



SERIES 21/31 INSTALLATION INSTRUCTIONS and field service check list

MAXITROL® company

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System Components

SERIES 21 Amplifiers (single furnace):

- A1010A - use with TD121
- A1010B - high fire ignition - use with TD121
- A1010E - integral temp. selector
- A1010F - integral temp. selector and high fire ignition

SERIES 31 Amplifiers (multiple furnace):

- A1011A - use with TD121
- A1011B - high fire ignition - use with TD121
- A1011E - integral temp. selector
- A1011F - integral temp. selector and high fire ignition

Modulator-Regulator Valves:

- MR410 - (3/8" and 1/2" pipe size)
- MR510 - (1/2" and 3/4" pipe size)
- MR610 - (3/4" and 1" pipe size)

Remote Temperature Selectors:

- TD121 - (55° to 90° F)
- TD121A - (80° to 130° F)
- TD121B - (120° to 170° F)
- TD121C - (160° to 210° F)
- TD121D - (200° to 250° F)
- TD121E - (100° to 250° F)
- TD121F - (40° to 80° F)

NOTE: Remote Selector and Discharge Temperature Sensor must have same temperature range to be compatible.

Optional: ETD-1 enclosure,
EFP-1 cover plate only - no enclosure

Discharge Temperature Sensors: use with Mixing Tube

- TS121 - (55° to 90° F)
- TS121A - (80° to 130° F)
- TS121B - (120° to 170° F)
- TS121C - (160° to 210° F)
- TS121D - (200° to 250° F)
- TS121E - (100° to 250° F)
- TS121F - (40° to 80° F)

Mixing Tubes: used with Sensors

- MT1-9 or 2-9 (9" length)
- MT1-12 or 2-12 (12" length)
- MT1-23 or 2-23 (23" length)
- MT1-28 or 2-28 (28" length)
- MT1-57 (57" length)

Optional:

Inlet Air Sensors: use with Mixing Tube

- TS10765A - (8:1 ratio)
- TS10765B - (5:1 ratio)
- TS10765C - (3.5:1 ratio)

Override Stat: use with TD121 only

- T115 - (40° to 90° F)



A1010 Amplifier



A1011 Amplifier



Override Stat



Sensor and Mixing Tube



Remote Temperature Selector



Valve

Introduction and Dimensions

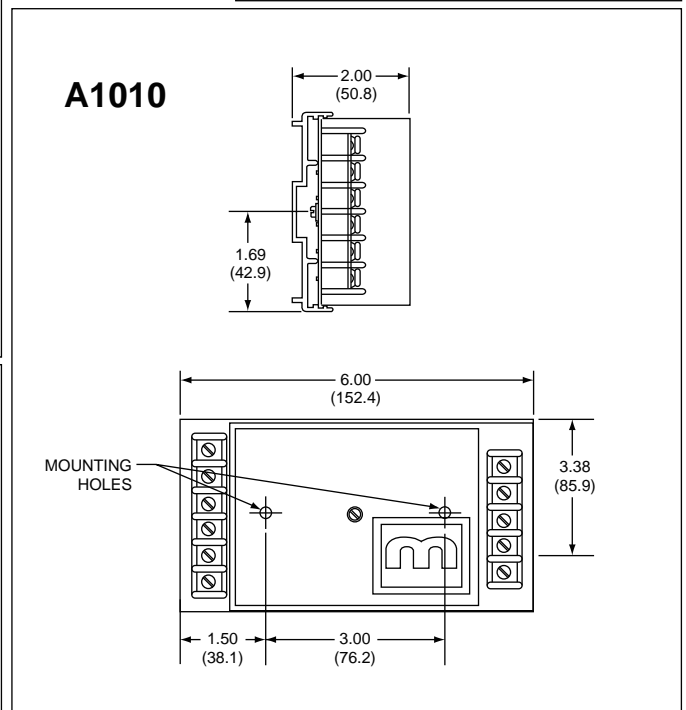
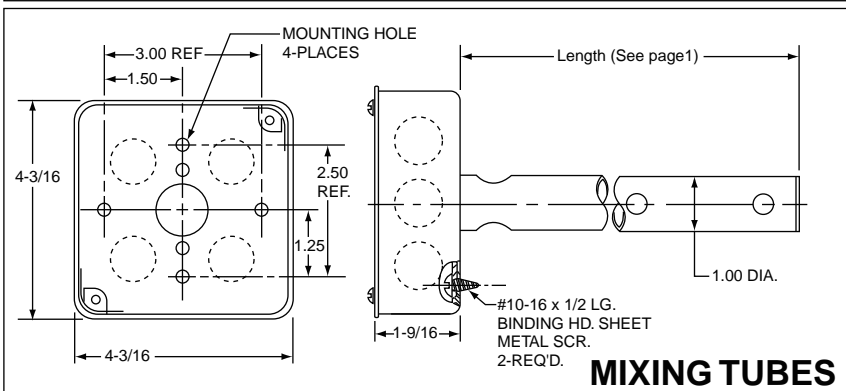
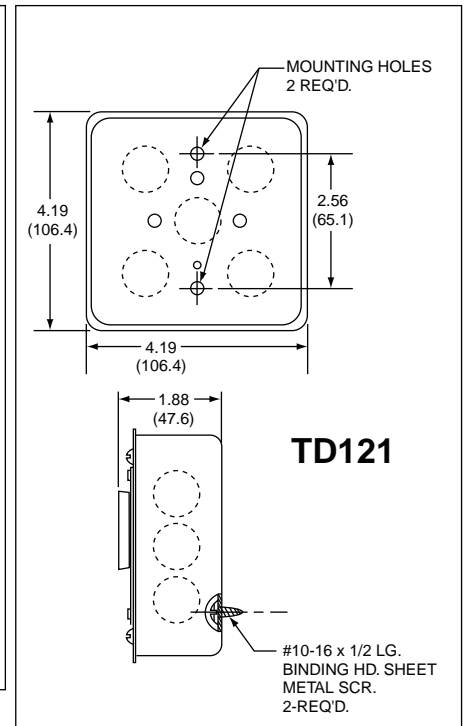
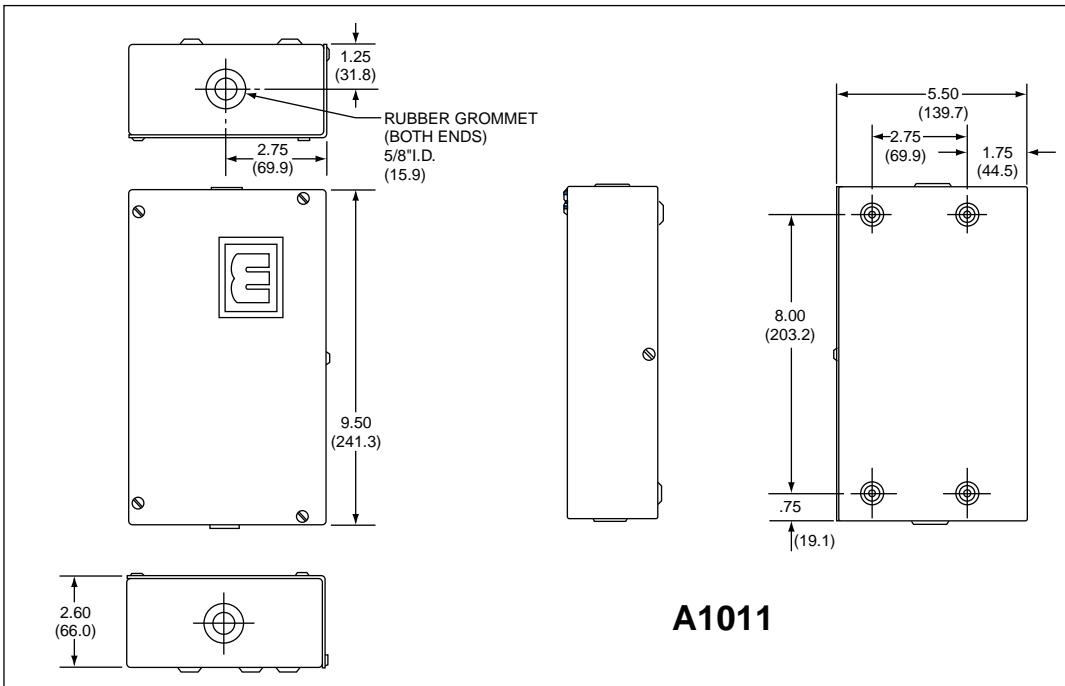
Selectra SERIES 21/31 electronic gas flame modulation systems are designed primarily for make-up air heating, as components of indirect fired units with atmospheric burners. All fuel gases are compatible.

The SERIES 21 is designed for single function operation, and the SERIES 31 is capable of handling up to four furnances. They may be field installed on existing equipment or specified for new equipment installation.

The systems utilize Modulator-Regulator valves. Amplifiers are available for high-fire ignition with

integral or remote temperature selection. A discharge air temperature sensor is mounted within a mixing tube housing. Optionally, a room override thermostat provides space temperature control by raising the discharge air temperature to a pre-selected point - when used in conjunction with the remote temperature selector.

Also optional, an inlet air sensor (and mixing tube) provides inverse change in discharge air for each degree change in inlet air - when installed in a convenient duct location upstream of the burner.



Specifications

Power Requirements:

Single Furnace.....24V AC, 40VA capacity
 Multiple Furnace.....24V AC, 100VA capacity

NOTE: Transformer secondary must not be grounded in any portion of the circuit external to a Maxitrol amplifier. If existing transformer is grounded, a separate isolated transformer must be used. Electrical interference may effect performance and/or damage equipment.

Temperature Control Range:

Standard.....55° to 90°F
 Optional ranges to.....250°F

Ambient Limits: -30° to 125° F / -34° to 52° C

Gases: All fuel gases.

Pressure Limits:

Inlet (maximum) MR410 / 510 / 610.....1 psi / 69 mbar

Outlet (maximum fire)
 standard spring*.....3.0" to 5.0" w.c. / 7 to 12 mbar
 H - models.....7.5" to 12" w.c. / 19 to 30 mbar
Max. set point not to exceed 10" w.c. above min.set point

Outlet (minimum fire)
 MR*10B10L standard spring*.....0.2" to 1.2" w.c. / .5 to 3 mbar
 MR*10B10L-1 spring*.....1" to 2.8" w.c. / 2.5 to 7 mbar
** other spring ranges available - consult factory*

Installation of Components

Wiring Run: Control wires connected to the Override Stat, Discharge Air Sensor, or Remote Temperature Selector must not be run close to or inside conduit with power or ignition wires. Doing so may cause the unit to function erratically or may destroy the amplifier. If shielded wires are used, shield must be insulated and grounded at the amplifier location only.

Amplifier: Slide or snap out circuit board from amplifier base. Mount base with two screws in chosen location protected from weather or contaminated atmosphere. Amplifier is ready for wiring when circuit board is replaced on base - protective cover need not be removed.

Discharge Temperature Sensor (in Mixing Tube): Cut hole in air duct - install several feet from heat exchanger to avoid thermal radiation effects. Locate in discharge air stream. Remove cover and wire as shown in diagram, page 7 - reassemble.

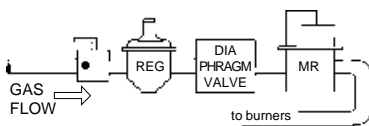
Remote Selector: Install in control cabinet or other chosen location. Remove cover and wire as shown in diagram, page 7 - reassemble.

Room Override Thermostat: Place in heated area to sense average room temperature, not in direct path of discharge air stream. Use only with TD121 Remote Temperature Selector. Wire as shown in diagram, page 7.

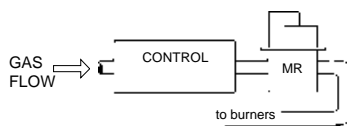
Note: For systems using up to four automatic gas valves with 0.8 amp maximum current each, a 100VA transformer will be adequate.

In the event that an automatic valve's current exceeds 0.8 amps, it would be advisable to wire according to the 'Independent Power Supply' diagram, page 7. The transformer for the modulating power - terminals 8 and 9 - should be 40VA, and the automatic valve transformer should be capable of handling required loads up to 3.5 amps maximum. If exceeding 3.5 amps, it will be necessary to operate an auxiliary relay with contact rating sufficient to handle the automatic valves.

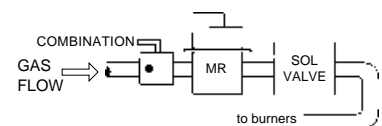
Valve: The MR valve must be in upright position, in a horizontal run of pipe only, with pilot gas supply upstream.



If diaphragm type automatic gas valve is used with separate regulator, install MR valve downstream from diaphragm gas valve. Retain regulator in manifold and adjust 2 or 3 turns to compensate for pressure drop of MR valve.



If full combination control is used, install MR valve downstream. Adjust regulator in combination control 2 or 3 turns to compensate for pressure drop at MR valve.



If solenoid type automatic gas valve is used with separate regulator, replace regulator with the MR valve.

Field Service Checklist

SYMPTOM	POSSIBLE CAUSE	FIELD TEST	REMEDY
<p>A. Automatic control valve will not close despite full range of modulating voltage at terminals 1 and 2.</p>	<ol style="list-style-type: none"> Faulty automatic control valve. Installation wiring error. Amplifier is faulty. 	<ol style="list-style-type: none"> Remove wire from valve, if valve does not close valve is faulty. Remove wire from amplifier terminal 10 or 11. If valve remains open, check for miswiring. If AC voltage will not drop at terminals 8 and 11 - when DC voltage at terminals 1 and 2 is above 20V DC - amplifier is faulty. If space temperature is less than 60° or greater than 85°F (<16° or >29°C), see Preliminary Circuit Analysis, page 6. 	<ol style="list-style-type: none"> Replace automatic control valve. Correct wiring. Replace amplifier.
<p>B. Automatic control valve won't open despite full range of modulating voltage at terminals 1 and 2.</p>	<ol style="list-style-type: none"> Faulty automatic control valve. Open wire to automatic valve. Amplifier is faulty. 	<ol style="list-style-type: none"> Read voltage across valve terminals. If 24V AC, valve is faulty. Read voltage across terminals 8 and 11 on amplifier. If 24V AC, check for open circuit to automatic valve. If space temperature is less than 60° or greater than 85°F (<16° or >29°C), see Preliminary circuit Analysis, page 6. If AC voltage reading remains zero - when DC voltage at terminals 1 and 2 is below 14V DC - amplifier is faulty. If space temperature is less than 60° or greater than 85°F (<16° or >29°C), see Preliminary Circuit Analysis, page 6. 	<ol style="list-style-type: none"> Replace automatic control valve. Correct wiring. Replace amplifier.
<p>C. No gas flow.</p>	<ol style="list-style-type: none"> Faulty power supply. MR valve installed backwards. 	<ol style="list-style-type: none"> Read voltage at amplifier terminals 8 and 14 (24V AC). Arrow on MR valve should point in direction of gas flow. 	<ol style="list-style-type: none"> Power supply must be 24V AC. Install properly.
<p>D. Continuous high fire.</p>	<ol style="list-style-type: none"> Room Override Thermostat, if used, calls for heat. Open circuit in sensing and setting circuit. 	<ol style="list-style-type: none"> Remove T1 15 wires from amplifier terminals 3 and 14. Disconnect and measure across wires connected to amplifier terminals 3 and 4 (A1010 models). Should read between 8,000 and 12,000 ohms. 	<ol style="list-style-type: none"> If proper operation is obtained, check the thermostat wiring for shorts. Rotate thermostat dial above and below room temperature to prove thermostat function. If above 12,000 ohms, check circuit for open or loose wires.
<p>E. Continuous high fire but automatic valve cycles.</p>	<ol style="list-style-type: none"> Open circuit in wiring to MR valve. Plunger jammed or installed upside down. Faulty MR valve. 	<ol style="list-style-type: none"> Check wiring for defects. Plunger should be smooth, clean, and operate freely in solenoid sleeve. Measure voltage across MR valve. 	<ol style="list-style-type: none"> Replace wiring if necessary. Clean or replace plunger. If modulating voltages are obtained but no gas modulation, MR valve is faulty. Replace if necessary.
<p>F. Furnace won't activate due to constant high modulating voltage (above 17V DC).</p>	<ol style="list-style-type: none"> Short circuit in sensing and setting circuit. 	<ol style="list-style-type: none"> Disconnect and measure across wires connected to amplifier terminals 3 and 4 (A1010 models). Should read between 8,000 and 12,000 ohms. 	<ol style="list-style-type: none"> If below 8,000 ohms, check circuit for shorts or miswiring.
<p>G. Continuous low or medium fire, but automatic valve cycles correctly.</p>	<ol style="list-style-type: none"> Heat load requires low fire only. Plunger and/or maximum spring missing. Jammed plunger Other valve faults. Inadequate supply pressure. 	<ol style="list-style-type: none"> Increase temperature setting 10 degrees. Check for parts (see 'Valve Adjustments' figure, page 8). Examine. Plunger should be clean, smooth, and operate freely in solenoid sleeve. Remove wire from MR valve. Remove spring 5 from MR valve (see valve figure, page 8), push down on plunger. Insufficient manifold pressure with furnace operating indicates supply is too low. 	<ol style="list-style-type: none"> If heater goes to high fire, system is working correctly. Install correct parts. Clean, or replace plunger if necessary. If MR valve remains on low fire, valve may be faulty. Check item 19 below, then replace valve if necessary. Check for obstruction in gas pipe ahead of controls. Increase gas pressure if possible.
<p>H. Incorrect discharge air temperature.</p>	<ol style="list-style-type: none"> Calibration. 	<ol style="list-style-type: none"> Check seal on calibration potentiometer. 	<ol style="list-style-type: none"> Recalibrate per 'Temperature Calibration' procedure.
<p>I. Erratic or severely pulsating flame.</p>	<ol style="list-style-type: none"> Dirty or sticking plunger. Intermittent shorting in wiring. Faulty amplifier. 	<ol style="list-style-type: none"> Examine. Plunger should be clean, smooth, and operate freely in solenoid sleeve. Inspect wiring. Observe DC voltage across amplifier terminals 1 and 2. 	<ol style="list-style-type: none"> Clean, or replace plunger if necessary. Correct wiring. If erratic or pulsating DC voltage is observed and wiring shows no defects, replace amplifier. If erratic or pulsating voltage continues, contact Maxitrol.

***Control circuits external to the Series 21 and 31 can cause burner malfunction. Always check manual valve to be certain gas is on, and check limit controls for normal operation.**

Preliminary Circuit Analysis

In order to diagnose the cause of problems in this system it is necessary to determine certain values. It is helpful to have an AC and DC voltmeter and an ohmmeter capable of reading 0 to 15,000 ohms. For ease in trouble shooting, it is necessary to rewire the system, replacing the discharge air sensor with a 4500 ohm (4300 ohm + 200 ohm), 1/2 watt test resistor.

Modulating Function Test:

Connect a DC voltmeter to amplifier terminals 1 and 2. If more convenient, the meter may be attached to the MR valve terminals. Rotate temperature selection knob to maximum setting - the DC volts should read zero. The voltage should gradually increase to at least 20 volts when the temperature selector is slowly rotated to its minimum (generally over a 3° to 4° range).

Automatic Valve Function:

After the electronic modulation function is tested, a voltage reading must be taken across the automatic gas valve. These voltage readings will be approximately 24 V AC with the temperature selection knob at maximum setting, zero volts AC with the selector at minimum setting. The relay switching action should occur when the modulating voltage is between 15 and 19V DC.

If these voltage readings are observed as noted, it is proved that the amplifier and temperature selector are operating properly.

After testing, remove the resistor and reconnect the discharge air sensor.

Performance Check

With the modulator-regulator valve installed as instructed (voltages are approximate)...

Minimum fire is above 14 volts DC.

Manifold pressure can be adjusted as follows:

*MR*10B10L Standard spring* 0.2" to 1.2" w.c.
(.5 to 3 mbar)

*MR*10B10L-1 spring* 1" to 2.8" w.c.
(2.5 to 7 mbar)

Maximum fire is obtained at zero volts DC.

Use manufacturer's pressure specifications when available. Maxitrol standard factory settings are 0.5" w.c. (1.25 mbar) minimum and 3.5" w.c. (8.75 mbar) maximum. H-1 models 1.75" w.c. (4.35 mbar) minimum and 11" w.c. (27 mbar) maximum.

At Temperature Selector:

- 1) Set the selector at least 10° higher than incoming air and allow discharge air temperature to stabilize. Discharge air temperature should agree with temperature selector setting.
- 2) Increase temperature setting by 5° to 10°. Heater manifold pressure should immediately go to high fire.

Manifold pressure will decrease as the discharge air temperature approaches the setting and will stabilize at the temperature setting.

3) Decrease temperature to the original setting. Burner should immediately turn off. Then, as the discharge air temperature decreases, the burner should ignite at low fire. The discharge air temperature should again stabilize at the temperature setting. *On amplifiers containing a high fire ignition function, refer to Extended High-Fire Ignition section below.*

If the preceding readings are not obtained:

- 4) Recheck wiring to ensure system is consistent with appropriate wiring diagram.
- 5) Check power source for 24 volts.
- 6) Some automatic control valves require as much as 20 seconds to open. In this case, check for 24VAC output at automatic valve terminals.

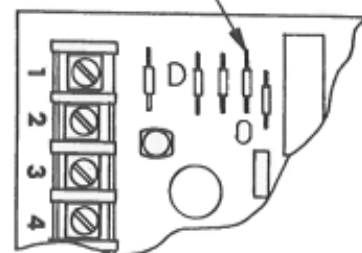
Note: Depending on the Btu capacity of the heater and the temperature rise, the discharge air temperature may be controlled by a continuous modulated flame (high temperature rises) or by on/off operation (low temperature rises).

Extended High-Fire Ignition

On A1010B, A1010F, A1011B, and A1011F amplifiers, the high fire start duration is approximately five seconds. To extend it from 5 seconds to approximately 25 seconds, remove 100K (brown-black-yellow-gold) resistor from board as shown.

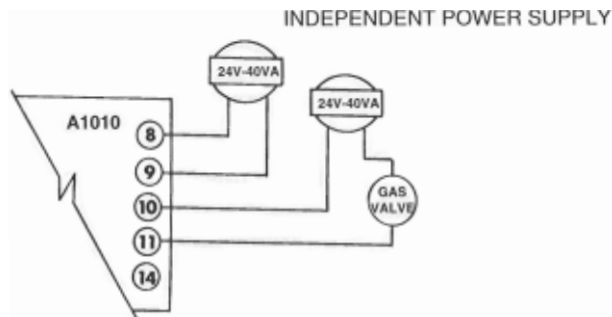
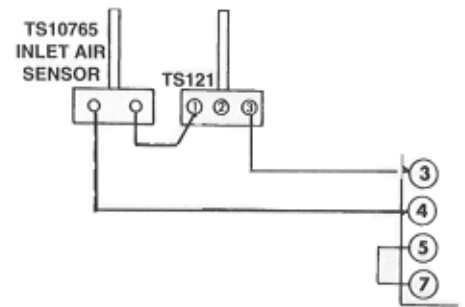
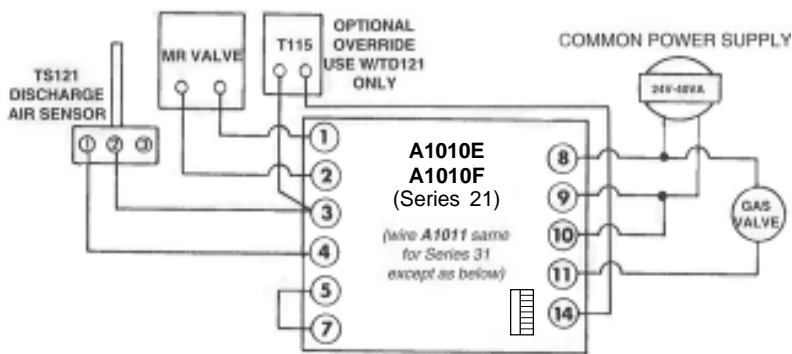
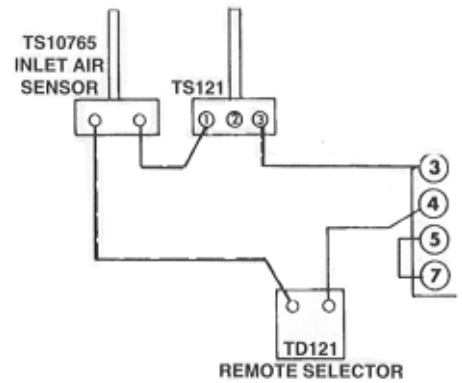
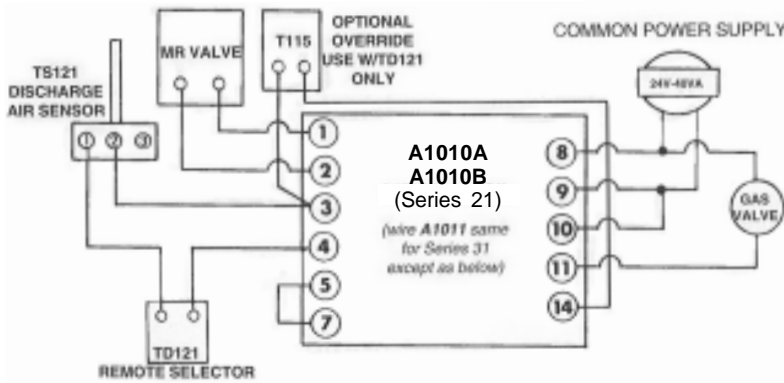
On furnaces equipped with slow opening automatic valves, it is recommended to make this modification.

Snip Off Resistor



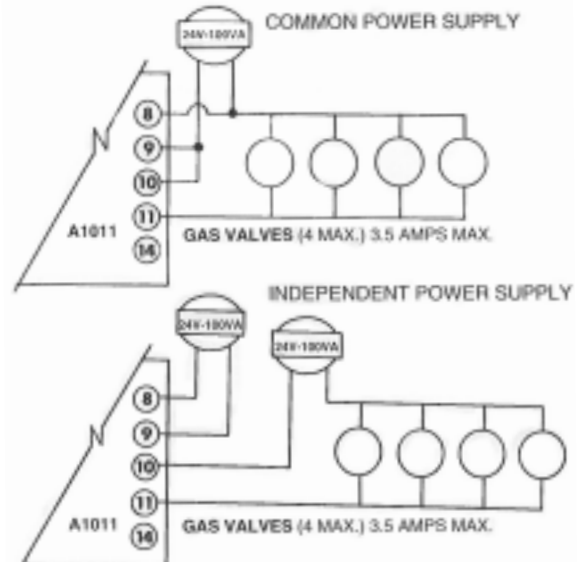
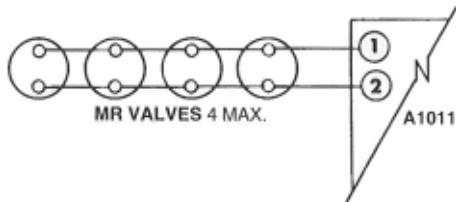
Preliminary Circuit Analysis

Single Furnace Operation - Series 21



Multiple Furnace Operation - Series 31

(MR valves and automatic gas valves wired in parallel as shown)

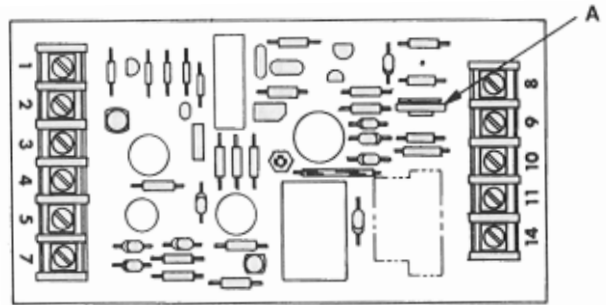


Temperature Calibration

If needed - amplifier potentiometer adjustment - for heat sensing with Discharge Temperature Sensor (TS121) :

Install a thermometer or other temperature measuring device at a point adjacent to the tip of the TS121 Discharge Air Sensor. Set the temperature selector at least 15° above the existing outdoor air temperature. (Accurate calibration cannot be made at temperature differentials of less than 15°.)

Adjust calibrating potentiometer (A) until thermometer reading agrees with temperature setting. **Note:** Adjust (A) in small increments and allow time for the discharge air temperature to stabilize after each adjustment.



Valve Adjustments

(See bulletin MT2035 for additional M/MR valve information)

Note: High Fire Adjustment should be checked whenever Low Fire Adjustment is changed.

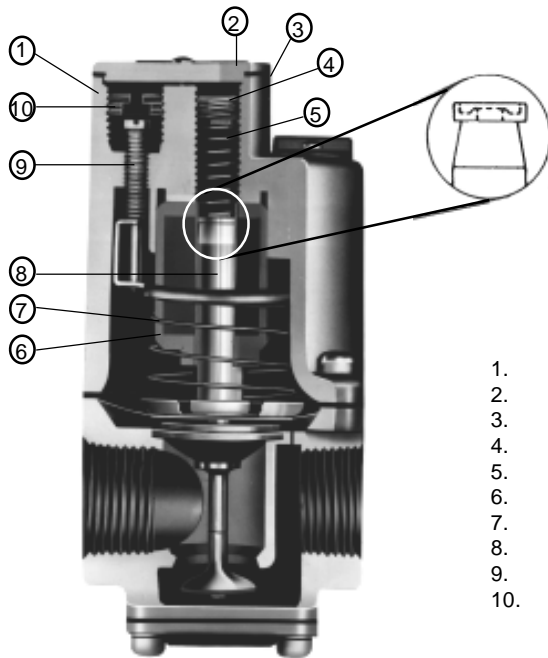
Disconnect wire from amplifier terminal 3, remove cover plate (2).

High Fire Adjustments:

- A) Using maximum adjustment screw (4), set manifold pressure to furnace manufacturer's specifications.
- B) Replace cover plate (2) on Modulator-Regulator valve and reconnect wire to amplifier terminal 3.

Low Fire Adjustments:

- A) Remove maximum adjusting screw (4), spring (5), and plunger (8). A small magnet is useful for this purpose. CAUTION - The plunger is a precision part. Handle carefully to avoid marring or picking up grease and dirt. Do not lubricate.
- B) Using minimum adjusting screw (9), set manifold pressure to furnace manufacturer's specifications.
- C) Replace plunger and spring retainer, spring, and maximum adjusting screw in proper order.



- 1. TOP HOUSING
- 2. COVER PLATE
- 3. SEAL GASKET
- 4. MAXIMUM ADJUSTMENT SCREW
- 5. MAXIMUM ADJUSTMENT SPRING
- 6. SOLENOID
- 7. MINIMUM ADJUSTMENT SPRING
- 8. PLUNGER
- 9. MINIMUM ADJUSTMENT SCREW
- 10. MINIMUM ADJUSTMENT SCREW STOP

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CAUTION: Operation of combustion equipment can be hazardous resulting in bodily injury or equipment damage. Each burner should be supervised by a combustion safeguard and only qualified personnel should install, make system adjustments and perform any required service.



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NOTICE: Maxitrol practices a policy of continuous improvement in the design of its products. It reserves the right to change the specifications at any time without prior notice.

MAXITROL[®]  **company**

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