

APPLICATION

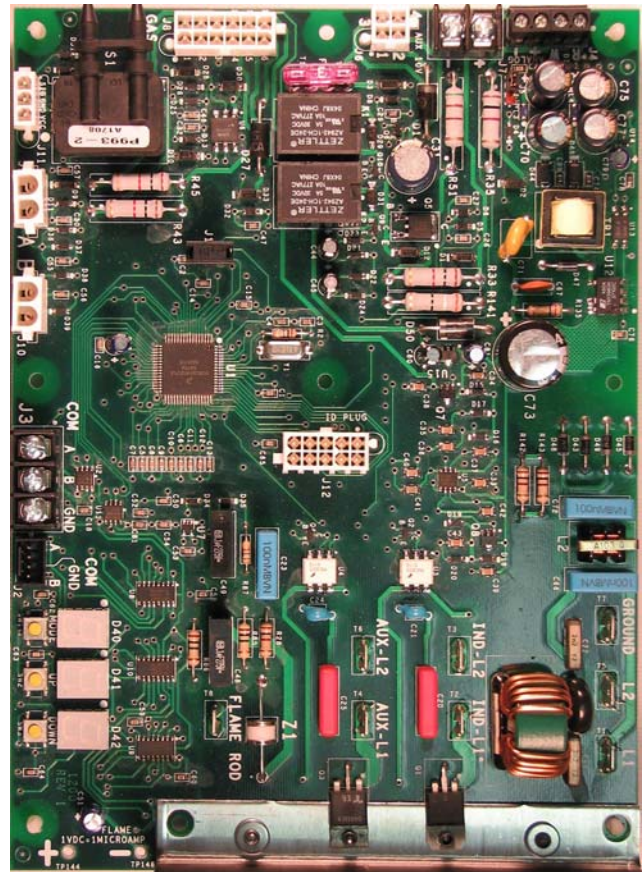
Varidigm's Commercial Variable Burner Controller (VB1200) integrates the operation of all functions required to modulate indirect, gas-fired equipment with induced draft burners. The VB1200 manages ignition, safeties, sequencing and control of all components including the inducer motor and gas valve to achieve maximum turndown, optimal system efficiency and clean combustion at every point in the firing range.

This control is intended for use with Varidigm approved shaded pole or PSC 120/208/240 VAC induced draft motors ranging from 1/20 to 1 HP.

VB1200 Features:

- Customized to optimize the unique characteristics of gas-fired OEM burner & heat exchanger combinations.
- Independent closed-loop sensing and control of combustion air and fuel:
 - Optimize burner efficiency.
 - Maximize turndown.
 - Insure clean combustion.
- Automatically compensates for changes in altitude and variations in vent length.
- Suitable for use with most shaded pole or PSC inducer motors.
- Patented speed control provides high turndown of single speed induced draft motors.
- Control options:
 - 0 – 10 VDC input (or 4–20 mA input).
 - Discharge air temperature.
 - Differential temperature.
- Automatically detects and controls up to four (4) Satellite/Slave furnaces.
- Automatically detects capacity and calculates linear firing rate over 2-10 VDC range to provide proportional heat output.
- Two (2) configurable analog inputs (Discharge temperature, differential temp, etc.).
- One (1) configurable 0-10 VDC analog output (e.g. VFD command, status, alarm).
- Controls remote Direct Spark Ignition (DSI).
- Three bright 7-segment LED's report Status codes for clear understanding and easy diagnosis.

COMMERCIAL VB1200 VARIABLE BURNER CONTROLLER



- Dedicated flame sense test points are easy to access and converted to a 0-4 VDC scale which can be read with a standard voltmeter.
- ID plug allows a single platform to be used for multiple, unique equipment platforms.
- UL/CUL component recognition under ANSI Z21.20.

SPECIFICATIONS

Power source: 120/208/240 VAC, 60 Hz, 1 phase,
15 ampere

Humidity: 5 to 95% non-condensing

Maximum Ambient Temperature:
Operating: -40° to 160 °F (71 °C)
Shipping: -40° to 185 °F (85 °C)

Motor load rating: 15 A @ 120 VAC
7 A @ 240 VAC

Air pressure sensor range:
0.1 - 2.0 inches W.C. (Inducer Pressure)
0.1 – 5.0 inches W.C. (Inducer Pressure)

Gas pressure sensor range:
NG: 0.05" - 4.0" W.C.
LP: 0.15" – 13.5" W.C.

Temperature sensor(s): 10,000 ohm thermistor

Indicator light: Three 7-segment LED's indicate
status of unit and diagnostic codes

Required Components

External DSI Board: DSI-2
Safety gas valves: 24 VAC, 1 A
Varidigm approved modulating gas valve:
Ball valve – actuator assembly:
RTC modulating ball valve
Siemens proportional actuator –
Input: 0 – 10 VDC
Feedback: 0 – 10 VDC
Maxitrol EXA STAR
*Confirm compatibility of other gas valves with
Varidigm*

Combustion air motor current: 15 A max *Confirm
compatibility with Varidigm*

UL/CUL: Component Recognition under ANSI
Z21.20

ORDERING INFORMATION

When ordering, specify model number from the
table below:

| Model Number | Description |
|--------------|-----------------------------|
| VB1200-XXXX | Control Board |
| DSI-2 | Direct Spark Ignition Board |

INSTALLATION

WHEN INSTALLING THIS PRODUCT

1. Read these instructions carefully.
Failure to follow them could damage the
product or cause a hazardous condition.
2. Check ratings given in instruction and on
product to make sure product is suitable
for application.
3. Installer must be a trained experienced
service technician.
4. After installation is complete, check out
product operation as provided in these
instructions.

CAUTION

Controller carries line voltage and suitable
interlocks should be used to protect service
personnel.

Location & Mounting

This control is intended for mounting in a control
compartment or other suitable location that is
protected from moisture and combustion
condensate. The enclosure must restrict access
to live electrical parts. See Figure 2 below for
mounting dimensions.

Disconnect/Breaker

External over current and disconnect means
must be provided in accordance with NEC and
local codes. The fuse or breaker protecting the
motor/controller and other loads within the
appliance must not exceed 20 amps. If the
appliance requires a fuse greater than 20 amps,
a separate 20-amp fuse must be provided for the
motor/controller.

Polarity & Grounding

Line voltage connections are polarity sensitive
and the incoming electrical service requires an
earth ground. Wired correctly, a voltmeter will
display 115 – 132 VAC between L1 and the
chassis ground of the furnace.

VB 1200 Sequence of Operation

1. Call for Heat
 - a. Closed circuit path between “R” & “W”.
 - b. Minimum 2.0 VDC Firing Rate Input.
2. Heating Cycle Initiation
 - a. Command modulating gas valve to “Park” position.
 - i. Typically within 1.0 VDC of firing position.
 - ii. Pre-purge delayed until valve is in position.
 - b. Check air pressure switch for open contacts at minimum inducer setting.
3. Trial for Ignition
 - a. Check air pressure sensor calibration against air pressure switch setting.
 - i. Ramp inducer up to “Must Close” pressure setting – pressure switch closes.
 - ii. Ramp inducer down to “Must Open” pressure setting – pressure switch opens.
 - iii. Inducer times out after 2 minutes if conditions not met.
 - b. Pre-Purge
 - i. Position modulating gas valve to “light-off” position.
 - ii. Verify modulating gas valve feedback indicates “light-off” position.
 - iii. Ramp inducer up to “light-off” pressure setting – pressure switch must close.
 - iv. Start pre-purge timing.
 - c. Ignition Trial
 - i. Energize ignition output to DSI module.
 - ii. Open main gas valve.
 - iii. Monitor flame sense circuit.
 1. If flame is established during the ignition trial period, cycle continues.
 2. If flame is not established, control sequences for an ignition retry.
 3. If flame is not established in 3 successive retries, 1 hour lockout.
4. Warm-up
 - a. Once flame is established, burner operation continues at light-off settings.
 - b. Warm-up duration = minimum 10 seconds to stabilize flame.
5. Run
 - a. The modulating gas valve is set as commanded by FIRING RATE input:
 - i. 0 – 1.5 VDC OFF.
 - ii. 1.6 – 2.0 VDC Minimum fire.
 - iii. 2.1 – 9.5 VDC Modulation linearized to firing rate.
 - iv. 9.5 – 10.0 VDC Maximum fire.
 - b. The gas pressure sensor monitors actual gas manifold pressure.
 - c. The inducer is set to maintain air pressure setting based on combustion curve data at the given gas manifold pressure.
 - d. The control maintains burner operation with the air pressure switch contacts open at lower modulated rates.
6. Heating Cycle Termination
 - a. Heating cycle is terminated for the following conditions:
 - i. 24 VAC removed from the “W” terminal (“R” & “W” open).
 - ii. Firing rate input below 1.5 VDC.
 - iii. Any lock-out condition (Safety).
 - iv. The VB-1200 cycles off and restarts every six hours of continuous operation.
 - b. When the heating cycle is terminated, the following actions occur:
 - i. Main gas valve is closed.
 - ii. Modulating gas valve is set to the “Park” position.
 - iii. Flame sense is ignored for 25 seconds.
 - iv. The inducer is set to post-purge.
7. Post-Purge
 - a. Inducer is set to the “light-off” setting.
 - b. Inducer operates for a post-purge period.
8. OFF Mode
 - a. The control is idle with most outputs de-energized.
 - i. Modulating gas valve is set to the “Park” position.
 - b. The VB-1200 continues monitoring primary safety circuits:
 - i. Internal microprocessor checks.
 - ii. Internal memory checks.
 - iii. Flame safeguard circuitry.
 - iv. Main gas valve circuitry.
 - v. Primary limit circuitry.

VB1200 LAYOUT

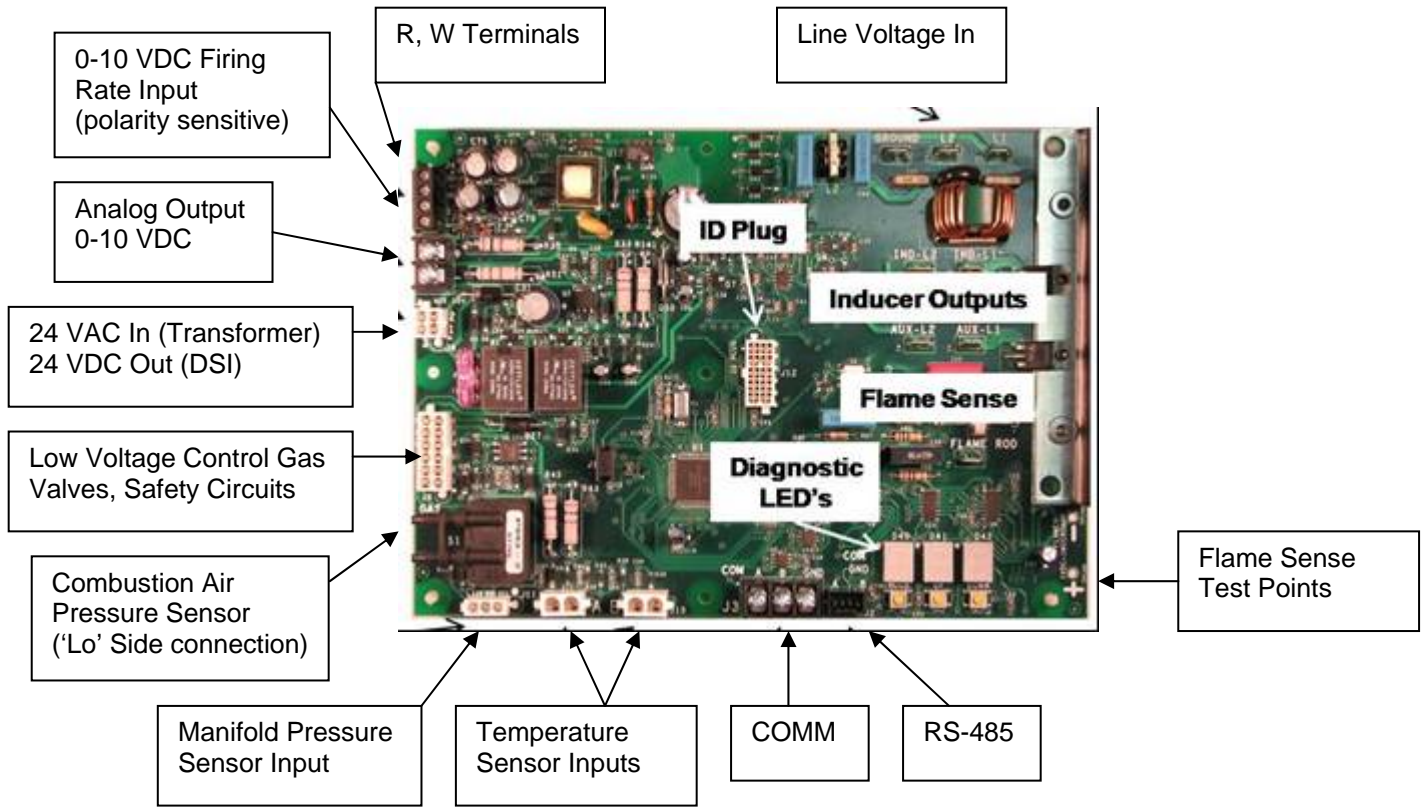


Figure 1 - VB1200 Connections

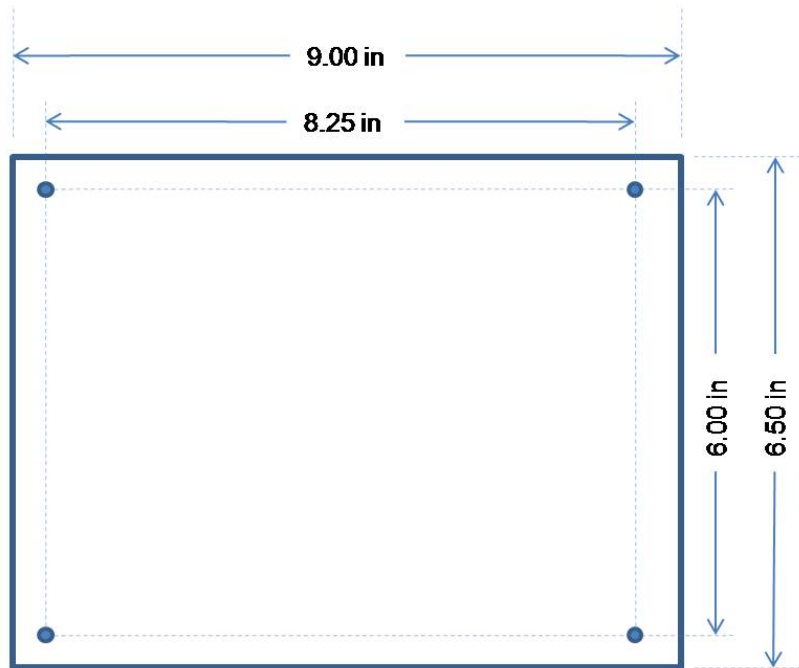


Figure 2 – VB1200 Mounting Dimensions

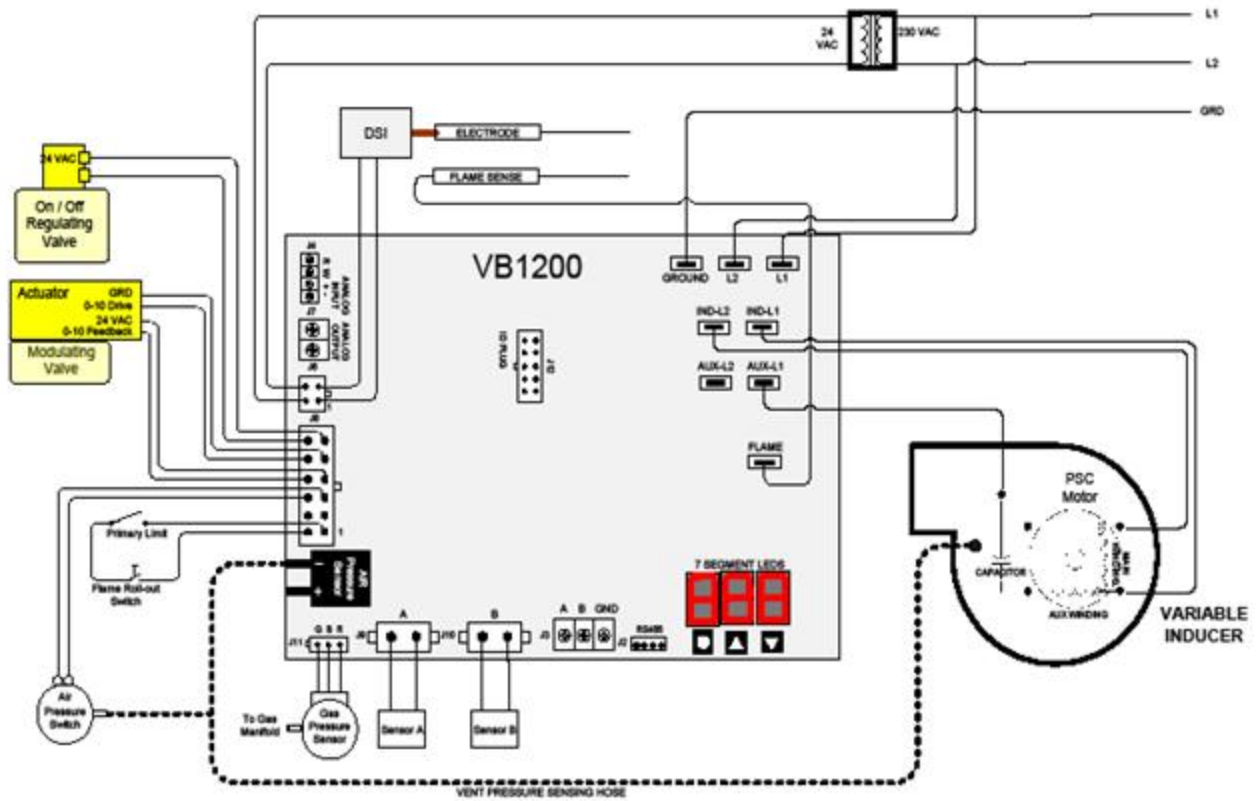
VB1200 Error Codes

| Display Code | Description | Additional comments and notes |
|--------------|---|---|
| BBB | Board Failure <i>(Also during board initialization)</i> | Verify 24 VAC signal input at connector J6. |
| OFF | Burner state = Off | |
| Pur | Burner state = Purge | |
| Ign | Burner state = Ignition | |
| HEA | Burner state = Warmup | |
| run | Burner state = Run | |
| Ret | Burner state = Retry <i>(with AO1 or AO2)</i> | Retry delay following either a failed ignition or a flame loss. |
| AO1 | Failed ignition attempt | |
| AO2 | Lost Flame | Ignition was successful but then flame disappeared. |
| AO3 | Insufficient Combustion Air | Blocked vent with actuator position derated by >20% from Firing Rate Input setting. |
| AO4 | Limited Low Fire ¹ <i>(due to Lost Flame Auto-Adaptation)</i> | Flame loss at low fire results in an auto-adjustment that limits the burner turn down during the rest of the current call for heat. |
| AO5 | Weak Flame Signal | Flame rod aged. |
| AO6 | No Low Fire Mode ¹ <i>(due to Hi Gas Pressure at Low Fire)</i> | The Gas Pressure is not modulating down to low fire. |
| AO7 | Loss of Inducer Motor Control | The Air Pressure is not modulating down at minimum inducer drive. |
| A99 | COM Error – Slaves | CRC errors, serial bus loaded down or poor cable/routing? |
| EO1 | Failed Ignition | Four failed ignition attempts have occurred. |
| EO2 | Primary Limit Failure | Verify Primary Limit input at connector J8 and fuse at F1. |
| EO3 | Modulation Valve Failure | The Valve Actuator did not reach a Park or Full On position. |
| EO4 | Air Sensor Failure - <i>Pressure Reading Low</i> | Includes insufficient air --- lockout due to blocked vent. Includes air switch failure to open during pre-purge switch check. |
| EO5 | Air Sensor Failure - <i>Pressure Reading High</i> | Includes air switch failure to close during pre-purge switch check. |
| EO6 | Gas Sensor Failure - <i>Pressure Reading Low</i> <i>(Possible modulating valve actuator misalignment)</i> | Verify Gas Pressure Sensor signal input at connector J13. Includes detection of an LP Gas Pressure Sensor on an NG burner. |
| EO7 | Gas Sensor Failure - <i>Pressure Reading High</i> <i>(Possible modulating valve actuator misalignment)</i> | Includes detection of an NG Gas Pressure Sensor on an LP burner. |
| EO8 | Improper Flame | |
| EO9 | No Firing Rate Input | The thermostat "W" input is calling for heat but the Firing Rate Input is < 2.0 V. |
| E id | Invalid I.D. Plug Installed | |

¹ Applicable only to Varidigm 1200 controllers that are configured to modulate down to very low fire rates in order to achieve the desired turn down ratio.

VB1200 Wiring Diagram with RTC Ball Valve - Actuator

1200 Commercial Control Wiring Diagram Factory Wiring



VB1200 PSC Inducer Wiring

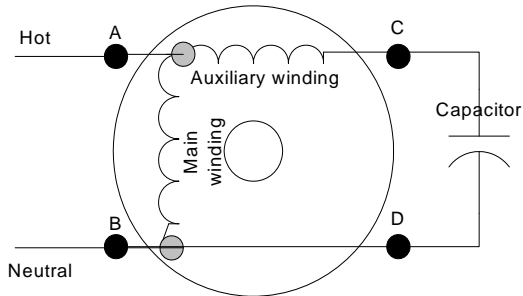


Figure 1

Referring to Figure 1, a typical PSC inducer motor has five connections:

- A. Power (High speed tap)
- B. Power (Neutral)
- C. Capacitor
- D. Capacitor
- E. Ground - (not shown, but ground the wire to an earth ground)

Procedure:

1. Disconnect the motor from the power source.
 - Short from C-D using a 15-50 ohm, ½ watt resistor to assure that the capacitor is discharged.
 - Disconnect capacitor from terminals C-D.
2. Determine the leg that has zero resistance.

| Terminal | Terminal | Ohms |
|----------|----------|------|
| A | C | 2.2 |
| A | D | 2.8 |
| B | C | 5.0 |
| B | D | 0 |

In the above example (Figure 1), the zero resistance leg was identified as leg B–D.

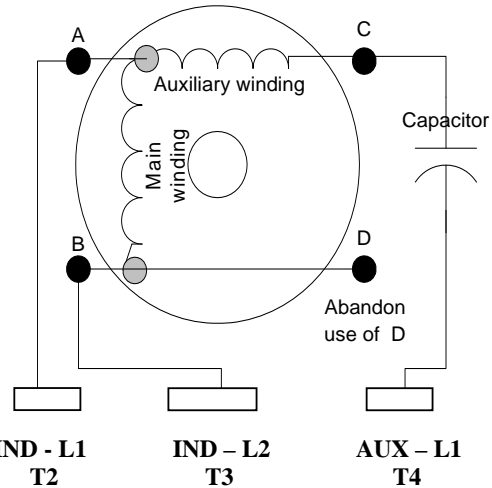



Figure 2

Make the connections to the VB1200 controller as shown in Figure 2:

Using the zero resistance leg in this example make the following connections:

- Connect terminal B to the terminal marked IND – L2 (T3) on the controller.
- Connect the capacitor lead previously connected to terminal C directly to the terminal marked AUX – L1 (T4) on the controller.
- Using a wire nut (or equivalent), insulate terminal D, which will no longer be used.
- Connect terminal A to the terminal marked IND – L1 (T2) on the controller.

Warning: Only single speed PSC Inducer motors can be used for this application.



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