 volts with the F75 AC power input on.

2.4 Wiring for Different Failure Modes

Valve Failure Mode	Actuator Size	Actuator Motor Wiring	Wiring Between Actuator and Series F75 Module	
			Actuator Terminal #	Module Terminal #
Close (Clockwise) (Standard)	10, 20 *(Fast)	Red to Terminal #1.	1	2
		Black to Blue Wire Connecting Limit Switches.	3	1
			4	3
Open (Counter-Clockwise)	10, 20 *(Fast)	Black to Terminal #1.	1	2
		Red to Blue Wire Connecting Limit Switches.	3	3
			4	1
Close (Clockwise)	12, 22, 23 *(Slow)	Black to Terminal #1.	1	2
		Red to Blue Wire Connecting Limit Switches.	3	1
			4	3
Open (Counter-Clockwise)	12, 22, 23 *(Slow)	Red to Terminal #1.	1	2
		Black to Blue Wire Connecting Limit Switches.	3	3
			4	1

* Marked indication "FAST" or "SLOW" on gear box of actuator will be located next to the actuator's shaft.

- 2.4.1 If heater option is used, an AC heater must be used. The heater is wired to terminals 11 and 12 of 75 actuator terminal strip that are then wired to terminals 9 and 10 of the fail-safe module.

3. TESTING

The instructions below use directional conventions established for standard wiring.

Once the Series F75 Module has been wired to the actuator, the power source, and the external circuitry, the testing sequence has to be completed as follows:

- 3.1 With AC power wired and ON, close external control circuit switch between module terminals 4 and 5.
- 3.2 Press the “RESET” switch. The module will supply DC power to the actuator from the AC power supply. The actuator will move to the non-fail-safe, or CCW (counter-clockwise) position.
- 3.3 Open external control circuit switch between module terminals 4 and 5, and actuator will reverse its action — it will move to the fail-safe, or CW (clockwise) position.
- 3.4 Close external control circuit switch between terminals 4 and 5 to bring module/actuator to non-fail-safe position.
- 3.5 Press and hold “TEST” switch for period of at least three seconds to simulate a power interruption of the AC power line. The actuator should move to the fail-safe, or CW position.
- 3.6 Press and hold the “OPERATE” switch. Module should move actuator to the non-fail-safe position, or CCW position. When the “OPERATE” switch is released, the module should return actuator to fail-safe, or CW position.
- 3.7 Press the “RESET” switch. The module will return to normal operation on the AC power supply. This switch resets module to AC power supply only if it is available.

IMPORTANT: Use paragraph 3.5 test procedure at least once a month to verify continuous module operation and battery capability.

4. ILLUMINATED DISPLAY OF BATTERY STATUS

- 4.1 The Series F75 Module is provided with an illuminated display system to provide visual indication of battery voltage and charge rate. The display system is comprised of three indicator lamps (one each green, yellow and red) located on the face of the module’s enclosure.

IMPORTANT: The indicator lamps are powered from the 120 or 240 VAC power supply and, therefore, will only be operational when this power supply is available. The illuminated display system is not functional during a power outage while the module is operating the actuator on battery power.

- 4.2 Interpretation of the illuminated display is as follows:

- 4.2.1 Green – The green lamp will be illuminated when the batteries are receiving a normal float charge from the charging circuit. Battery voltage is between 27 and 28 VDC.

- 4.2.2 Yellow – The yellow lamp will be illuminated when the batteries are being charged at a higher rate. Battery voltage is between 20 and 27 VDC. The yellow lamp will be illuminated as soon as the AC power supply returns after an outage. Once the battery voltage has reached 27 VDC, the yellow lamp will go out and the green lamp will be illuminated.

CAUTION: If the yellow lamp remains illuminated for two days, the batteries are not being charged properly. Verify charger operation as per paragraph 5, and if correct, replace batteries as soon as possible.

- 4.2.3 Red – The red lamp will be illuminated when the battery voltage drops below 20 VDC. This is a normal occurrence following a power failure since the actuator has been driven by the batteries. As soon as the battery voltage becomes more than 20 VDC, the red lamp will go out and the yellow lamp will be illuminated.

CAUTION: If the red lamp remains illuminated for several hours after using battery power, the batteries and their charging system should be checked. (See paragraph 5, “Checking Battery Charger.”)

5. CHECKING BATTERY CHARGER

- 5.1 The following procedure may be used to verify proper operation of Series F75 Module charging circuits:

- 5.1.1 Disconnect AC power. The actuator will move to the fail-safe position after a delay of approximately two seconds.
- 5.1.2 Carefully disconnect battery leads at the terminals 6 and 7 being careful not to short battery. Cover the leads with electrical tape after they are removed.
- 5.1.3 Connect a 15 watt, 50 ohm resistor across these terminals 6 and 7.
- 5.1.4 Apply AC power to fail-safe module. Depress “Reset” switch. Verify that about 0.3 amps is flowing through connected 50 ohm resistor with about 18V measured across the resistor.
- 5.1.5 If voltage and current measurements are correct, charger is working properly and batteries must be replaced. Install new batteries using procedure described in paragraph 2.3.6, 7 and 8.
- 5.1.6 When new batteries are installed in the fail-safe module, allow a minimum period of four hours of charging for the red light to go out and the green or yellow light to go on.

- 5.2 New batteries should be permitted to come to the fully charged condition (green light on) before considering the F75 Module to be fully operational.

6. BATTERIES

- 6.1 To obtain optimum shelf life, batteries should be stored in a cool area; if possible, store batteries between 40° to 65°F. Never store batteries at temperature over 100°F.

Each battery is to be inspected for a date code on the top of the battery between its terminals. Within 6 months of this date, the battery should be charged, and every 6 months of storage thereafter, and before placing the batteries into service. They must be inspected to make sure rough handling has not damaged the battery. If damaged, there is a possibility of loss of sulfuric acid electrolytes and possible corrosion of adjacent components. Sulfuric acid can cause severe burns to skin and eyes. If a battery is damaged, the battery cannot be used and must be discarded. Be careful in handling and disposing of any damaged batteries.

If any skin contact is made with a damaged battery, immediately flush the contacted skin with water for at least five minutes.

The batteries are “carefree”; they cannot spill, never require maintenance, have dual covers, and are completely rechargeable.

For maximum protection from high temperatures, it is recommended that the ambient where the fail-safe module is used should be between 65° and 100°F.

6.2 Alternative Power Supply

Large external lead-acid batteries may be used as a non-interruptible 24 VDC supply. If this is done, internal batteries should be disconnected from terminals 6 and 7, removed from module, and properly stored. External DC power supply should then be connected to terminals 6 and 7.

7. MAINTENANCE AND TROUBLESHOOTING

- 7.1 The Series F75 module requires no regular maintenance other than checking and eventually replacing batteries as described in paragraph 2.3.6, 7 and 8.

For maintenance, troubleshooting and other information on the Series 75 actuator itself refer to IOM for Series 75 Electric Valve Actuators.

- 7.2 If it becomes necessary to replace the fail-safe circuit board, the replacement board may need to be calibrated to achieve the required voltage. If so, use the following procedures (reference wiring diagram in Figure 1 on page 1 of this manual or wiring label inside of 75 actuator cover):

7.2.1 Across terminals 6 and 7, connect a $\frac{1}{4}$ watt, 2K resistor. Connect Series F75 module to AC power as required — 120 VAC or 240 VAC. Measure amperage through resistor and voltage across it. Adjust R7 on circuit board to achieve a voltage of 27–27.5 VDC, at about 13 mA current.

7.2.2 Disconnect AC power. Remove the 2K resistor. Connect a 470 ohm, 3 watt resistor across terminals 6 and 7. Again apply AC power. Measure voltage across resistor. Voltage should be about 26.5 to 27 VDC. Adjust R8 so that green status light on front cover goes out and yellow status light on cover goes on.

7.2.3 Again, disconnect AC power. Remove the 470 ohm resistor at terminals 6 and 7 and replace with a 10 watt, 68 ohm resistor. Reapply AC power and measure voltage across resistor. Voltage should be a 21 to 21.5 VDC. Adjust R9 so that red status light on cover goes on and yellow status light on cover goes out.

The battery charger and indicator status light circuit has been calibrated.

To verify, connect the load again across 6 and 7 and slowly decrease resistance while measuring voltage to verify the voltages at which the indicator light switch goes on and off while decreasing and increasing the loads. (The voltage at which light goes on and off will be slightly different).

7.3 Troubleshooting

Symptom	Check	Results
1. Unit has switched to the fail-safe mode. No other evidence of AC power failure.	Operate panel "Reset" switch.	The unit should reset to AC line operation as indicated by panel lamps lighting. If not, proceed to 2.
2. Unit has switched to fail-safe mode. No other evidence of AC power failure.	Check terminals 9, 10 for normal line power.	If power supply will be 90 V or less, check AC power circuit. If normal, AC to DC power supply is defective.
3. Red alert light stays on. Actuator operates normally on AC line power.	Terminals 6, 7 with battery leads disconnected.	27.6 VDC (-2%, +5%) should be found on terminals. Low or zero volts indicate defective charge circuit.
4. Yellow light (high charge rate light) stays on after extended charge period.	Terminals 6, 7 for voltage readings as shown in paragraph 5.	If readings agree with manual or can be adjusted to agree and conditions persist, replace batteries.
5. Actuator inoperative. Panel lamps indicating normal line power available.	Check continuity and operation of external control circuit wired to terminals 4 and 5.	If external circuit is operating properly, proceed to 6.
6. Actuator inoperative. Panel lamps indicating normal line power available.	With external control circuit in the off state (open circuit) check voltage on terminals 2 and 3.	Voltage on terminals 2, 3 should be 24 VDC (negative on 3, positive on 2). If correct, go to 7.
7. Actuator inoperative. Panel lamps indicating normal line power available.	With external control circuit in the on state (closed circuit) check voltage on terminals 1 and 2.	Voltage on terminals should be 24 VDC (negative on 2, positive on 1). If voltage correct on all terminals 1, 2, 3, check actuator wiring and actuator. If incorrect, unit relay switching circuit is defective. Module should be replaced or repaired by factory.

8. ELECTRICAL REQUIREMENTS

Normal power supply: 120 VAC, 60 Hz, single-phase
240 VAC, 50 Hz, single-phase

Alternative power supply: Large external lead-acid batteries as non-interruptible 24 VDC supply

Coupled to: Size 20 Series F75 Module with 10 to 23 Series 75 actuator

Any other motor-powered reversing device that uses 24 VDC may be run by the Series F75 module.

Maximum amperage rating: Size 20 Series F75 Module, 4.0 amps

9. SPARE PARTS

The following are recommended spare parts that should be kept on hand for Series F75 Fail-safe Modules:

Battery pack, consisting of: Two Power Sonic, PS-1212 or Eagle-Picher, CF-12 V1-L batteries; Part No. 11360 for 20 F 75.

ITEM	QTY.	DESCRIPTION
1	1	ENCLOSURE, COVER BOX (SEE SHEET 2)
2	1	BRACKET, TRANSFORMER & P.C. BOARD
3	1	TRANSFORMER (#P4165)
4	1	CIRCUIT BOARD SUB-ASSY. (SEE SHEET 4)
5	4	SPACER, TRANSFORMER (.75LG. FOR #10 SCREW)
6	4	LOCKWASHER, INTERNAL TOOTH (#8)
7	4	HEX. NUT (#8-32)
8	4	SCREW (SUPPLIED W/ENCLOSURE)
9	1	BATTERY SUPPORT SUB-ASSY.
10	1	TIE STRIP (12 TERMINAL)
11	2	MOUNTING SCREW, TIE STRIP (#6-32 x .25LG. P.H.M.S.)
12	1	HEX. NUT (#6-32)
12A	1	LOCKWASHER, INT. TOOTH (#6)
13	1	CABLE/PLUG ASSY. (16 PIN)
14	5	CABLE TIE
15	3	MOUNTING SCREW, CIRC. BOARD (#6-32 x .63LG. P.H.M.S.)
16	3	HEX. SPACER (#6-32 x .19LG.)
17	6	NYLON WASHER (#6)
18	3	HEX. SPACER (#6-32 x .75LG.)
19	1	RESET SWITCH - N.O. (BLACK P.B.)
20	1	TEST SWITCH - N.C. (RED P.B.)

ITEM	QTY.	DESCRIPTION
21	1	OPERATE SWITCH - N.O. (BLACK P.B.)
22	3	LAMP ASSY. (24-28 VOLTS)
23	1	LENS/BUSHING ASSY. (GREEN)
24	1	LENS/BUSHING ASSY. (AMBER)
25	1	LENS BUSHING ASSY. (RED)
26	1	BREATHER VENT
27	1	RIBBON CABLE CLIP
28	3	BOOT-SWITCH
29	7	QUICK-SLIDE CONNECTOR (FOR .110 x .032 TAB)
30	1	WIRING DIAGRAM
31	2	BATTERY
32	1	BATTERY SCREW #8 SELF-TAP
33	1	SIDE BRACKET, BATTERY
34	4	QUICK-SLIDE CONN., BATTERY
35	1	WIRE LEAD, BROWN
36	1	WIRE LEAD, RED
37	1	WIRE LEAD, BLACK
38	1	TOP BRACKET, BATTERY
39	1	BATTERY CAUTION LABEL
40	1	INSULATING TAPE

Figure 2 – Transformer Lead Wiring

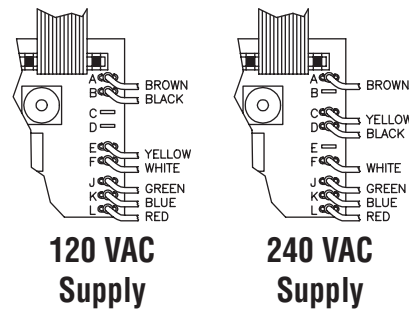


Figure 3

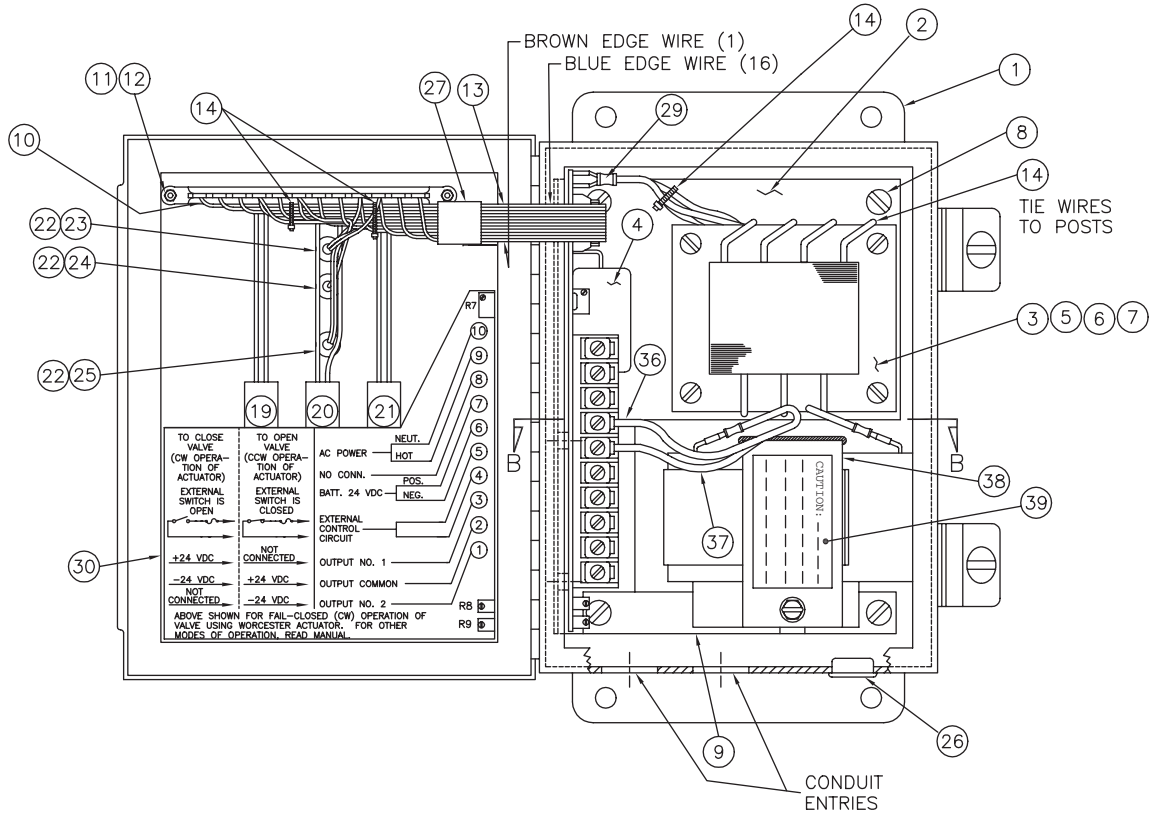
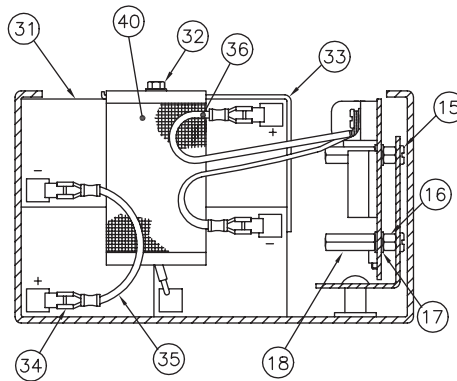


Figure 4 – Section B-B
Eagle-Picher Batteries Shown



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