

# Installation Instructions

## General Instructions

**Important: Do not discard packing material until all loose items are accounted for.**

To prevent damage in transit, connecting linkage components may be packed separately and shipped loose with your new Maxon MULTI-RATIO™ Mixer, “LG” or “HG” Mixing Tube system.

The mixer itself is normally only a part of your complete combustion system. Additional pipe train accessories and control components will be required for a complete system installation. The sketches at right show typical gas trains as might be used with “LG”/“HG” Mixing Tubes or MULTI-RATIO™ Mixers.

- Combustion air blower** provides the air supply to your combustion system and is essential to the mixing of fuel gas. It should be located in the coolest, cleanest position that you can find near the burner itself. It must not be exposed to direct radiant heat or positioned where it might draw in the inert gases or hot air rising from a furnace or oven. If problems exist, consider filters, relocation and/or ducting of an outside fresh air supply.
- Electrical service** must match the voltage, phase and cycle of all electrical system components and be compatible with burner nameplate ratings. Insure that all normal control safeguards are satisfied. Combustion air blower should continue to run after shutdown to allow burner to cool.
- Gas supply piping** must be large enough to maintain the required fuel pressures cataloged for the particular burner size used with burner operating at full-rated capacity.

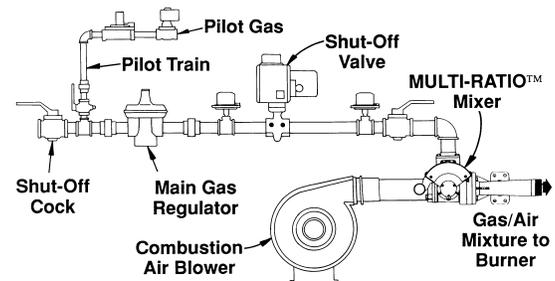
Natural gas pressures generally required (as measured at the mixer gas inlet) are 3" wc to 8 osi for “LG” Mixing Tubes and MULTI-RATIO™ Mixers, or 1 PSIG higher than air pressure for “HG” Mixing Tubes.

Anything more than minimal distance or piping turns may necessitate “oversizing” piping runs to keep pressure drops within acceptable ranges.

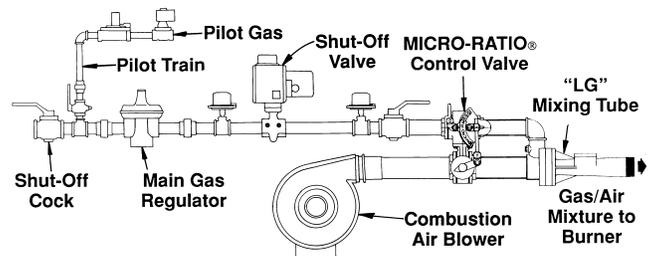
Inlet pipe leading to any burner should be at least four pipe diameters in length. If multiple burners are fed from a single gas train, care should be taken to minimize pressure drop and give maximum uniformity.

Piping Layouts as sometimes required by insurance and standards groups

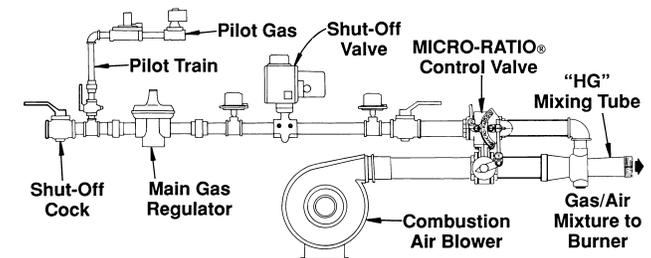
## MULTI-RATIO™ Mixer System



## “LG” Mixing Tube System



## “HG” Mixing Tube System



**Maxon assumes no responsibility for the use or misuse of the piping layouts shown. Specific piping and wiring diagrams should always be submitted to the appropriate agencies for approval on each application.**

## Installation Instructions

4. **Clean fuel lines** are essential to prevent blockage of pipe train components or burner gas ports. All dirt, scale and pipe dope should be blown out of any new gas line before actually connecting to the burner system.
5. **Main gas shut-off cock** should be upstream of both main gas regulator and pilot line take-off. Use it to shut off fuel to both pilot and main burner during shutdown periods of more than a few hours. Maxon Control Valves, such as the MULTI-RATIO™ Mixer and MICRO-RATIO® Valve, are not intended for tight shut-off.
6. **Main gas regulator** is essential to maintain a uniform system supply pressure. A separate regulator should be provided in the branch leading to each burner system if more than one is served by a common main. Size regulator for full system capacity at required pressure, including pipe train losses. Follow the instructions attached to the regulator during installation.
7. **Pilot take-off** should be upstream of main gas regulator but downstream of main gas cock. It should normally include its own pilot gas regulator (selected to meet pilot flow and pressure needs), a solenoid valve and shut-off cock. An adjustable gas orifice at the pilot inlet simplifies adjustment.

Appropriate pilots should be provided which are compatible with the type of burner and control system being used.
8. **Fuel shut-off valves** (when properly connected to a safety control system) shut the fuel supply off when a hazardous operating condition is sensed. Manual reset valves require operator attendance each time the system is started up (or restarted after a trip-out). Motorized shut-off valves permit automatic start/restart when used with appropriate control system.
9. **Minimums:** The MULTI-RATIO™ Mixer includes a minimum air valve adjusting screw on the side of the screw carrier for setting the minimum differential mixture pressures.

See specific start-up and adjusting instructions for systems involving Maxon MICRO-RATIO® Control Valves to set minimums.
10. **Minimize combustion air pressure drop** between blower and mixer. Keep a minimum straight run of four pipe diameters into the mixer air inlet. Downstream piping from mixer to burner should be kept as short as possible.
11. **Inlet pipe leading** to any burner should be at least four pipe diameters in length. If the mixer is supplying multiple burners or multiple inlets to a single burner element, care should be taken so that air/gas mixture piping gives minimum pressure drop and maximum uniformity. **Do not install any shut-off device in the air/gas mixture line.**
12. **Test connections** are essential for burner adjustment. At a minimum, they should be provided downstream of the mixing tube and at each burner inlet. Test connections should never be installed in elbows or pipe tees. **Test connections must be plugged except when readings are being taken.**
13. **Vent dampers and pressure controllers** should be used to maintain balanced or slightly positive furnace pressures (0.0" to 0.5" wc) for maximum efficiency. Excessive back pressure can damage furnace and/or reduce burner capacity. Negative pressures allow infiltration of secondary air and can seriously affect efficiency and temperature uniformity.



*Maxon practices a policy of continuous product improvement. It reserves the right to alter specifications without prior notice.*

## Start-Up Instructions

Read complete instructions before proceeding, and familiarize yourself with all the system's equipment components. Verify that your equipment has been installed in accordance with the original manufacturer's current instructions.

**CAUTION: Initial adjustment and light off should be undertaken only by trained and experienced personnel familiar with combustion systems, with control/safety circuitry, and with knowledge of the overall installation. Instructions provided by the company and/or individuals responsible for the manufacture and/or overall installation of complete system incorporating Maxon burners take precedence over these provided by Maxon. If Maxon instructions conflict with any codes or regulations, contact Maxon Corporation before attempting start-up.**

### For initial burner start-up:

1. **Close all burner fuel valves and cocks.** Make preliminary adjustments to fuel gas regulators. Remove pilot and main gas regulators' adjusting screw covers. Turn adjusting screw down (clockwise) to approximately mid-position. Close pilot gas adjustable orifice screw by turning in clockwise until it stops. (Do not over-tighten.) Then back out the adjustable orifice (counter-clockwise) approximately 2-3 turns.
2. **Check all electric circuitry.** Verify that all control devices and interlocks are operable and functioning within their respective settings/ranges. Be sure all air and gas manifolds are tight and that test ports are plugged if not being used.
3. **Check that all duct and chamber dampers are properly positioned** and locked into operating positions.
4. **Disconnect the automatic control motor's linkage** from your MICRO-RATIO® Control Valve or MULTI-RATIO™ Mixer's operating crank arm by loosening the control motor's connecting rod from the toggle linkage.

**Initial start-up adjustment should only be accomplished during a "manual" burner control mode.**

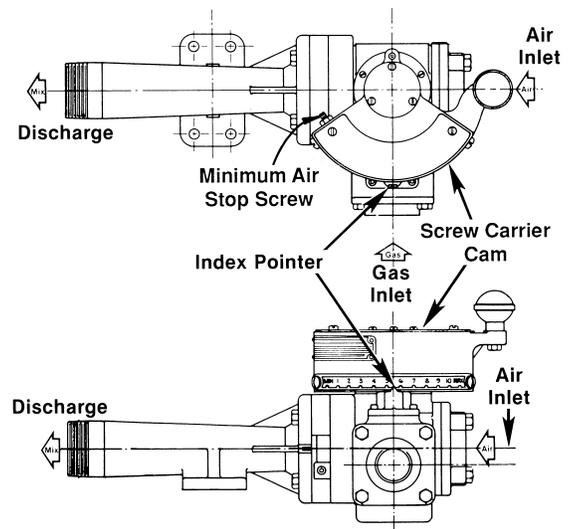
5. **Start all system-related fans and blowers.** Check for proper blower motor rotation and impeller direction. Verify that all control interlocks

are working. Allow air handling equipment to run for adequate purge of your manifolds and combustion chamber plenums. With main gas shut off, manually advance MULTI-RATIO™ Mixer or MICRO-RATIO® Control Valve's operating crank to "high fire" position so that air only flows through burner and combustion chamber.

**CAUTION: Do not by-pass control panel timers typically controlling sequential operations.**

6. **Check minimum mixture pressure** at burners by turning the MULTI-RATIO™ Mixer or MICRO-RATIO® Control Valve to its minimum position and reading differential air pressure only at each burner with a water column manometer. Any reading below 0.25" wc differential (natural gas), or 0.10" wc for VF LINOFLAME® Burners, requires re-adjustment as described below.
- 6A. **Setting minimum mixture pressure with MULTI-RATIO™ Mixer system:**

If minimum mixture pressure must be increased, open the MULTI-RATIO™ Mixer slowly (by turning toward the higher-numbered positions) until the required minimum differential air pressure is reached. Mark air valve dial at the position opposite pointer and note the numbered position on screw carrier cam assembly which is opposite index pointer (see sketch below).



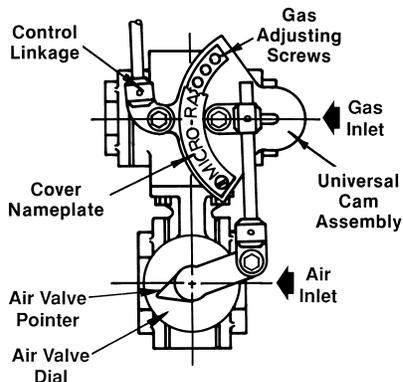
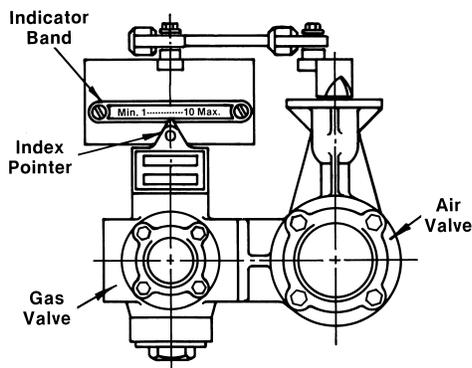
## Start-Up Instructions

Screw in on the minimum air stop screw on the side of the screw carrier cam. This makes a physical "stop" that prohibits the screw carrier from going all the way down to the minimum firing positions. Screw down until the established minimum differential air pressure readings at each burner are above the minimum mixture pressure settings described in step 6.

Tighten down on the locking nut on the minimum air stop screw to lock the MULTI-RATIO™ Mixer at the minimum air mixture pressure setting.

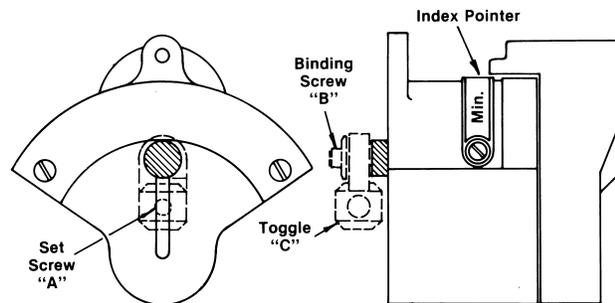
### 6B. Setting minimum mixture pressure with a MICRO-RATIO® Control Valve and Series "LG" or "HG" Mixing Tube system:

If minimum mixture pressure must be increased, open the MICRO-RATIO® air valve slowly (by turning toward higher-numbered positions) until the required differential air (mixture) pressure is reached, then mark air valve dial at the position opposite pointer. This point will become the minimum air setting for your MICRO-RATIO® Valve mixing tube system (see sketch below).



Continue opening the MICRO-RATIO® air valve while watching the manometer connected into the burner's air/gas mixture manifold. Determine the point at which further opening of the air valve gives no appreciable increase in air pressure within the manifold/burner. Mark the air valve dial at this position opposite the air valve pointer. This point will become the maximum air setting for your MICRO-RATIO® Valve mixing tube system.

Having marked and/or recorded the MICRO-RATIO® Control Valve's air valve settings for both minimum and maximum firing positions, you may adjust the linkage and travel of the gas valve's stroke (see sketch below).



Loosen Allen set screw "A" and binding screw "B" in toggle "C". Move the toggle in universal cam assembly slot towards the center of rotation so that gas valve can rotate from its minimum to maximum position, while the air valve swings between the established (and marked) minimum and maximum settings.

Place air valve on pre-determined "minimum" position and rotate gas valve to its "minimum" setting position. Tighten down set screw "A" and binding screw "B" with both valves set at "minimum".

Establish set screw "A" as minimum-end adjustment point and binding screw "B" as maximum-end adjustment point. (Note: It doesn't matter which is maximum or minimum, as long as you identify and keep the same reference points for the next adjustment steps.)

Now rotate MICRO-RATIO® Valve to "maximum" position. The air valve maximum setting was previously determined. Loosen binding screw "B" and adjust pointer and linkage to correct just half of the distance required to make the air valve pointer indicate the maximum air valve setting.



*Maxon practices a policy of continuous product improvement. It reserves the right to alter specifications without prior notice.*

## Start-Up Instructions

Re-tighten binding screw "B" and return the MICRO-RATIO® Valve to the "minimum" air setting.

This time, loosen set screw "A" and again correct for just half of the distance required to make the air valve pointer indicate the minimum air valve setting.

Re-tighten set screw "A" and again return the MICRO-RATIO® Valve to its maximum position.

Similarly, correct one half the distance with binding screw "B" for the maximum setting, etc.

Continue this adjustment procedure until the gas and air valves reach their minimum and maximum positions simultaneously. Normally, this is accomplished within seven adjustments.

7. **Remove cover plate** from screw carrier cam assembly and turn all adjusting screws counter-clockwise until flush with outer surface of casting (new equipment is shipped this way).
8. **Open main and pilot gas cocks** and light first burner pilot following instructions appropriate for that burner and pilot type. If multiple pilots are used, open individual cocks and adjust each in turn.

To light and adjust gas pilot: Check to insure pilot combustion air supply is flowing to any pressure pilot mixer. Pilot gas regulator should initially be set at approximately midpoint of its adjustment range. With pilot gas solenoid closed, open main fuel gas and pilot gas cock. Energize spark ignitor and pilot gas solenoid. Observe pilot ignition through sight port of pilot assembly and/or by viewing micro-amp signal metered from flame safeguard relay circuit.

Refine pilot setting for a hard blue flame (and/or strongest micro-amp signal) by adjusting gas flow through pilot orifice and/or pilot regulator.

Shut off pilot gas cock to extinguish pilot fire. Re-open and confirm easy re-ignition several times. The flame safeguard relays should now power the main fuel shut-off valves.

9. **Light main burners at minimum** as follows:  
First, turn MICRO-RATIO® Valve or MULTI-RATIO™ Mixer to its minimum setting (which may be at position 1 or 2 after completing step 6), then open fuel shut-off valve and turn corresponding screw in (clockwise) until flame ignites at all burner nozzles. (This may take several turns of the screw.)

**NOTE:** At this point, it is more important to get any kind of a flame as soon as possible. The flame geometry can be adjusted and refined as needed later.

Continue turning in slowly until flame becomes noticeably rich (usually purple or green with a slight yellow tip). Then slowly back the screw out until the flame becomes bright blue.

10. Once your flame is established and refined at this position, and without advancing the screw carrier quadrant higher, screw all remaining screws down to at least the same level as your first adjusted screw.

**NOTE:** A preliminary setting can be established with all the remaining adjusting screws. Generally, each succeeding screw needs to be screwed in approximately one full turn more (clockwise) than its preceding screw. A smooth "stair-step" gradient pre-set at this point from low to high will simplify the remaining adjustment steps.

**CAUTION: If flame is extinguished, immediately return MICRO-RATIO® Control Valve or MULTI-RATIO™ Mixer to minimum position and shut off fuel (if flame safeguard has not already done so). Turn in slightly on adjusting screw at point where ignition was lost, then return valve/mixer to minimum position, re-establish pilots, open fuel valve and verify ignition.**

11. Without advancing the valve/mixer quadrant, screw down clockwise on #2 screw (one or two turns). Then slowly advance the screw carrier quadrant to the #2 position. Adjust flame appearance at this new position #2.

**NOTE:** If firing chamber is of refractory construction, allow your burner system to operate at this low setting for the necessary dry/cure-out time period recommended by the chamber or refractory manufacturer. Then continue adjustments of valve/mixer.

## Start-Up Instructions

12. Again, without moving valve/mixer, bring #3 and all remaining adjusting screws down to the same level as #2 screw.

**NOTE:** If approximate pre-set gradient was made earlier, the remaining screws will already be at or below appropriate levels.

Progressively work your way up through each adjusting screw position, developing a smooth progression slope from your first screw to the "maximum" position.

As each is adjusted, you must turn the remaining unadjusted screws in at least that far to prevent possible damage to flexible cam strips inside the screw carrier cam assembly.

Turning a screw in "clockwise" gives more gas at that setting; turning it out gives less.

**NOTE:** To adjust the flame at any position, you must move the valve quadrant to the number you desire to adjust. This aligns the adjusting screw directly on top of the fuel valve plunger. A resulting adjustment of the screw is directly applied to the fuel valve plunger and its interconnected valve body linkage.

13. **Cycle burner from minimum to maximum** and refine adjustment, if necessary.

For operation with interrupted pilot (as recommended), shut off pilots and cycle burner from minimum to maximum and back several times to verify the flame is maintained.

**CAUTION: After completing previously listed steps, check all interlocking safety components and circuitry to prove that they are properly installed, correctly set, and fully operational. If in doubt, shut the system down, close main and pilot cocks and contact responsible individual before proceeding further.**

14. **Reconnect linkage** to control motor, plug all test connections, replace equipment cover caps and tighten linkage screws.
15. **Check out overall system operation** by cycling through light-off at minimum, interrupting pilot, and allowing temperature control system to cycle burner from minimum to maximum and return. **Re-check all safety system interlocks** for proper setting and operation.

**WARNING: Test every UV installation for dangerous spark excitation from ignitors and other possible sources of direct or reflected UV radiation. Use only gas-tight scanner connections.**

16. **Before system is placed into full service, instruct operator personnel** on proper start-up, operation and shut-down of system. Establish written instructions for their future reference.



*Maxon practices a policy of continuous product improvement. It reserves the right to alter specifications without prior notice.*