

# MAXITROL

## Selectra® Series 20 Installation Instructions

### Installation Instructions and field service checklist

#### ⚠ WARNING

Read these instructions carefully. Failure to follow them could result in a fire or explosion causing property damage, personal injury, or loss of life. The product must be installed and operated according to all local regulations.

Service and or installation must be performed by a trained experienced service technician.

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#### DESCRIPTION

Selectra® SERIES 20 electronic gas flame modulation systems are designed primarily for commercial and light industrial space heating, as components of indirect fired units with atmospheric burners. All fuel gases are compatible.

The SERIES 20 is designed for single or multiple furnace operation. It is capable of controlling up to four furnaces. It may be field installed on existing equipment or specified for new equipment installation.

The system utilizes Modulator-Regulator valves. High Fire ignition selection (0, 5 or 25 second) is standard on all models. A wall mounted Selectrastat senses space temperature and has an integral selector with a 60° to 85° F range. Optionally, a remote Temperature Sensor paired with a separate Temperature Selector (60° to 85° F) can be substituted for the Selectrastat.

#### SYSTEM COMPONENTS

Series 20 Amplifiers (A1010U shown):	
	A1010U
Modulator-Regulator Valves	
	MR410 (3/8" and 1/2" pipe sizes) MR510 (1/2" and 3/4" pipe sizes) MR610 (3/4" and 1" pipe sizes)

#### Selectrastat: selector and integral sensing



T120 - (60° to 85° F)

#### Space Temperature Selector: selection only



TD120 - (60° to 85° F) - For use with TS120

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

#### Space Temperature Sensor: remote sensing



TS120 - For use with TD120

#### SPECIFICATIONS

##### Power Requirements:

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

##### NOTICE

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:** 60° to 85°F

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

**Gases:** Suitable for natural, manufactured, mixed gases, liquefied petroleum gases and LP gas-air mixtures.

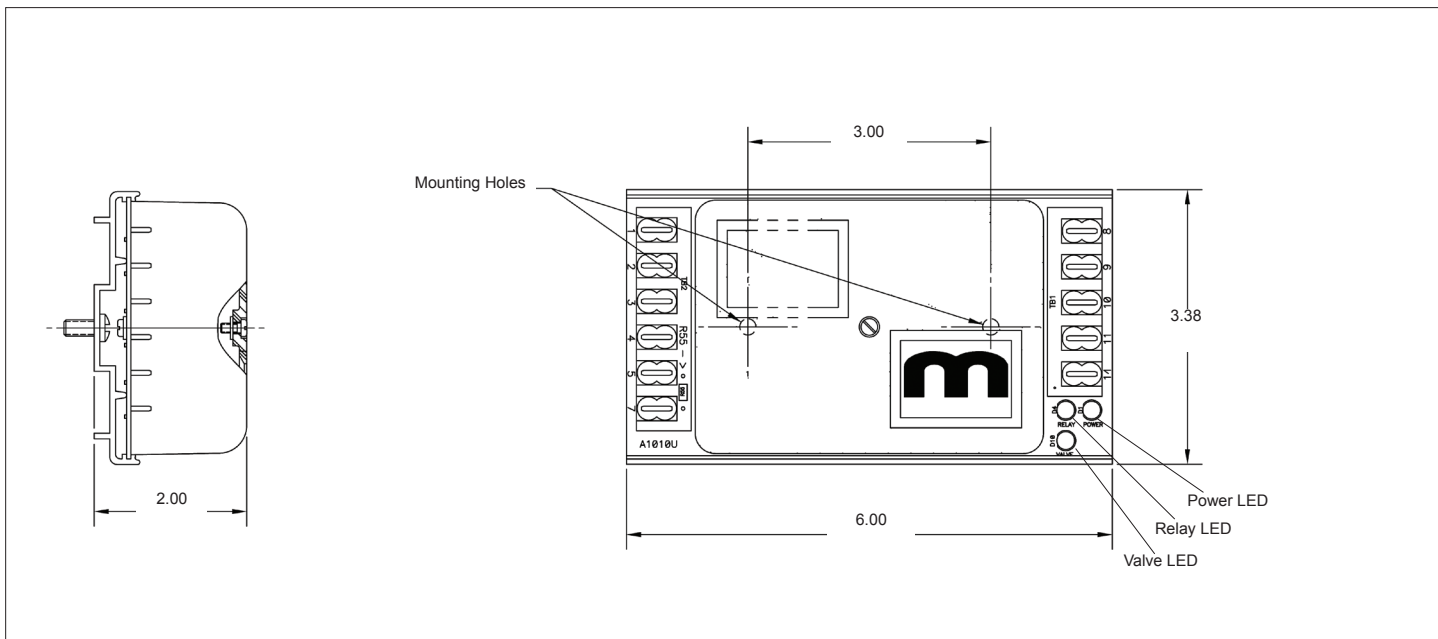
##### Pressure Limits:

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

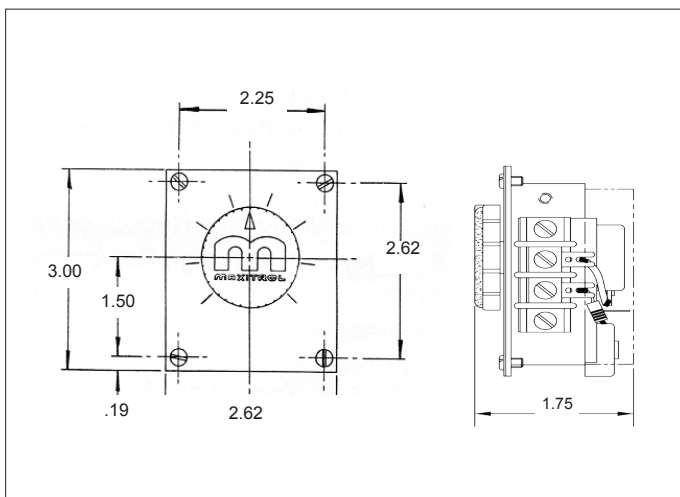
Outlet (maximum fire)  
standard spring\*.....3.0" to 5.0" w.c. / 7 to 12 mbar  
H - models..... 7.5" to 12" w.c. / 19 to 30 mbar  
**Max. set point not to exceed 10" w.c. above min. set point**

Outlet (minimum fire)  
standard spring\*.....0.2" to 1.2" w.c. / .5 to 3 mbar  
(-1) spring\*.....1" to 2.8" w.c. / 2.5 to 7 mbar  
(\*other spring ranges available - Consult Maxitrol Company.)

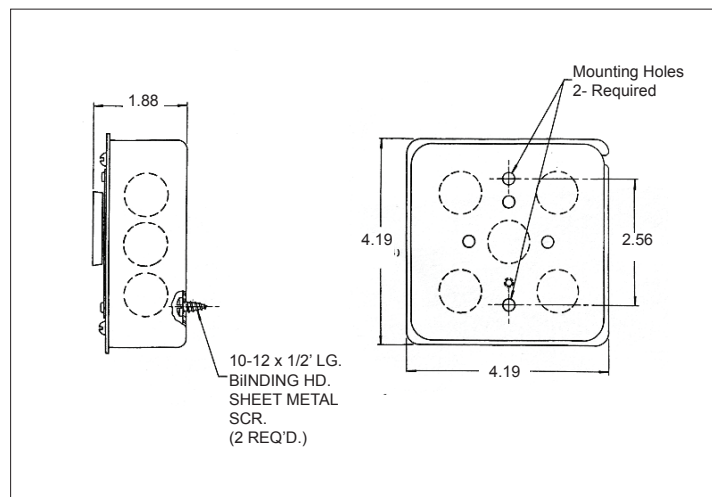
## DIMENSIONS



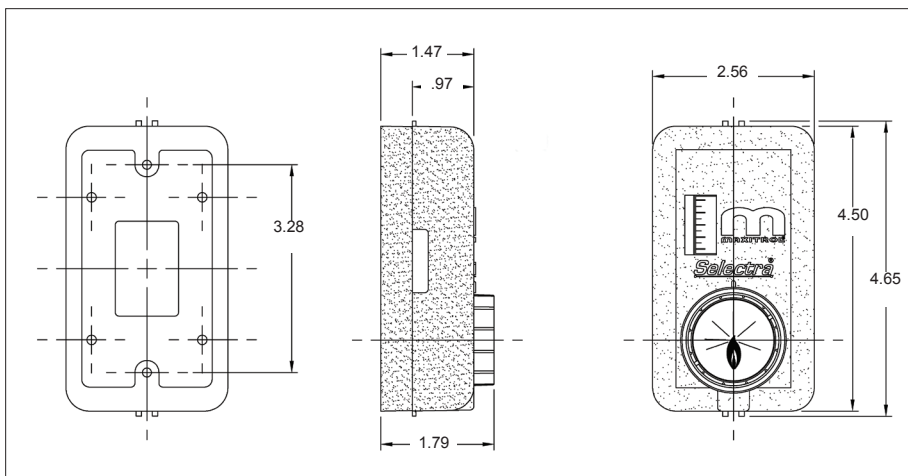
**A1010U**



**TD120**



**ETD-1**



**T120 / TS120**

## VALVE LED

The PCB "Valve" LED illuminates when the output DC voltage to the valve is approximately 2 VDC or greater. It does not indicate valve positioning or whether the system is in modulation mode.

### The Valve LED will be:

- "OFF" at maximum high fire (0VDC) and during the high fire ignition duration (if used)
- "ON" when PCB "Relay" LED is "OFF"
- "ON" or "OFF" when the "Relay" LED is "ON"

## INSTALLATION OF COMPONENTS

### NOTICE

**Wiring Run:** Control wires connecting the Selectrastat or Space Temperature Sensor 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. Clip R55 off of circuit board.

**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.

**Selectrastat:** Pull dial and cover outward. Loosen screws in terminal strip, tilt out and lift up. Install in area where representative space temperature is to be sensed. Wire as shown in appropriate diagram, page 6 - reassemble.

**Space Temperature Sensor:** Remove cover and install in area where representative space temperature is to be sensed. Wire as shown in appropriate diagram, page 6 - reassemble.

**Space Temperature Selector:** Install in control cabinet or other chosen location. Remove cover and wire as shown in appropriate diagram, page 6 - reassemble.

**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 the automatic valve(s) current exceeds 0.8 amps, it would be advisable to wire according to the 'Independent Power Supply' diagram, page 6. 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 and any accessories.

## 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 ohms, eg. 4300 ohm + 200 ohm, 1/2 watt test resistors in series.

### Modulating Function Test - when temperature at Selectrastat or Sensor is 60° to 85°F (16° to 29°C):

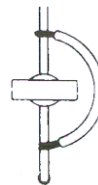
Connect a DC voltmeter to amplifier terminals 1 and 2. If more convenient, the meter may be attached to the MR valve terminals. Rotate temperature selection knob to maximum setting. The DC volts should read zero, Valve LED is "OFF". When the temperature selector is slowly rotated to its minimum setting, the voltage should gradually increase to 20+ volts, Valve LED is "ON". See pg. 2, "Valve LED".

### Automatic Valve Function - when temperature at Selectrastat or Sensor is 60° to 80°F (16° to 29°C):

Disconnect the wires at amplifier terminals 10 and 11, and connect an ohmmeter. Rotate temperature selector to maximum setting - ohmmeter should show continuity, Relay LED is "ON". Rotate temperature selector to minimum setting - ohmmeter should show open circuit, Relay is "OFF". Reconnect the wires to terminals 10 and 11.

### Automatic Valve Function - when temperature at Selectrastat or Sensor is less than 60°F (16°C) or greater than 85°F (29°C):

Disconnect the wires at amplifier terminals 10, 11 and 3. DC modulating voltage across terminals 1 and 2 should be zero. Ohm reading across terminals 10 and 11 should be zero ohms.

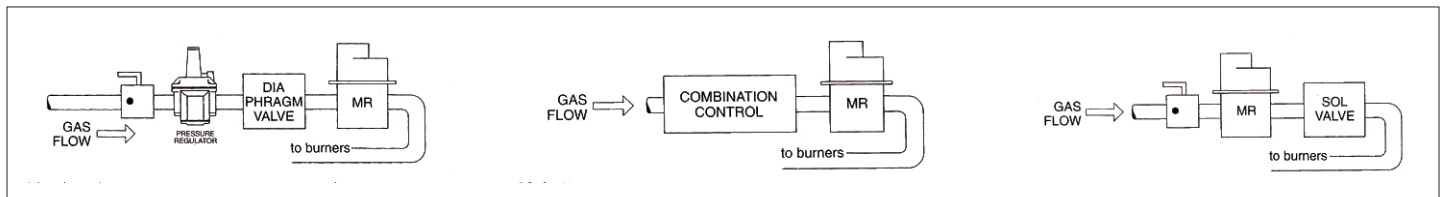


Reconnect wire to terminal 3 of amplifier. Carefully connect a piece of jumper wire across the thermistor as shown (make only temporary connection). Ohm reading at terminals 10 and 11 should be infinite (open circuit). Modulating voltage at terminals 1 and 2 should be greater than 17 volts.

Reconnect wires to terminals 10 and 11. Amplifier is not faulty if the above conditions are met.

## GAS TRAINS

**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
<b>A.</b> Automatic control valve will not close despite full range of modulating voltage at terminals 1 and 2.	<ol style="list-style-type: none"> <li>Automatic control valve not operating properly.</li> <li>Installation wiring error.</li> <li>Amplifier is not operating properly.</li> </ol>	<ol style="list-style-type: none"> <li>Remove wire from valve, if valve does not close - valve is not operating properly.</li> <li>Remove wire from amplifier terminal 10 or 11. If valve remains open, check for miswiring.</li> <li>If AC voltage will not drop to zero at terminals 8 and 11 - when DC voltage at terminals 1 and 2 is above 20 VDC - amplifier is faulty. If space temperature is less than 60° or greater than 85°F (&lt;16° or &gt; 29°C), see Preliminary Circuit Analysis, page 3.</li> </ol>	<ol style="list-style-type: none"> <li>Replace automatic control valve.</li> <li>Correct wiring.</li> <li>Replace amplifier.</li> </ol>
<b>B.</b> Automatic control valve won't open despite full range of modulating voltage at terminals 1 and 2.	<ol style="list-style-type: none"> <li>Automatic control valve not operating properly.</li> <li>Open wire to automatic valve.</li> <li>Amplifier is not operating properly.</li> </ol>	<ol style="list-style-type: none"> <li>Read voltage across valve terminals. If 24 VAC, valve is not operating properly.</li> <li>Read voltage across terminals 8 and 11 on amplifier. If 24 VAC, check for open circuit to automatic valve. If space temperature is less than 60° or greater than 85°F (&lt;16° or &gt;29°C), see Preliminary Circuit Analysis, page 3.</li> <li>If AC voltage reading remains zero - when DC voltage at terminals 1 and 2 is below 14 V DC - amplifier is faulty. If space temperature is less than 60° or greater than 85°F (&lt;16° or &gt; 29°C), see Preliminary Circuit Analysis, page 3.</li> </ol>	<ol style="list-style-type: none"> <li>Replace automatic control valve.</li> <li>Correct wiring</li> <li>Replace amplifier.</li> </ol>
<b>C.</b> No gas flow.	<ol style="list-style-type: none"> <li>Malfunctioning power supply.</li> <li>MR valve installed backwards.</li> </ol>	<ol style="list-style-type: none"> <li>Read voltage at amplifier terminals 8 and 11 (24 VAC).</li> <li>Arrows on MR valve should point in the direction of gas flow.</li> </ol>	<ol style="list-style-type: none"> <li>Power supply must be 24 V AC.</li> <li>Install properly.</li> </ol>
<b>D.</b> Continuous high fire.	<ol style="list-style-type: none"> <li>Open circuit in sensing and setting circuit.</li> </ol>	<ol style="list-style-type: none"> <li>Disconnect and measure across wires connected to amplifier terminals 3 and 4 (A1010U models). Should read between 8,000 to 12,000 ohms.</li> </ol>	<ol style="list-style-type: none"> <li>If above 12,000 ohms, check circuit for open or loose wires.</li> </ol>
<b>E.</b> Continuous high fire but automatic valve cycles.	<ol style="list-style-type: none"> <li>Open circuit in wiring to MR valve.</li> <li>Plunger jammed or installed upside down.</li> <li>MR valve not operating properly.</li> </ol>	<ol style="list-style-type: none"> <li>Check wiring for defects.</li> <li>Examine. Plunger should be smooth and clean and operate freely in solenoid sleeve. Must be installed as shown in "Valve Adjustments" pg. 7, "M/MR Valve Diagram".</li> <li>Measure voltage across MR valve.</li> </ol>	<ol style="list-style-type: none"> <li>Replace wiring if necessary.</li> <li>Clean plunger if necessary.</li> <li>If modulating voltages are obtained but no gas modulation, MR valve is faulty. Replace if necessary.</li> </ol>
<b>F.</b> Furnace won't activate due to constant high modulating voltage. (above 17 V DC)	<ol style="list-style-type: none"> <li>Short circuit in sensing and setting circuit.</li> </ol>	<ol style="list-style-type: none"> <li>Disconnect and measure across wires connected to amplifier terminals 3 and 4 (A1010U models). Should read between 8,000 and 12,000 ohms.</li> </ol>	<ol style="list-style-type: none"> <li>If below 8,000 ohms, check circuit for shorts or miswiring.</li> </ol>
<b>G.</b> Continuous low or medium fire, but automatic valve cycles correctly.	<ol style="list-style-type: none"> <li>Heat load requires low fire only.</li> <li>Plunger and/or maximum spring missing.</li> <li>Jammed plunger.</li> <li>Other valve problems.</li> <li>Inadequate supply pressure.</li> </ol>	<ol style="list-style-type: none"> <li>Increase temperature setting 10 degrees.</li> <li>Check for parts (see "Valve Adjustments" pg. 7, "M/MR Valve Diagram").</li> <li>Examine. Plunger should be smooth and clean and operate freely in solenoid sleeve. Must be installed as shown in "Valve Adjustments" pg. 7, "M/MR Valve Diagram".</li> <li>Remove wire from MR valve.</li> <li>Remove spring 5 from MR valve (see "Valve Adjustments" pg. 7, "M/MR Valve Diagram") push down on plunger. Insufficient manifold pressure with furnace operating indicates supply is too low.</li> </ol>	<ol style="list-style-type: none"> <li>If heater goes to high fire, system is working correctly.</li> <li>Install correct parts.</li> <li>Clean plunger if necessary.</li> <li>If MR valve remains on low fire, valve is not operating properly. Check item 19 below, then replace valve if necessary.</li> <li>Check for obstruction in gas pipe ahead of controls. Increase gas pressure if possible.</li> </ol>
<b>H.</b> Incorrect discharge air temperature.	<ol style="list-style-type: none"> <li>Calibration</li> </ol>	<ol style="list-style-type: none"> <li>Check seal on calibration potentiometer.</li> </ol>	<ol style="list-style-type: none"> <li>Recalibrate per "Temperature Calibration" procedure.</li> </ol>
<b>I.</b> Erratic or severely pulsating flame.	<ol style="list-style-type: none"> <li>Dirty or sticking plunger.</li> <li>Intermittent shorting in wiring.</li> <li>Amplifier not operating properly.</li> </ol>	<ol style="list-style-type: none"> <li>Examine. Plunger should be smooth and clean and operate freely in solenoid sleeve. Must be installed as shown in "Valve Adjustments" pg. 7, "M/MR Valve Diagram".</li> <li>Inspect wiring.</li> <li>Observe DC voltage across amplifier terminals 1 and 2.</li> </ol>	<ol style="list-style-type: none"> <li>Clean plunger if necessary.</li> <li>Correct wiring.</li> <li>If erratic or pulsating DC voltage is observed and wiring shows no defects, replace amplifier. If erratic or pulsating voltage continues, contact Maxitrol Company.</li> </ol>
<b>*Control circuits external to the Series 20 can cause burner malfunction. Always check manual valve to be certain gas is on, and check limit controls for normal operation.</b>			

## PERFORMANCE CHECK

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

**Low Fire** is above 14 volts DC.

Manifold pressure can be adjusted as follows:

*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).

**High 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 Selectrstat/Temperature Selector:

- 1) Set below room temperature and slowly increase setting until furnace begins operating. Furnace should ignite and remain on low fire. If high fire ignition is being used the furnace will ignite at high fire for the set duration or either 5 or 25 seconds (see Extended High Fire Ignition below), then modulate to low fire. At low fire (manifold pressure about 0.5" w.c. [1.25 mbar]), a reading of approximately 14 or more volts DC should be obtained.
- 2) Rotate 3° higher.
- 3) Furnace should now be at high fire, manifold pressure about 3.5" w.c. (8.75 mbar). Less than 2 volts DC should read across Modulator-Regulator valve terminals. Rotate slowly to a lower setting. Furnace should modulate to low fire, with voltage at modulator approximately 15-17 volts, internal relay will trip and solenoid automatic control valve (s) will close.

*If the preceding readings are obtained, proceed with Furnace Adjustments. 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, Power LED is "ON".
- 6) Some automatic control valves require as much as 20 seconds to open. In this case, check for 24VAC output at automatic valve terminals, Relay LED is "ON".

### Furnace Adjustments:

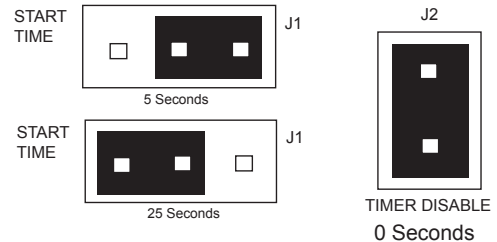
For space heating, first calculate heat loss. If reduction of furnace input is indicated, consult furnace manufacturer about changing to smaller orifices. *Do not try to reduce by pressure adjustment or throttling the gas supply.*

An oversized furnace input is easily identified, particularly during cold weather. If outdoor temperature is low and the system cycles on and off instead of maintaining a low input, the furnace is oversized. Consult furnace manufacturer.

## EXTENDED HIGH-FIRE IGNITION

The high fire start duration is field selectable. Amplifier will hold MR valve in the High Fire position for the set duration.

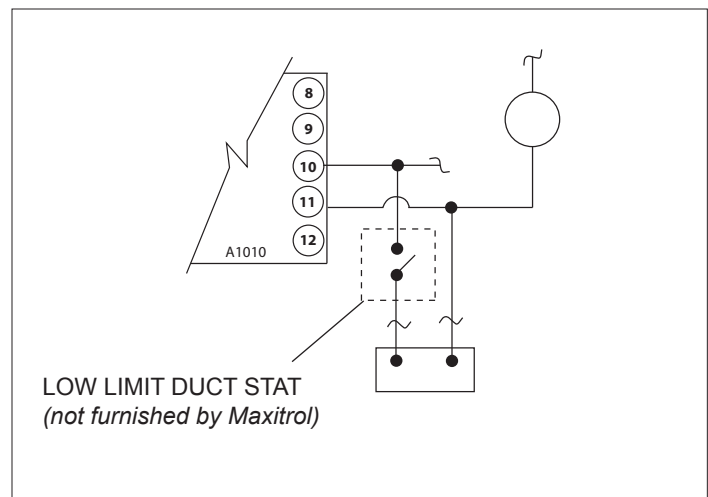
High-Fire duration of 0 seconds, 5 seconds, 25 seconds. (Times are approximate).



### High Fire Ignition

## LOW LIMIT STAT

When fresh outside air is introduced and the space being heated is up to temperature, the furnace will shut off. If the recirculated air should be too cool, temper it by wiring a duct-stat, as shown.



### Low Limit Duct Stat

**Note:** Terminals 10 & 11 MAX LOAD is 3.5 Amps.

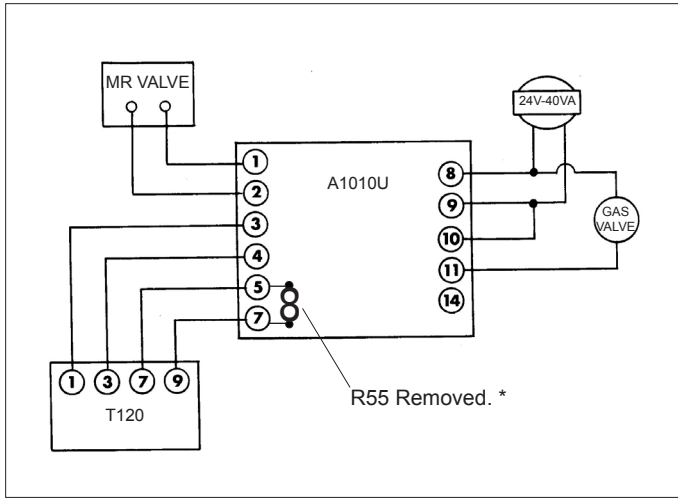


## ⚠ CAUTION

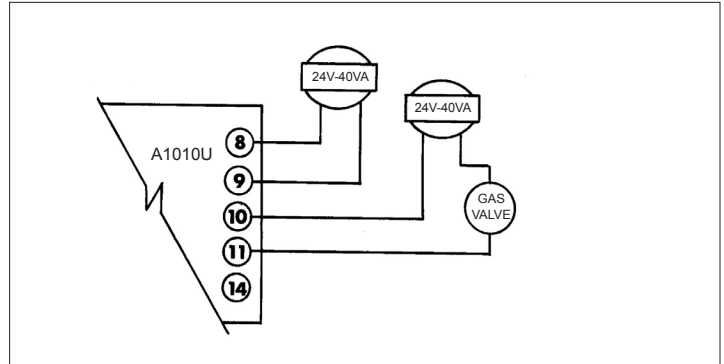
These wiring diagrams are for Series 20 space air sensing systems only.

The R55 (Zero ohm Jumper) MUST be Clipped off of circuit board (located near terminals 5 & 7, outside of cover.)

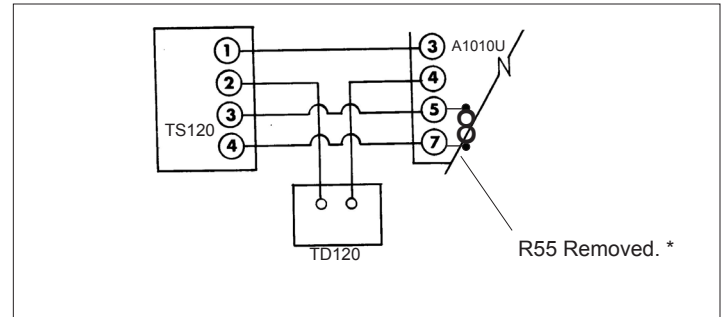
### SINGLE FURNACE OPERATION



Common Power Supply



Independent Power Supply

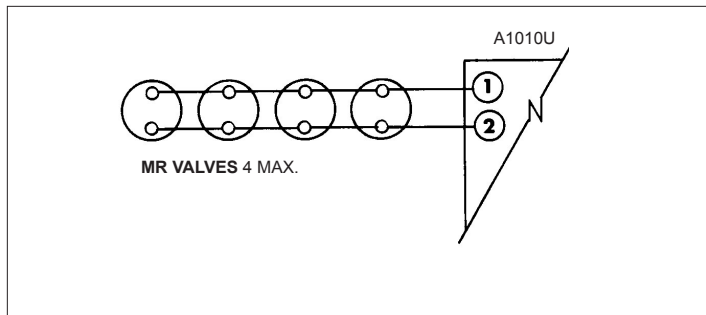


Remote Temperature Sensor with Separate Selector

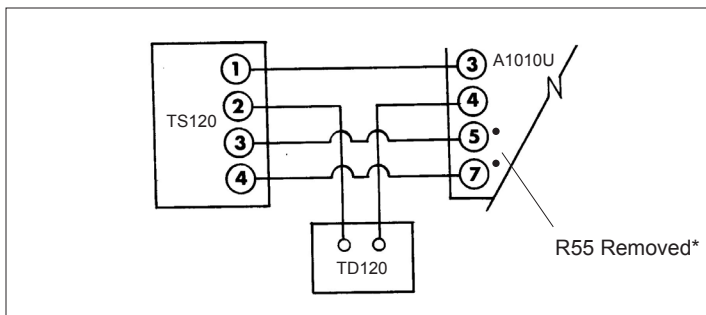
\* R55 IS A ZERO OHM JUMPER

### MULTIPLE FURNACE OPERATION

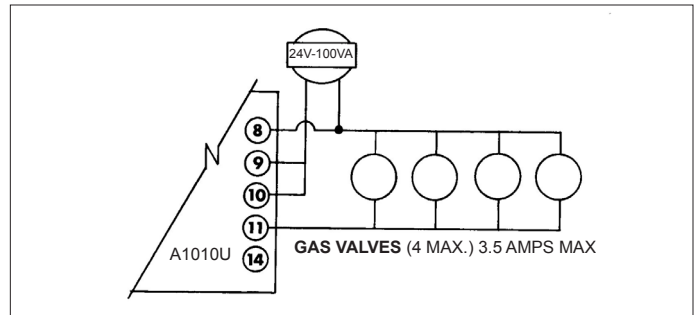
(MR valves and automatic gas valves wired in parallel as shown)



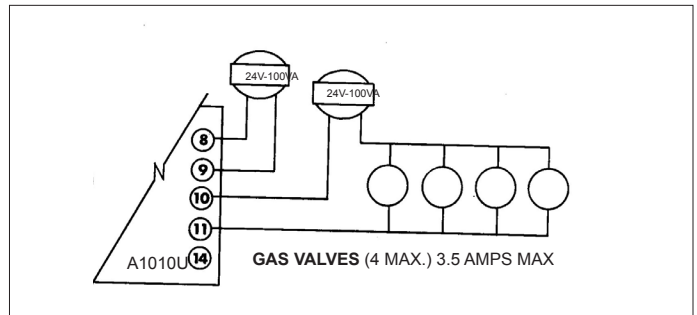
Wired in Parallel



Remote Temperature Sensor with Separate Selector



Common Power Supply



Independent Power Supply

## VALVE ADJUSTMENTS

(See bulletin MMR\_MT\_EN for additional M/MR valve information)

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

### Low Fire Adjustments:

- A) Remove Cover (2)
- B) Remove maximum adjusting screw (4), spring (5), and plunger (8). A small magnet is useful for this purpose.

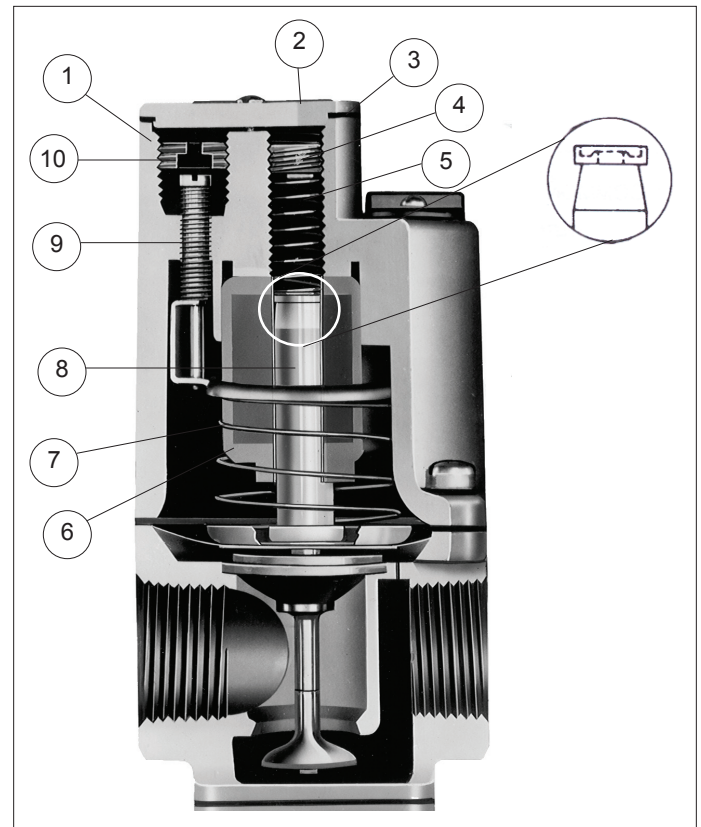
#### NOTICE

The plunger is a precision part. Handle carefully to avoid marring or picking up grease and dirt. Do not lubricate.

- C) Using minimum adjusting screw (9), set manifold pressure to furnace manufacturer's specifications.
- D) Replace plunger, spring retainer, spring and maximum adjusting screw in proper order.
- E) Perform High Fire adjustment.

### High Fire Adjustments:

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



M/MR Valve Diagram

- 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

