



# N Series 24 VAC Direct Spark Ignition Control

## Application

The N Series Direct Spark Ignition Control is a safety control designed for indirect burner ignition and supervision, for use with all gases and applicable to gas-fired appliances.

The N Series is a microprocessor based ignition control. The microprocessor provides reliable software control of all timings and operates a diagnostic two-color Light-Emitting Diode (LED). It provides ignition sequence, flame monitoring, and safety shutoff for boilers, furnaces and other heating appliances.

## Installation

**IMPORTANT:** Only qualified personnel should install or service BASO Gas Products®. These instructions are a guide for such personnel. Carefully follow all instructions for the appliance.

**IMPORTANT:** Make all gas installations in accordance with applicable local, national, and regional regulations.

 **WARNING: Risk of Explosion or Fire.**  
Do not install the control in an area that is exposed to water (for example, dripping, spraying, rain). Do not use the control if it has been exposed to water. Exposure to water may cause malfunction and can lead to an explosion or fire and may result in severe personal injury or death.

**IMPORTANT:** This control is approved for use with noise suppression (resistive) spark wires. If the application has copper wire, it must be replaced.

Instructions for installing the pilot burner/igniter-sensor are typically provided by the appliance manufacturer. It is important to follow those instructions. If such information is not included, refer to the *Location and Mounting Considerations* section.

## Location and Mounting Considerations

 **CAUTION: Risk of Electric Shock.**  
Disconnect power supply before making electrical connections to avoid electric shock.

 **WARNING: Risk of Explosion or Fire.**  
Shut off the gas supply at the main manual shutoff valve before installing or servicing the control. Failure to shut off the gas supply can result in the release of gas during installation or servicing, which can lead to an explosion or fire, and may result in severe personal injury or death.

**IMPORTANT:** Do not mount the control where it can be exposed to direct infrared radiation from the main burner or to temperatures in excess of the maximum product temperature rating.

Choose a location that provides the shortest, direct cable route to the spark electrode, pilot burner/igniter-sensor assembly. Easy access to the terminals is desired for wiring and servicing. The control may be mounted in any position. Mount the control on a grounded metal surface with #6 sheet metal or machine screws through the mounting holes provided in the enclosure.

The pilot burner/igniter-sensor must be securely mounted to the main burner to ensure that the pilot burner flame remains properly positioned with respect to the main burner flame. The pilot burner must be located such that the flame receives an ample supply of air, free from the products of combustion. The flame must not be exposed to draft conditions, the full force of main burner ignition, or falling scale, which could otherwise impede ignition of main burner flame.

Securely mount the pilot burner/igniter-sensor to the main burner with metal screws at a distance approximately 3/8 in (9.52 mm) above and 1/4 in (6.35 mm) away from the center of the nearest main burner port. Ensure that the main burner flames do not impinge on any part of the pilot burner.

## Wiring



### WARNING: Risk of Explosion or Fire.

Locate all safety, limit, and operating controls in series with the thermostat terminal (TH) on the ignition control. Improper installation may cause gas leaks, which can lead to an explosion or fire and may result in severe personal injury or death.

Refer to Figure 1 for wiring diagrams. All wiring should be in accordance with the National Electrical Code (NEC) and all other local codes and regulations.

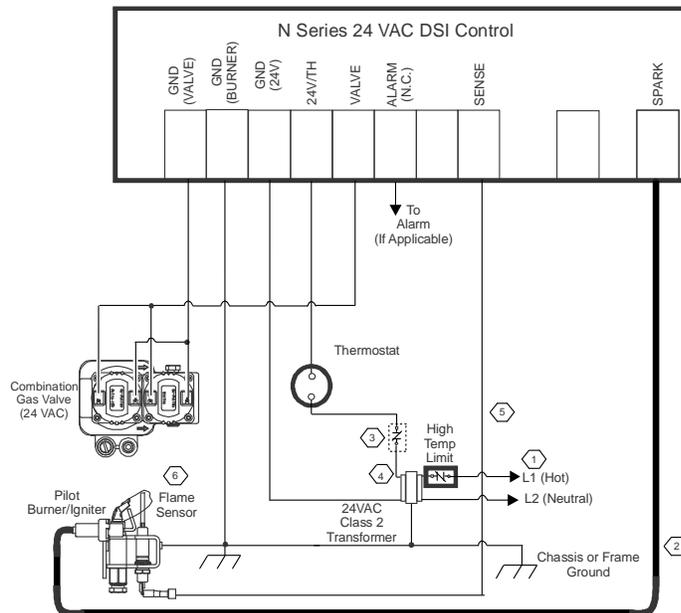
Check the voltage rating marked on the control and make sure it is suited to the application. Use a Class 2 transformer capable of providing 24 VAC under maximum load, including valves. A transformer having excessive primary impedance due to poor coupling affects the ignition potential.

The high-voltage spark transformer cable is noise suppression (resistive) type rated for at least 15kV and must not be in continuous contact with a metal surface. Use insulated standoffs where needed to keep spark wire from touching any metal. Ensure that the flame sensor wire and high voltage spark transformer cable are separated from one another by a minimum of 1/2 in. (12.7 mm) and are not wrapped around any pipe, other wiring, or accessories.



### WARNING: Risk of Electric Shock.

Before applying power to the control, connect the high voltage cable to the spark transformer terminal and spark electrode (pilot burner assembly). Verify the ground wire is attached to the pilot burner and the control ground terminal strip. Failure to follow this procedure can cause electric shock and may result in severe personal injury or death.



- ① Power Supply. Provides disconnect means and overload protection as required.
- ② Maximum cable length 48 inches (1,220 mm). (Resistive wire recommended.)
- ③ Alternate location for limit controller.
- ④ Controls in 24V circuit must not be in ground leg to transformer.
- ⑤ Maximum cable length 48 inches (1,220 mm).
- ⑥ Sensor rod must be 3/8" (9.53 mm) to 1/2" (12.7 mm) of the sensor tip should be in the flame for proper sensing signal.

**Figure 1: Wiring for Remote Flame Sense**

## Setup and Adjustments

### Checkout



**WARNING: Risk of Explosion or Fire.** Verify that there are no gas leaks by testing with appropriate equipment. Never use a match or lighter to test for the presence of gas. Failure to test properly can lead to an explosion or fire and may result in severe personal injury or death.

Make sure all components function properly by performing the following test.

1. Before starting the appliance, perform a safety inspection of piping, burners and venting. Check for gas leaks, etc. Check all wiring for proper connections. Be sure the system is properly grounded, including ground connection to the pilot burner/igniter.
2. With the gas and thermostat off, turn on power to the appliance.
3. Turn the thermostat to a high setting and verify that the control goes through the operating sequence to a shutoff condition.

**Note:** The burner does not light because the gas is off.

4. Turn off the thermostat.
5. Turn on the gas and purge gas lines of all air.
6. Check for gas leaks on all pipe joints upstream and downstream of the gas valve with a soap solution.
7. Turn the thermostat to the highest setting and verify successful ignition and a normal run condition for at least 5 minutes. If the appliance fails to run, see the *Troubleshooting* section.
8. Turn the thermostat down for at least 15 seconds and then back up again. Verify successful ignition at least five times.
9. Return the thermostat to a normal temperature setting before leaving the installation.

**IMPORTANT:** Only qualified personnel should install or service BASO Gas Products®. If any faults are detected, see Troubleshooting Tables 2 and 3. If control module has been opened or any attempts to repair are done, the warranty is void.

## Operation

**Table 1: Green LED Indications, Normal Operation**

Flash Code	Flash Code Indication
Steady On	Flame detected, main burner on
0.1 Second On 0.1 Second Off	Trial time spark on trying to light pilot burner
0.5 Second On 0.5 Second Off	Pre-Purge or Inter-Purge Time
0.5 Second On 4.5 Second Off	Retry or Recycle Time

### Sequence of Operation

The heating cycle starts when a call for heat from the thermostat supplies 24VAC to the 24V/TH terminal. After a 1 second maximum diagnostic period, the control enters **pre-purge mode**, after pre-purge time, the spark will start and the gas valve will turn on, starting with the trial for ignition period. If **no pre-purge**, trial for ignition mode begins immediately (see Table 1 for LED normal operation).

During the trial for ignition period, the control sparks while rapidly flashing green LED. It then turns off the spark and LED while checking pilot flame sense. This cycle will repeat until pilot flame is detected or trial time is over.

When pilot flame is detected, the spark will stop, the gas valve remains open and the green LED will stay on continuously. The control will remain in this state until the pilot flame is lost or the call for heat ends. **Model with no inter-purge**, if the pilot flame is lost, the gas valve remains open and a new trial for ignition will start. If the pilot flame is lost longer than the trial time, the ignition will lock out. **Model with inter-purge**, if flame is lost within 5 seconds of an established flame, the gas valve remains open; the control initiates sparking, and begins a trial for ignition period immediately. If flame is lost after 5 seconds of an established flame, the gas valve is closed, and the control initiates the inter-purge time delay before beginning another trial for ignition period. **Model with no retry and one trial**, if pilot flame is not detected during the trial for ignition period, the gas valve will be closed. Lockout will occur and a red LED will flash indicating an error (see Table 2 and 3 for proper diagnostics of the error). **Model with retry and three trials**, if flame is not sensed by the end of the trial for ignition time period, the gas valve closes and the control module initiates an inter-purge time delay, followed by another trial for ignition period (this occurs up to three trials). After the third trial, the control initiates 60 minute retry period. If flame is not sensed, the ignition sequence is repeated.

## Troubleshooting

If the system does not function properly, determine the cause using the procedures in this section.

Before proceeding with troubleshooting the system, check the following.

## Preliminary Checks

- Are you using resistive wire between the module spark (10) and the pilot connection?
- Are all mechanical and electrical connections tight?
- Is the system wired and grounded correctly?
- Is gas inlet pressure per manufacturer's specifications?
- Is the system powered?
- Is the thermostat calling for heat?

**Table 2: Red LED Indications, Error Operation**

Flash Code	Error Definition	Error Type
Blinks 1 Time	No Flame in Trial Time Error	Lockout + Alarm (If Applicable)
Blinks 2 Times	Flame Sense Circuit Error	Lockout + Alarm (If Applicable)
Blinks 3 Times	Valve Circuit Error	Lockout + Alarm (If Applicable)
Blinks 4 Times	Flame Loss Error	Lockout + Alarm (If Applicable)
Blinks 7 Times	Ground or Internal Error	Lockout + Alarm (If Applicable)
Steady On	Line Voltage/Frequency Error	Standby

## Red LED Error Indications

If the control module's internal diagnostics detect a fault it will go into lockout. Spark and gas valve will be turned off and the alarm output (if applicable) is on. The red LED will flash an error code .25 seconds on and .25 seconds off for each count of the error code with 1 second off between codes. The control will remain in this condition until power is removed by turning off the call for heat to clear the error and alarm output (if applicable) is off. In standby mode, the control disables operation until the error is corrected,

at which time the normal operation sequence is initiated again. A flashing red LED error code indicates either a problem with wiring, or a component not working, or the control module is faulty. Try to cycle the power to the control, and if the error repeats then see Table 3 for troubleshooting the control.

**Table 3: Red LED Error Indications**

Flash Code	Flash Code Description	Troubleshooting Guide
No LED "ON"	No power	<ol style="list-style-type: none"> <li>1. Check for 24 volts on terminal 24V/TH and terminal GND (24V).</li> <li>2. Check for 24 volts on the secondary coil of the incoming transformer.</li> </ol>
1	No flame in trial time	<ol style="list-style-type: none"> <li>1. Check that the gas is turned "ON".</li> <li>2. If no spark, check spark wire and connection to terminal SPARK and spark ground to terminal GND (BURNER).</li> <li>3. Check for 24 volts on terminal VALVE and terminal GND (VALVE).</li> <li>4. Check for 24 volts at the VALVE coil.</li> <li>5. Check that the VALVE is wired to terminal VALVE and common is wired to terminal GND (VALVE).</li> <li>6. Check Flame Sensor tip is in the flame. For proper sensing the rod tip must be 3/8" (10 mm) to 1/2" (12.7 mm) in the flame.</li> <li>7. Check Flame Sensor is wired to terminal SENSE and terminal GND (BURNER).</li> <li>8. Check that the sense wire is not shorting to ground.</li> </ol>
2	Flame sense circuit error	<ol style="list-style-type: none"> <li>1. Check if pilot flame is distinguished before the call-for-heat cycle is started.</li> </ol>
3	Valve circuit error	<ol style="list-style-type: none"> <li>1. Check for 24 volts on terminal VALVE and terminal GND (VALVE).</li> <li>2. Check for 24 volts at the VALVE coil.</li> <li>3. Check that the VALVE is wired to terminal VALVE and common is wired to terminal GND (VALVE).</li> </ol>
4	Flame loss error	<ol style="list-style-type: none"> <li>1. Check burner ground connections.</li> <li>2. Check flame sensor connections.</li> <li>3. Check gas valve connections.</li> <li>4. Check for drafts.</li> </ol>
7	Internal control error	<ol style="list-style-type: none"> <li>5. Review all ground connections.</li> <li>6. Check if using fiber core resistive wire for Spark Wire.</li> <li>7. Software error – Restart control module.</li> </ol>
Solid Red	Line frequency/voltage error	<ol style="list-style-type: none"> <li>1. Check for 24 volts on the secondary coil of the incoming transformer (+10%/-15% rated voltage).</li> <li>2. Check for 60 Hz or 50 Hz.</li> </ol>

**NOTE:** If all checks have been made using the troubleshooting guide and you have confirmed there are no other defective components, and the red LED error light is flashing, then the ignition may need to be replaced.



BASO Gas Products LLC

450 East Horseshoe Road  
 PO Box 170  
 Watertown, WI 53094  
 1-877-227-6427

Published in U.S.A.  
 www.baso.com