

SLATE™

Dual Burner Applications:

Tech Features

The SLATE burner platform may be applied to most multi-burner applications. In every application, safety requirements must be considered as they will determine how SLATE should be used, taking into consideration configuration, wire sheet programming, and wiring. Another important component of setting up multi-burner applications is the fuel train and its piping as a system as well as to each individual burner. Finally, understanding at the system level the normal firing and shutdown sequences versus a lockout shutoff sequence will help determine how SLATE will be applied.

To begin, let's consider the "one out, all out" requirement in case one of the system burners locks out. This requirement dictates that if any one of the system burners goes into lockout, all burners are forced off. While SLATE's programming functionality allows the designer to create any number and combination of firing and shut down sequences (with/without voting), we must keep in mind that the wire sheet is not part of SLATE's safety circuit and thus we must assume it can fail in ways which would interrupt the firing and shutdown sequences (not to be confused with the Burner Module's intrinsic safety which is separate and unaffected by the SLATE Base Module or any other module failure). If this occurs, then we can no longer depend on the wire sheet to support the shutdown sequence of "one out, all out".

Items to consider:

- Is the 'one out, all out" requirement a safety critical function that must occur immediately upon the loss of any of the system burners (the requirement is not user specified)?
 -
- Is there an *immediate safety hazard* if all burners don't shut down when one of the burners in the system goes into lockout?
 -
- Is there an *absence* of independent limits on each of the burner sections which can safely force that section and other sections to shut down in case a limit threshold is exceeded?

These questions help us understand how much we can count on the wire sheet for the startup sequence (burner firing sequence) and shutdown sequence (normal or lockout). If you answered "YES" to any of these questions, then your multi-burner application may still depend on the wire sheet for its start sequence, but must consist solely on Burner Module configurations and the gas train configuration to assure that all burners will shut down when any burner goes into lockout. In such applications, the requirement on the multi-burner application start sequence is that all burners fire at the same time with a single burner demand as each burner must have a shutoff valve in the main gas train supply branch.

Dual Burners Examples:

One out, all out considered safety critical; no wire sheet component, no voting

On/Off-Burners receive demand simultaneously

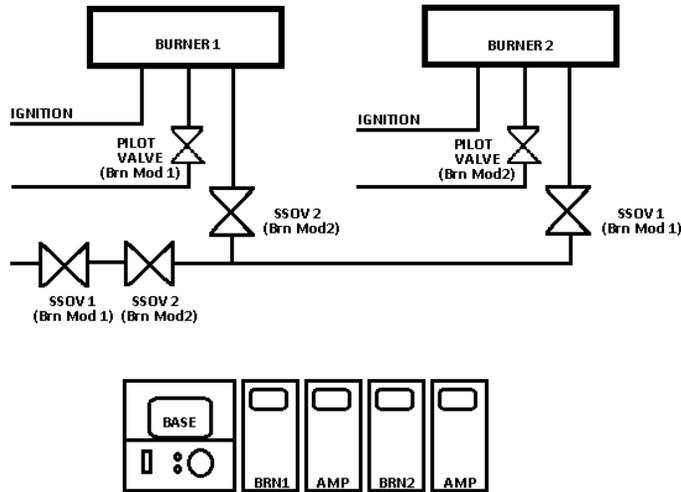
With/without purge, pilot

At least one of the Burner Modules must have the ILK inputs

Purging/Post-purge may be done by either Burner Module.

Each burner has a safety shutoff valve on the gas train trunk

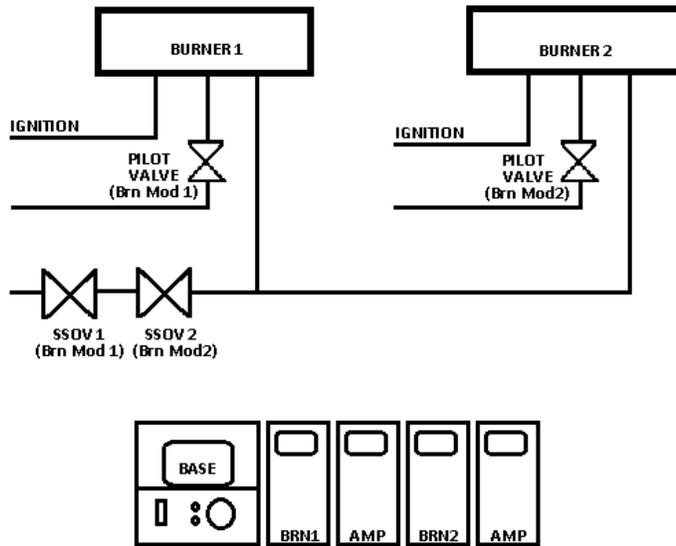
The examples below show different possible valve train configurations:



Example 1:

Each Burner Module controls its own igniter, pilot valve train/main gas train with one SSOV on the main trunk and another SSOV on the specific burner branch. This main valve train configuration insures that if flame is lost at either burner either during light-off or Run, gas flow is interrupted at the main trunk and both burners end up in lockout.

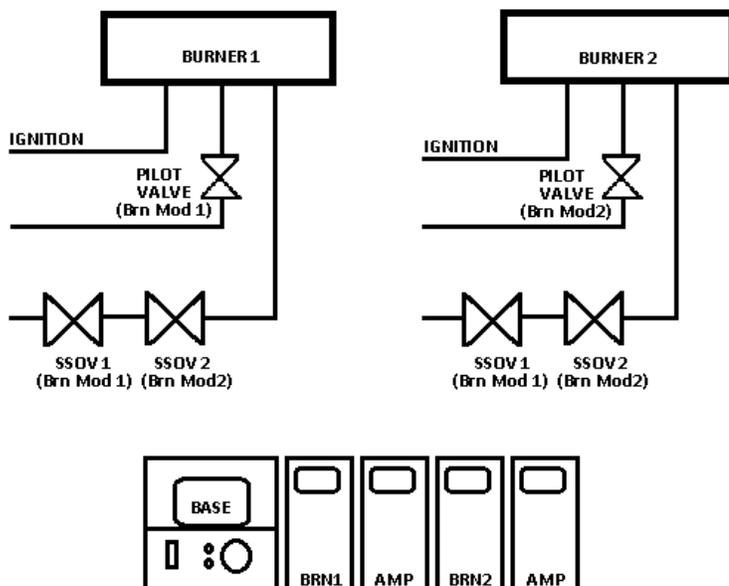
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Example 2:

In this example, the SSOV is removed from the burner branches and only one SSOV for each burner remains on the main trunk. This main valve train configuration insures that if flame is lost at either burner either during light-off or Run, gas flow is interrupted at the main trunk and both burners end up in lockout.

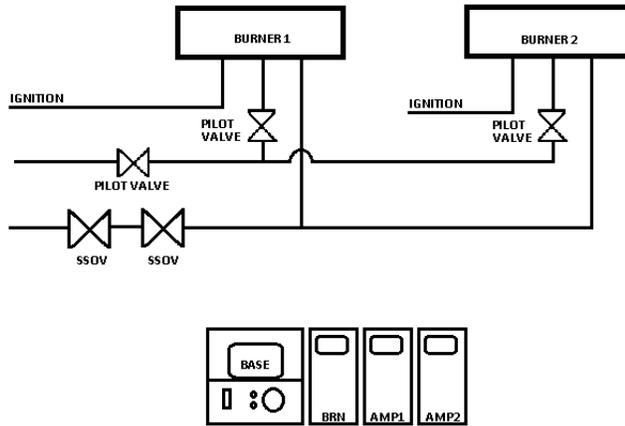
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Example 3:

In this example, each burner has its own individual gas train. As in Example 1, one of the SSOVs of each burner must be mounted on the other burner's main gas line. This main valve train configuration insures that if flame is lost at either burner either during light-off or Run, gas flow is interrupted to both burners and each will lock out.

In some dual burner applications, it may be preferable to use the dual-flame amplifier feature in SLATE (available in SW rev 3.01 or newer), rather than using the two Burner and two Amplifier Modules solution. The Burner Module controls two igniters and a single pilot/main valve train. This dual burner option saves one Burner Module as well as gas train components. It leverages SLATE's ability to connect to two similar or different flame sensors and monitor the two burners individually to either keep both burners firing or to lock out both burners on loss of flame from either burner.



The dual-amplifier approach requires Burner Module configuration to support the feature as well as an additional physical setting on the Amplifier Module.

We begin by configuring the Amplifier Modules. Each Amplifier Module has a setting switch on the back indicating the amplifier's position in a dual-amplifier application. The default factory setting is "1". The Amplifier Module which will occupy position two must be set to "2" using a small screw driver. The setting switch is located on the back of the Amplifier Module



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The dual-amplifier feature must also be configured in Niagara AX. The configuration for multiple Amplifier Modules is found in the Burner Module configuration. The flame sensing must work in an “AND” configuration since BOTH amplifiers must read flame signals in order for both burners to fire. If either amplifier loses its signal, the Burner Module must react. In this configuration example we will configure the Burner Module to lock out on loss of flame from either Amplifier Module (See Fig. 1).

	Name	ID	Setting	Help
1	r154: Purge rate proving failure response	m2r154	Hard lockout	r154 - Help
2	r155: Lightoff rate proving failure response	m2r155	Hard lockout	r155 - Help
3	r156: Valve proving failure response	m2r156	Hard lockout	r156 - Help
4	r157: Pilot ignition failure response	m2r157	Hard lockout	r157 - Help
5	r158: Main ignition failure response	m2r158	Hard lockout	r158 - Help
6	r159: Run flame failure response	m2r159	Hard lockout	r159 - Help
7	r160: LCI open response	m2r160	Hard lockout	r160 - Help

Fig. 1: Burner Module Pilot Ignition and Main Ignition Failure Reaction Configuration

We will also set the Amplifier Modules to function in an “AND” configuration with a five second allowable sighting delay between the first Amplifier Module and the second Amplifier Module in case the gas piping to the second burner pilot/main valve nozzle is farther from the source than the first burner pilot/main nozzle, and may require a little more time to light off.

There are multiple options for setting up functionality of a system with dual amplifiers (r128).

Ignition: S1 Run:S2-Sensor 1 is used only during Ignition while Sensor 2 is used in Run

Ignition: S1 Run: Combined S1 S2-Sensor 1 is used during Ignition while both Sensor 1 and Sensor 2 are used during Run in an “AND” or an “OR” configuration to be defined in another parameter (r265).

Combined S1 S2-Detection is done using both flame sensors during Ignition and Run in an “AND” or an “OR” configuration to be defined in another parameter (r265). See figure 2.

Name	Register Number	Setting	Help
Ignitor duration	126	Normal duration	Help
Ignition type	127	Interrupted pilot	Help
Flame sensing system type	128	Single flame sensor Single flame sensor Ignition:S1 Run:S2 Ignition:S1 Run:Combined S1 S2 Combined S1 S2	Help
Secondary flame sensing time	129		Help
Pilot valve hold enable	131		Help
Pilot valve hold transition time	132	10	Help
Manual open switch enable	133	Disable	Help
Auto ignition enable	134	Disable	Help
Delayed main valve 2 enable	135	Disabled	Help
Combination flame sensing	265	Not Combined	Help

Protect Mode

Fig. 2: Dual Flame Amplifier Configuration

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Setting up the dual amplifiers in an “AND” configuration:

For the requirement, the selection “Combined S1 S2” is made as both sensors are required during Ignition and Run states (See Fig. 3).

Name	Register Number	Setting	Help
Ignitor duration	126	Normal duration	Help
Ignition type	127	Interrupted pilot	Help
Flame sensing system type	128	Combined S1 S2	Help
Secondary flame sensing time	129	0	Help
Pilot valve hold enable	131	Disable	Help
Pilot valve hold transition time	132	10	Help
Manual open switch enable	133	Disable	Help
Auto ignition enable	134	Disable	Help
Delayed main valve 2 enable	135	Disabled	Help
Combination flame sensing	265	Not Combined	Help

Protect Mode

Fig. 3: “AND” Flame Amplifier Configuration

Next, the timing is selected that will give the second burner an opportunity to light-off given the possible delays between burners (r132). This timing is in addition to the PFEP/MFEP. In this example, we added 10 seconds (See Fig. 4).

Name	Register Number	Setting	Help
Ignitor duration	126	Normal duration	Help
Ignition type	127	Interrupted pilot	Help
Flame sensing system type	128	Combined S1 S2	Help
Secondary flame sensing time	129	10	Help
Pilot valve hold enable	131	Disable	Help
Pilot valve hold transition time	132	10	Help
Manual open switch enable	133	Disable	Help
Auto ignition enable	134	Disable	Help
Delayed main valve 2 enable	135	Disabled	Help
Combination flame sensing	265	Not Combined	Help

Protect Mode

Fig. 4: Adding a 10 Second Delay between Amplifiers

The next configuration selection is the “OR” or “AND” logic in which the amplifiers/sensors will function (r265). See Figure 5.

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Name	Register Number	Setting	Help
Ignitor duration	126	Normal duration	Help
Ignition type	127	Interrupted pilot	Help
Flame sensing system type	128	Single flame sensor	Help
Secondary flame sensing time	129	0	Help
Pilot valve hold enable	131	Disable	Help
Pilot valve hold transition time	132	10	Help
Manual open switch enable	133	Disable	Help
Auto ignition enable	134	Disable	Help
Delayed main valve 2 enable	135	Disabled	Help
Combination flame sensing	265	Not Combined S1 OR S2 - both required S1 OR S2 - one required S1 AND S2	Help

Protect Mode

Fig. 5: "AND"/"OR" Configuration for Dual Amplifier Modules

S1 OR S2-both required- This configuration is redundant in that either of the two sensors sensing flame is sufficient to maintain the burner(s) firing. Both amplifier modules must be present on the bus at all times.

S1 OR S2-one required- This configuration is redundant in that either of the two sensors sensing flame is sufficient to maintain the burner(s) firing. Only one amplifier module must be present on the bus at all times to keep the burner(s) firing. This configuration allows for the automatic transition to a single flame sensor should an amplifier fail.

S1 AND S2- This configuration requires that both sensors sense flame at all times. If either sensor loses flame, the burners shut down.

We set the Combination flame sensing parameter to S1 and S2-"AND" configuration (See Fig 6).

Name	Register Number	Setting	Help
Ignitor duration	126	Normal duration	Help
Ignition type	127	Interrupted pilot	Help
Flame sensing system type	128	Single flame sensor	Help
Secondary flame sensing time	129	0	Help
Pilot valve hold enable	131	Disable	Help
Pilot valve hold transition time	132	10	Help
Manual open switch enable	133	Disable	Help
Auto ignition enable	134	Disable	Help
Delayed main valve 2 enable	135	Disabled	Help
Combination flame sensing	265	S1 AND S2	Help

Protect Mode

Fig. 6: "AND" Configuration for Dual Amplifier Modules

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With these configurations dual burner systems can be managed with a single Burner Module and two similar or dissimilar Amplifier modules.

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