

HEATEC TEC-NOTE

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Troubleshooting modulation motors Firestorm™ water heaters

Purpose

This document provides a guide for troubleshooting burner modulation motors (**Fig. 1**), which are commonly called mod motors. They are also known as modulation actuators.

Scope

This document applies to Honeywell mod motors M7284C-1000 used on Heatec Firestorm water heaters.

What the mod motor does

The mod motor is connected to mechanical linkage that opens and closes fuel valves and air dampers of the burner (**Fig. 1**). It provides proportional

control of its firing rate. The shaft of the mod motor operates the linkage as it rotates within an arc of 90 degrees.

Key components of concern (Fig. 2)

- Low-fire cam and low-fire proof switch.
- High-fire cam and high-fire proof switch.
- Transformer.

NOTICE: For clarity some photos of mod motor are shown not installed on the heater. It is not necessary to remove it to perform the checks and adjustments described.

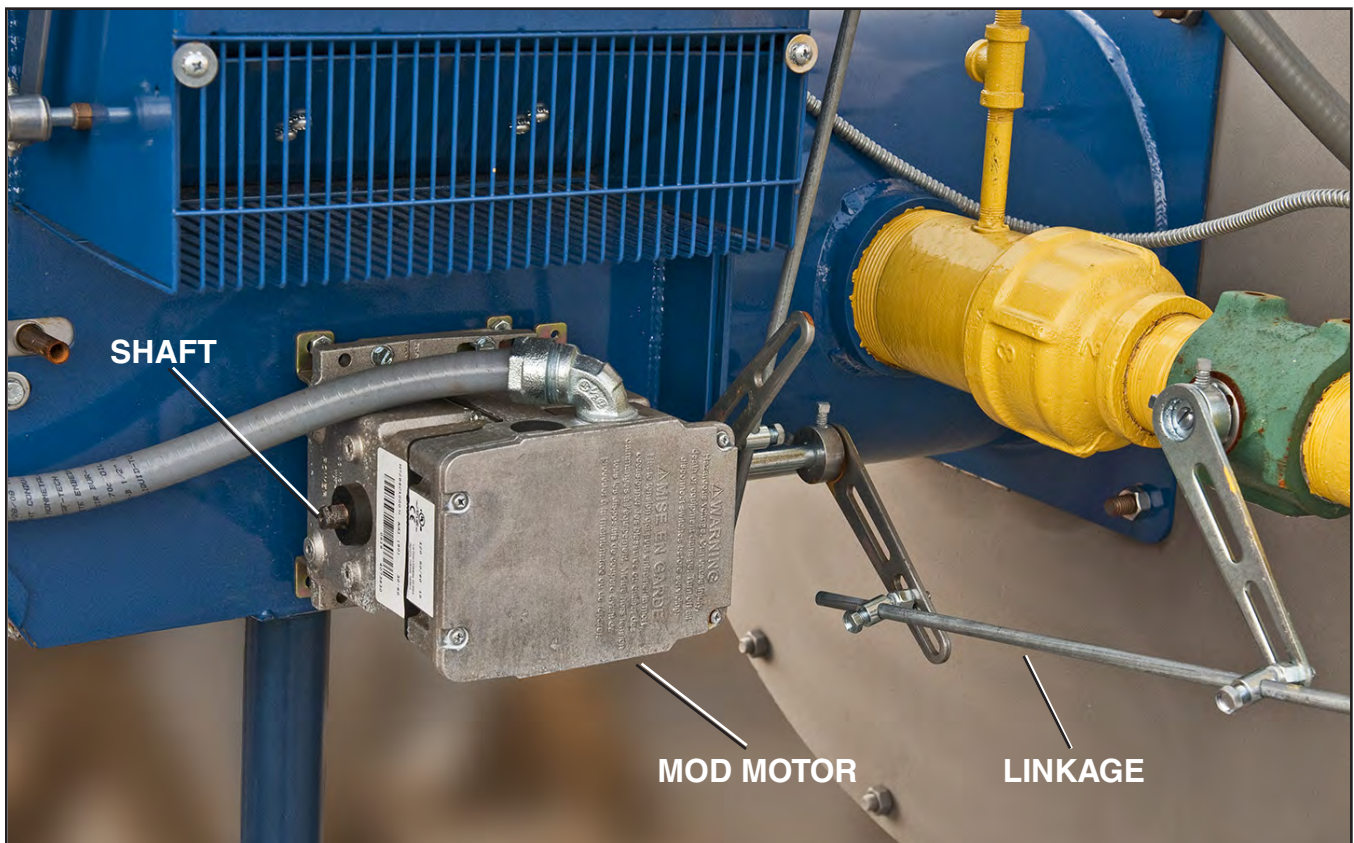


Figure 1. Honeywell mod motor installed on heater.

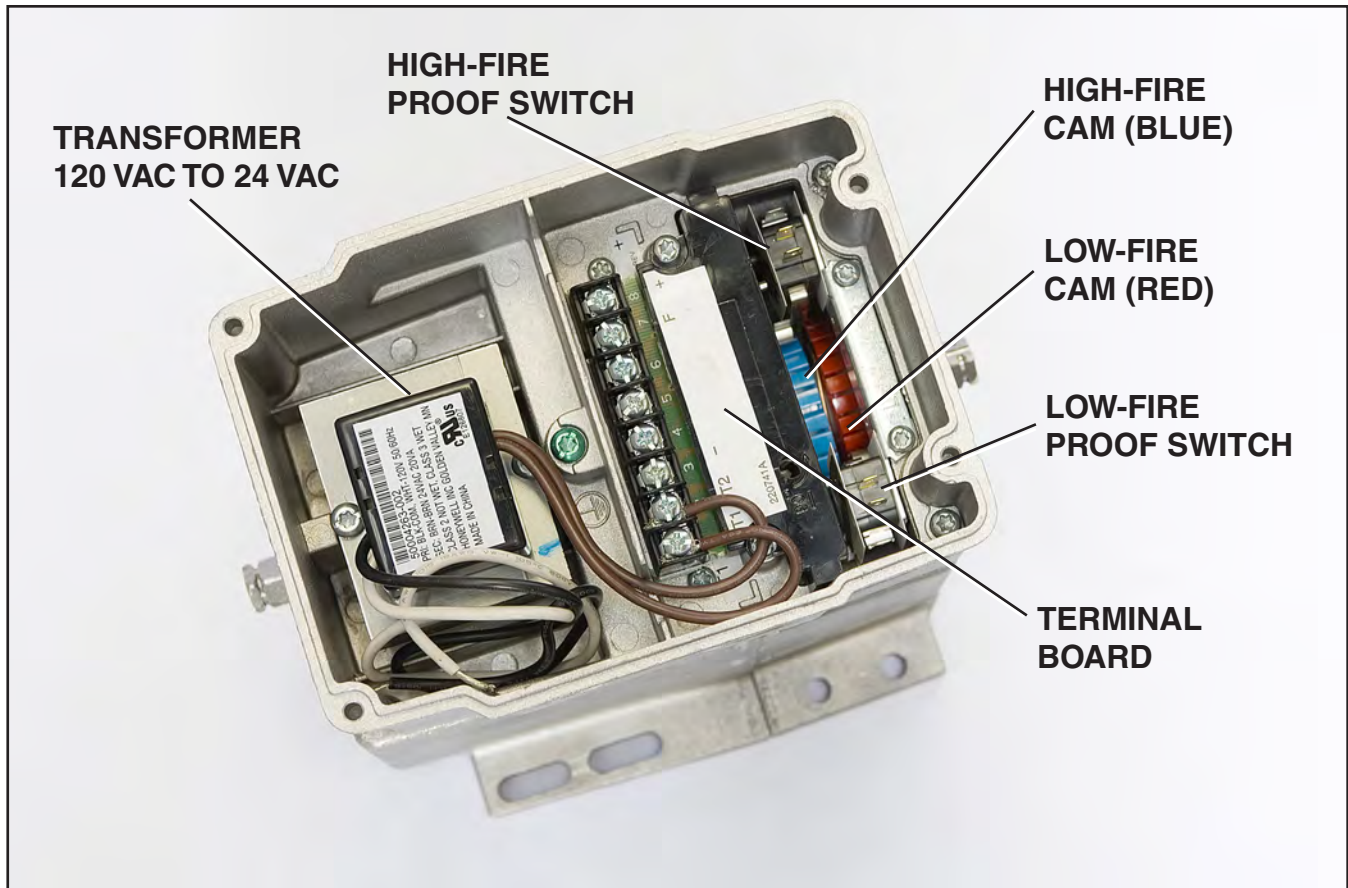


Figure 2. Top view of mod motor.

Interaction with Fireye burner controls (Fig. 3)

The Fireye burner controls monitor the open/closed status of the low-fire and high-fire proof switches in the mod motor while the burner is being purged. The low-fire proof switch is wired between terminals **M** and **D**. The high-fire proof switch is wired between terminals **M** and **8**. Thus, the burner display shows either **M-D LIMIT** or **M-8 LIMIT** when indicating the status of these switches. Each switch is activated and de-activated by its own rotating cam in the mod motor.

- The *low-fire proof switch* remains in its normally *closed* position while the damper is fully *closed*. After the damper begins to open, the cam opens the switch.
- The high-fire cam closes the *high-fire proof switch* when the damper reaches a preset *open* position. After the damper begins to *close*, the cam opens the switch.

Interaction with modulation controller (Fig. 3)

The modulation controller controls the mod motor using a circuit that provides an output of 4 to 20 mA after the burner is lit and operating. With a 4 mA signal the mod motor should be in the low-fire position with the damper fully closed. With a 20 mA signal the mod motor should open the damper to the high-fire position.

A common problem

Faulty electrical connections are common causes of mod motor malfunctions. Faulty connections can be caused from loose connections, dust, or corrosion from moisture. Connection problems may occur at the following locations:

- Terminals in mod motor. (**Fig. 4**)
- Terminals on temperature controller (**Fig. 5**).
- Terminal strip on back plate of heater panel (**Fig. 6**).
- Terminal strip in burner junction box (**Fig. 7**).

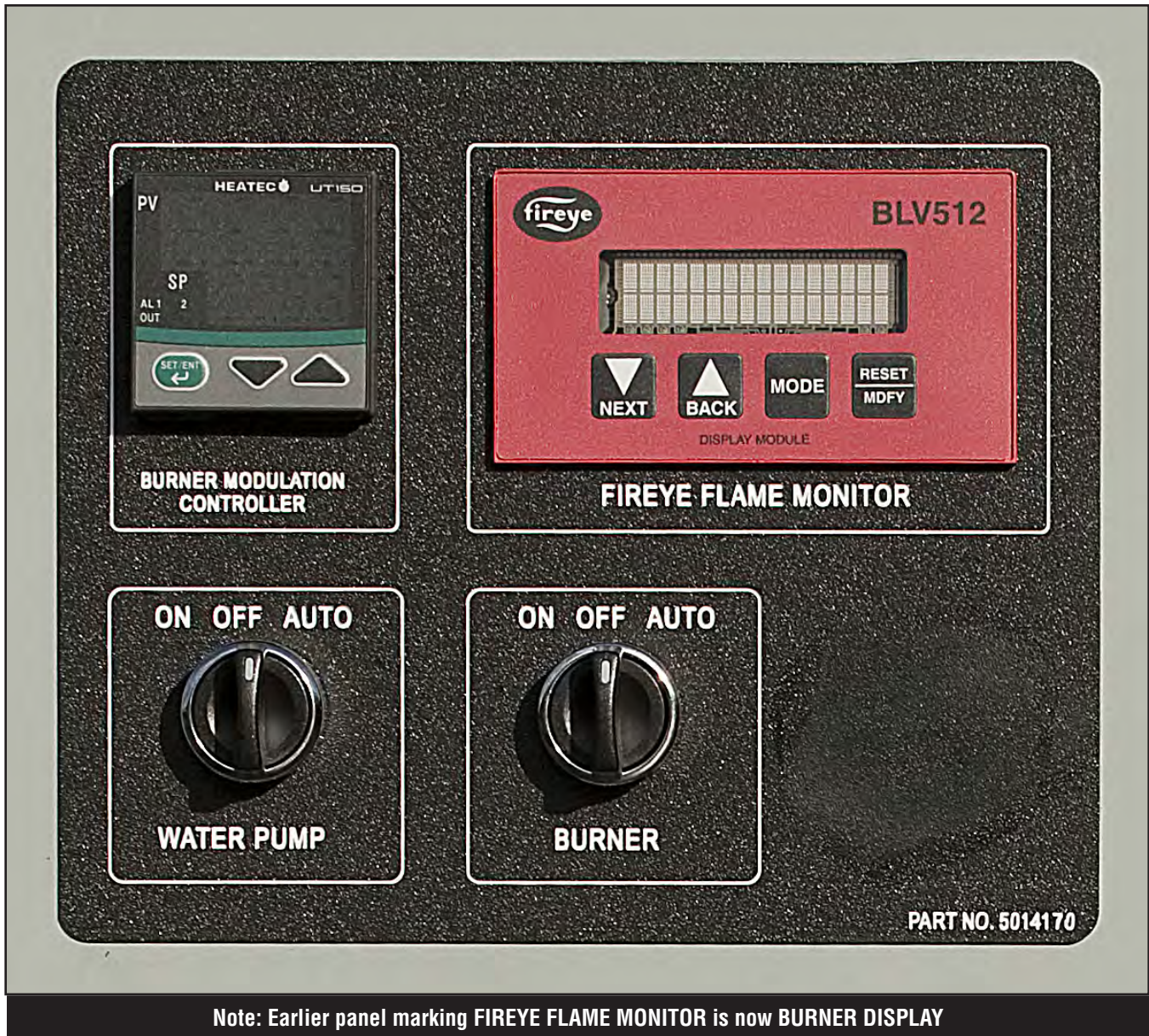


Figure 3. Firestorm controls.

Other problems

- Slippage of cams (**Fig. 2**).
- Failure of transformer (**Fig. 2**).

Symptoms of problems

- Mod motor fails to move when burner is first turned on.
- Burner display (**Fig. 3**) indicates abnormal status of either **M-D LIMIT** or **M-8 LIMIT**.
- Mod motor fails to operate the linkage.
- Modulation controller (**Fig. 4**) fails to modulate the mod motor.

Remedy for faulty electrical connections

All wire connections that pertain to the mod motor have either screw terminals or cage-clamp spring terminals. (**Fig. 4, 5, 6 and 7**). On connections with screw terminals use a screwdriver to slightly loosen the screws and retighten them. On connections with cage clamps, push on the wire, wiggle it and then pull on it to make sure it is held tightly.

Checking and resetting cams

1. Remove the top cover so that you can gain access to the tops of the cams (**Fig. 2**).

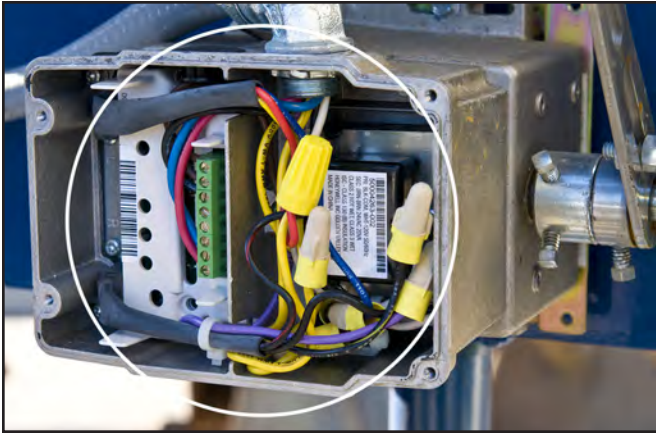


Figure 4. Terminal connections in mod motor.

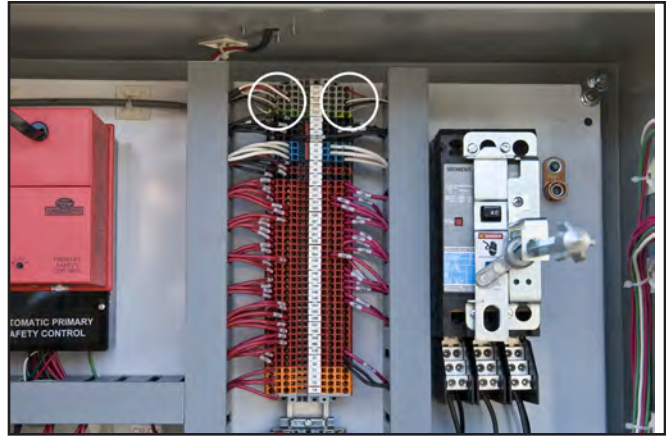


Figure 6. Terminal connections on back plate of heater panel.

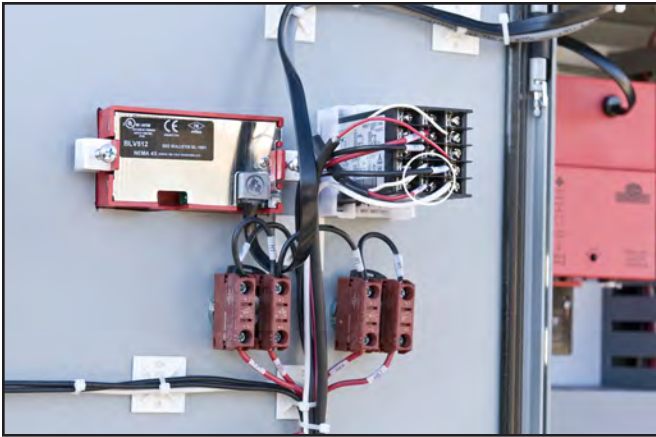


Figure 5. Terminal connections on modulation controller.



Figure 7 Terminal connections in burner junction box.

2. Make sure the shaft of the mod motor is rotated to its position for a fully closed damper.
3. Check positions of the *target* lobes of the cams. The cams have click stops that hold them in position. Repositioning a cam does not turn the drive shaft of the mod motor.
4. You may be able to rotate the cams with your fingers. Otherwise insert the blade of a screwdriver in the slots of the cam (**Fig. 8**) and rotate them.
5. In order to make sure the cams are positioned properly you may need to rotate them until you can see their *target* lobes (indicated by yellow dots in **Fig. 9**) and then reset them to their proper positions. NOTE: The yellow dots are only shown in **Fig. 9**. There are no dots on the actual lobes.
6. You can also use the blade of a small screwdriver to press on the actuating arms of



Figure 8. Using screwdriver to position cams.

the switches to determine whether they are actuated. The switches *should not* be actuated while the damper is closed. Thus you should hear a distinct click if you press on their actuating arms.

7. Make sure the *target* lobes of the two cams are rotated to the positions shown in **Fig. 9**. The

U-shaped ends of the switch arms should rest on the cams as shown in **Fig. 9**.

Checking transformer in the mod motor

1. Make sure **BURNER** switch is set to **OFF**.
2. Make sure there is 120 Vac on the primary winding of the transformer using an ac voltmeter. Check for 24 Vac on its secondary winding. The transformer is defective if there is no voltage on its secondary winding.

Checking terminal board and motor (Fig. 2)

1. Make sure **BURNER** switch is set to **OFF**.
2. Make sure its transformer is not defective. Refer to instructions above.
3. Disconnect wires from terminals **F**, **+**, and **-** of the terminal board.
4. Connect a short jumper wire from terminals **-** to **F**. The motor of the actuator should go to high-fire, indicating that the terminal board and
5. motor are okay. If the motor moves, remove jumper and reconnect wires to **F**, **+**, and **-** of the terminal board. Otherwise, remove jumper only and continue with the following steps.
5. Set main disconnect switch on door of control panel to **OFF**.
6. Remove the two brown wires from terminals **T1** and **T2**. Remove terminal board.
7. Reconnect one brown wire to the connector prong marked **T1** on the circuit board. Connect the other brown wire to the connector prong marked **T2** on the circuit board.
8. Temporarily connect a short jumper wire from the connector prong marked **-** to prong marked **F**.
9. Set main disconnect switch on door of control panel to **ON**.
10. If motor moves it is good, but terminal board is defective and must be replaced. If motor does not move replace motor.

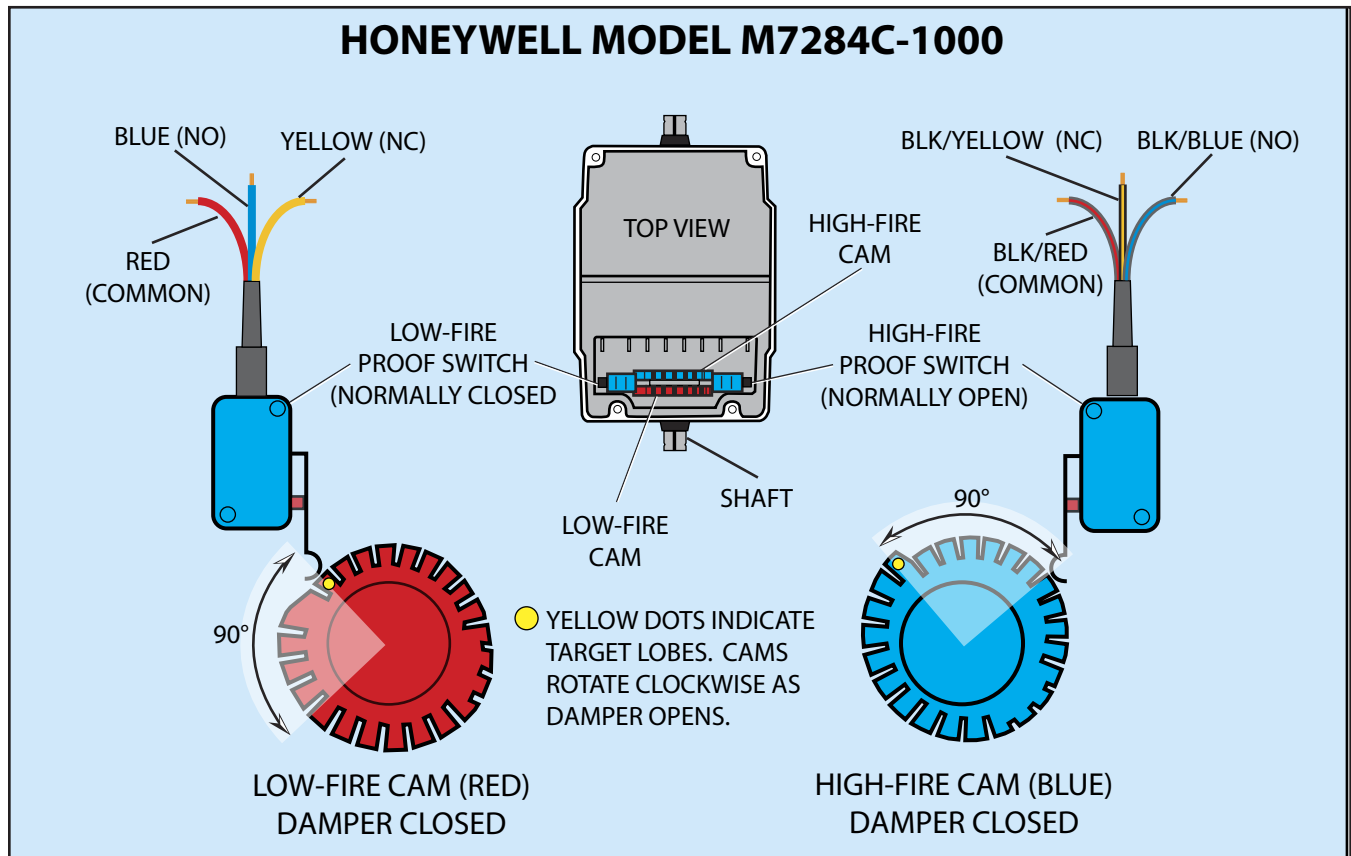


Figure 9. Configuration of cams and switches.