Honeywell

# DIGITAL BURNER CONTROLLER

DBC2000 SERIES

## PRODUCT HANDBOOK


## APPLICATION

The Honeywell DB2000E is a microprocessor-based integrated burner control for automatically fired gas, oil or combination fuel industrial single burner power burner applications. The DBC2000E system consists of the relay module and wiring subbase. The DBC2000E Standard Model provides the minimum requrements to control an industrial burner system, such as automatic burner sequencing, flame supervision, system status indication, system or self-diagnostics and troubleshooting. The DBC2000E Enhanced Model includes an integrated Valve Proofing System, as well as bus communication.

The DBC2000E is programmed to provide a level of safety, functional capability and features beyond the capacity of conventional controls.

## FEATURES

- Employs a plug-in mounting method
- Uses a microprocessor to improve performance
- The progress of the sequence can be easily determined by status indicator LEDs
- All models have a 4-wire firing rate switching circuit to control an air damper or other auxiliary equipment during startup of the burner.
- Safe start check before and during pre-purge
- Safety shutdown occurs on
  - malfunction of the burner controller
  - failure to ignite the pilot burner or main burner
  - loss of flame during run period
  - opening of air flow switch during pre-purge, start-up, run and post-purge period.
  - flame signal detection during standby or pre-purge period
- Remote communication (Enhanced model only)
- Valve Proving System (Enhanced model only)

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# SPECIFICATIONS

Table 1: Model Selection Guide

| Model | Description / Application | Supply voltage |
|---|---|---|
| DBC2000E1xxx | Standard model | 115 or 230Vac |
| DBC2000E2xxx | Enhanced model | 115 or 230Vac |
| The Enhanced Model includes remote bus communication and a Valve Proofing System. | | |

Table 2: Sequence timing

| Waiting for AFS | Waiting for HF | Pre-purge | Ignition trial | Pilot-only | Main trial | Main stabilized | Post purge | Flame failure response |
|---|---|---|---|---|---|---|---|---|
| 5m max | 5m max | 35sec | 3sec | 3sec | 3sec* | 4 sec* | 15 sec** | Max. 1sec |

* set to 0sec if DBI function is enabled
** set to 0sec if no postpurge feature is enabled
Sequence at flame failure: immediate lock out

Table 3: Contact ratings

| Terminal | Load | Contact rating |
|---|---|---|
| 3 | Blower / Fan | 3A @ cosφ=0.6 |
| 4 | Ignition transformer | 3A @ cosφ=0.6 |
| 5 | Intermittent pilot or main (DBI) valves | 3A @ cosφ=0.6 |
| 6 | Interrupted Pilot | 3A @ cosφ=0.6 |
| 7 | Main (PI) valves | 3A @ cosφ=0.6 |
| 8, 9, 10, 11 | Control motor | 0.5A @ cosφ=0.6 |
| 21 | Alarm | 0.5A @ cosφ=0.6 |

Total load (based on set): Max 8A (Internal Fuse : 10A)
Total load (based on terminal 4,5,6,7): Max 5A (Internal Fuse : 6.3A)

Table 4: Flame detection systems

| Detector type | Flame detector model No. | Standard flame current |
|---|---|---|
| UV detector | C7027A, C7035A, C7044A | 4μA min. |
| Flame Rod | Rectification type Flame rod, or C7012A/G | 18μA max. |

**Mains input: Supply voltage**
220 to 240Vac -15% +10% 50/60Hz or
110 to 120Vac -15% +10% 50/60Hz

**Allowable ambient Temperature & Humidity**
-10 °C; +60°C
90% RH max. at 40°C (non condensing)

**Approvals**
CE certification to standard EN298:2003
CE certification to standard EN230:2005

**Additional approvals:**
Lloyds (planned)
EN746-2 compliant
PED (planned)
SIL2 (planned)
Apave (planned)

**Power consumption**
9VA

**Protection class**
IP40

**Vibration**
0.5G

**Mounting**
Plug-in mounting method using sub-base

**Dimensions**
103mm x 103mm x 124mm (W x D x H) incl. sub base.

**Status indicator LEDs**
- Standby
- Purge
- Ignition
- Pilot
- Main
- Modulate
- Flame On
- Alarm

The LEDs will shortly blink as soon as power is applied to the DBC2000E and then as soon there is a heat demand , indicate the burner sequence.

The LED's are also used to indicate faults. For example, if a loss of flame signal occurs during RUN, the LED's for Alarm, Flame and Main will blink the fault code.

**Reset switch**
When the DBC2000 is in lock out condition and the alarm LED blinks, press reset button one time to reset the DBC2000 and stop the alarm. If the heat demand is still present, the DBC2000e will perform the start sequence normally if the fault condition has been resolved, otherwise the lock out will repeat.

If during the lock out condition the DBC2000E is deenergized and power is reapplied afterwards, the DBC2000 will remain in lock out (non-volatile lock out).

A remote reset push button switch can be connected between terminals 15 and 19. The functionality of the remote reset is the same as the red push button on the front of the device, with one exception:.

The remote reset may occur only 5 times during 15 minutes of operation, while the internal reset buton is unlimited.

**Remote communication**
- Communication protocol: Profibus or Modbus (future)
- Availability of:
  - Sequence status
  - Fault information
  - Flame signal strength
  - Remote reset (max 5x per 15mins)
  - Remote heat demand
- Transmission speed : 9600bps
- Interface type : RS485 (M+, M-, COM)
- Address select : 1~99 encoder switch

# DIMENSIONS

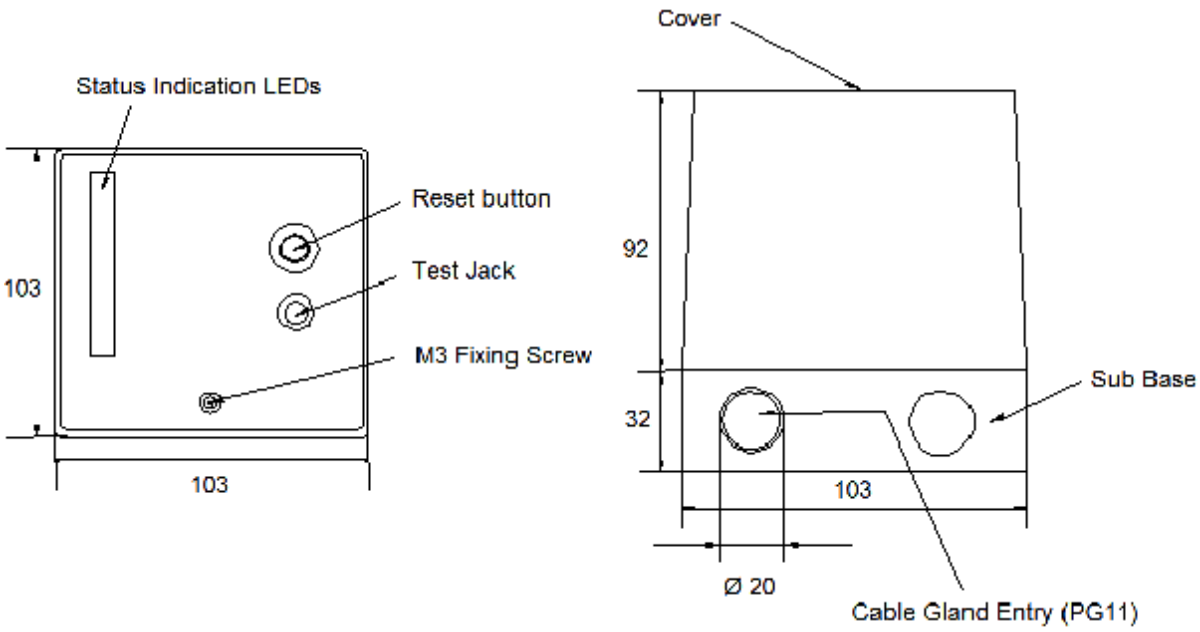


Fig. 1: External Dimensions (in mm)

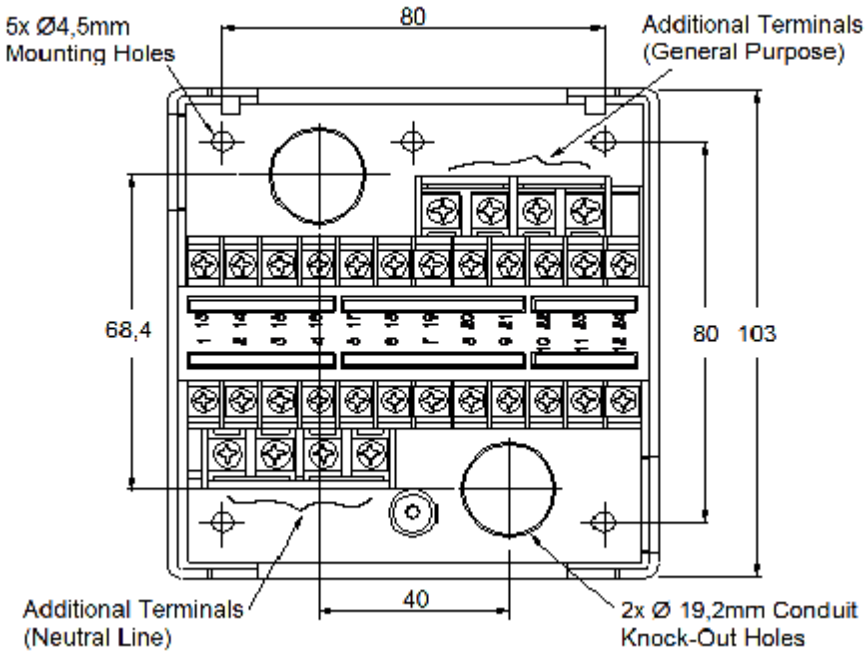


Fig. 2: Mounting dimensions of sub-base and terminal layout

# INSTALLATION AND WIRING

## CAUTION

## 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 the ratings given in the instructions and marked on the product to make sure the product is suitable for the application.
3. Installer must be a trained, experienced, flame safeguard service technician.
4. After installation is complete, check out the product operation as provided in these instructions.

## WARNING

**Fire or Explosion Hazard.**

**Can cause property damage,**

**severe injury, or death.**

Carefully follow safety requirements when installing a burner control.

## CAUTION

**Electrical Shock Hazard or Equipment/**

**Control Damage.**

**Can cause electrical shock or equipment damage.**

Disconnect power supply before beginning installation.

***IMPORTANT***

1. Wiring connections for the relay modules are unique; refer to Fig. 3-2 or the appropriate Specifications for individual subbase wiring.
2. Wiring must comply with all applicable codes, ordinances and regulations.
3. Wiring must comply with NEC Class 1 (Line Voltage) wiring.
4. Loads connected to the DBC2000E must not exceed those listed on the relay module label or the Specifications; see Table 3.
5. Limits and interlocks must be rated to simultaneously carry and break current to the ignition transformer and fuel valve(s).
6. All external timers must be listed or componentrecognized by authorities who have proper jurisdiction.
7. For on-off gas-fired systems, some authorities who have jurisdiction prohibit the wiring of any limit or operating contacts in series between the flame safeguard control and the main fuel valve(s).
8. Two UV flame detectors can be connected in parallel.
9. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, can cause interference with radio communications. It has been tested and found to comply with the limits for a Class B computing device of Part 15 of FCC rules, which are designed to provide reasonable protection against such interference when operated in an industrial or commercial environment. Operation of this equipment in a residential area can cause interference, in which case, the users, at their own expense, may be required to take whatever measures are required to correct this interference.
10. This digital apparatus complies with the requirements as stated in the EN298:2003.
11. Do not install the Burner Controller under any circumstances in the following locations.
    ① Where chemicals or corrosive gases are present, such as ammonia, sulfur, chlorine, ethylene compounds, acids, etc.
    ② Install the relay module where the relative humidity never reaches the saturation point. The relay module is designed to operate in a maximum 85% relative humidity continuous, noncondensing, moisture environment. Condensing moisture can cause a safety shutdown or damage the device.
    ③ Where temperatures exceed the maximum specification for this device.
    ④ Where vibration exceeds 0,5G continuous vibration.
12. Do not bundle power wiring and high voltage ignition cable with the flame detector wiring, or run them in parallel within the same conduit. High voltage cables must be kept separated at least 10 cm from the Burner Controller.
13. Use proper grounding work in accordance with the engineering standards for electrical equipment
14. Connect the high voltage cable of the ignition transformer properly to the ignition electrode. A poor connection can cause an electrical shock or damage the equipment. Additionally the ignition transformer must be properly grounded according the standards.

## REMOVE THE RELAY MODULE FROM ITS SUB BASE AND FIX THE SUB BASE

1. Loosen the M3 fixing screw as shown in Fig. 1 by about eight turns using a Philips head screwdriver.
2. Take the subbase and cover with both hands and unfold them gently. Fold the relay module upwards, the turning point is on the top. Do not apply excessive force, otherwise damage may occur.
3. Punch out the needed conduit knockout holes for the wiring as shown in Figs 1 and 2, and install the wiring conduit(s).
4. Using the fixing screws, mount the subbase in the specified position.

## WIRING THE RELAY MODULE BOTTOM TERMINALS

1. For applications with a UV detector, remove the jumper terminal located at the terminal block on the bottom of the relay module.
2. For applications using remote communication, connect communication cable to “BUS” terminal located at the terminal block on the bottom of the relay module. In addition, set the communication address uring the rotary switches at the bottom of the relay module.

## WIRING THE SUB BASE

1. Fig.2 shows the layout of the terminals on the subbase, and Figs.3-1 to 3-3 show examples of connections to external equipment. Regarding the wiring to the flame detector, refer to Fig.4.
2. When using Intermittent Pilot, connect the pilot valve to Terminal 5. Connect the main valves to Terminal 7 (Enhanced Model: connect main valve 1 to Terminal 7 and main valve 2 to Terminal 12 for the VPS function)
3. When using Interrupted Pilot, connect the pilot valve to Terminal 6. Connect the main valves to Terminal 7 (Enhanced Model: connect main valve 1 to Terminal 7 and main valve 2 to Terminal 12 for the VPS function)
4. When using direct ignition (DBI), jumper Terminals 15 and 22. And connect the Main(DBI) valves to Terminal 5.
5. When not using purge position interlock, jumper Terminals 15 and 16.
6. When not using start position interlock, jumper Terminals 13 and 17.
7. When not purge and start position interlocks, jumper Terminals 15 and 16 as well as Terminals 13 and 17 simultaneously.
8. Connect the safety switch circuit (lockout interlocks) between Terminals 15 and 18. The safety switch circuit must be closed always, otherwise a lockout occurs immediately.
9. For non-floating mains power grids (Neutral to Ground), connect the Line-L to Terminal 1and the Line-N to Terminal 2. Use a correct fuse: 10A fast blow maximum.
10. Check all wiring circuits and assure that the correct fuse is installed. Check the correct voltage.
11. Finally plugl the relay module on to its sub base and fix it with the M3 fixing screw. Do not overtight the screw.
12. When using a surge absorber, connect it between Terminal 2 and application ground.
13. Connect the mains supply voltage using 0.75㎟ or larger lead wire.

**DBC2000 standard model terminals**

1. Line Voltage (L)
2. Line Voltage (N)
3. Blower / Fan (O)
4. Ignition Transformer (O)
5. Intermittent Pilot or Main (DBI) Valves (O)
6. Interrupted Pilot (O)
7. Main (PI) Valves (O)
8. Firing Rate Common (I)
9. Firing Rate Modulate (O)
10. Firing Rate Purge (O)
11. Firing Rate Start (O)
12. Post-Purge Select (I)
13. Low Fire Interlock Override (O)
14. Air Flow Switch (I)
15. Control Switches Common (O)
16. HF - Purge Position Interlock (I)
17. LF - Start Position Interlock (I)
18. Safety Limits (I)
19. Remote Reset (I)
20. Heat Demand (I)
21. Alarm (O)
22. PI/DBI Select (I)
23. Flame Detector (F)
24. Ground (G)

**DBC2000 enhanced model terminals**

1. Line Voltage (L)
2. Line Voltage (N)
3. Blower / Fan (O)
4. Ignition Transformer (O)
5. Intermittent Pilot or Main (DBI) Valves (O)
6. Interrupted Pilot (O)
7. Main (PI) Valve 1 (O)
8. Firing Rate Common (I)
9. Firing Rate Modulate (O)
10. Firing Rate Purge (O)
11. Firing Rate Start (O)
12. Main (PI) Valve 2 (O)
13. Low Fire Interlock Override (O)
14. Air Flow Switch (I)
15. Control Switches Common (O)
16. HF - Purge Position Interlock (I)
17. LF - Start Position Interlock (I)
18. Remote Reset (I)
19. Safety Limits (I)
20. Heat Demand (I)
21. Alarm (O)
22. VPS Pressure Switch (I)
23. Flame Detector (F)
24. Ground (G)

Fig. 3-1: Terminal layout

**(1) For Modulating Control**
**( When using an intermittent pilot )**

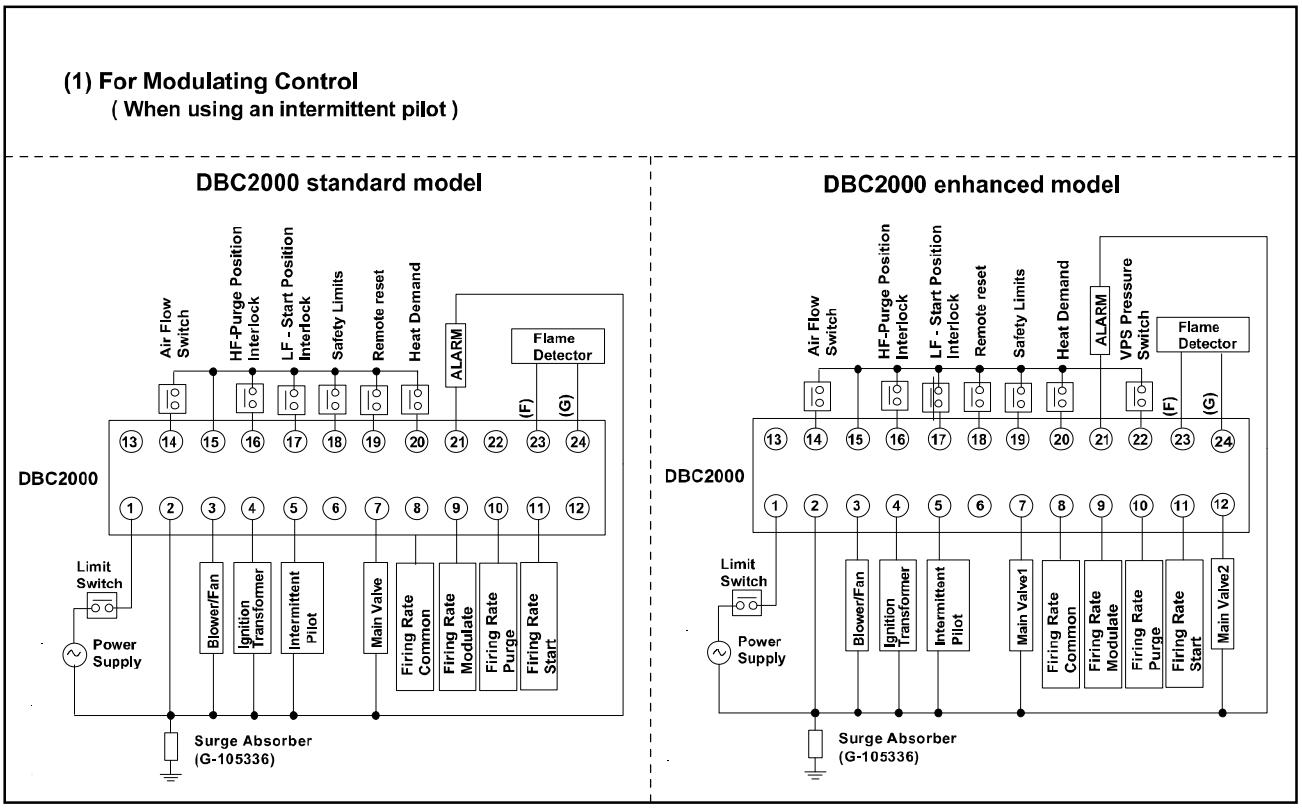


Fig. 3-2: Example1 of wiring to external equipment

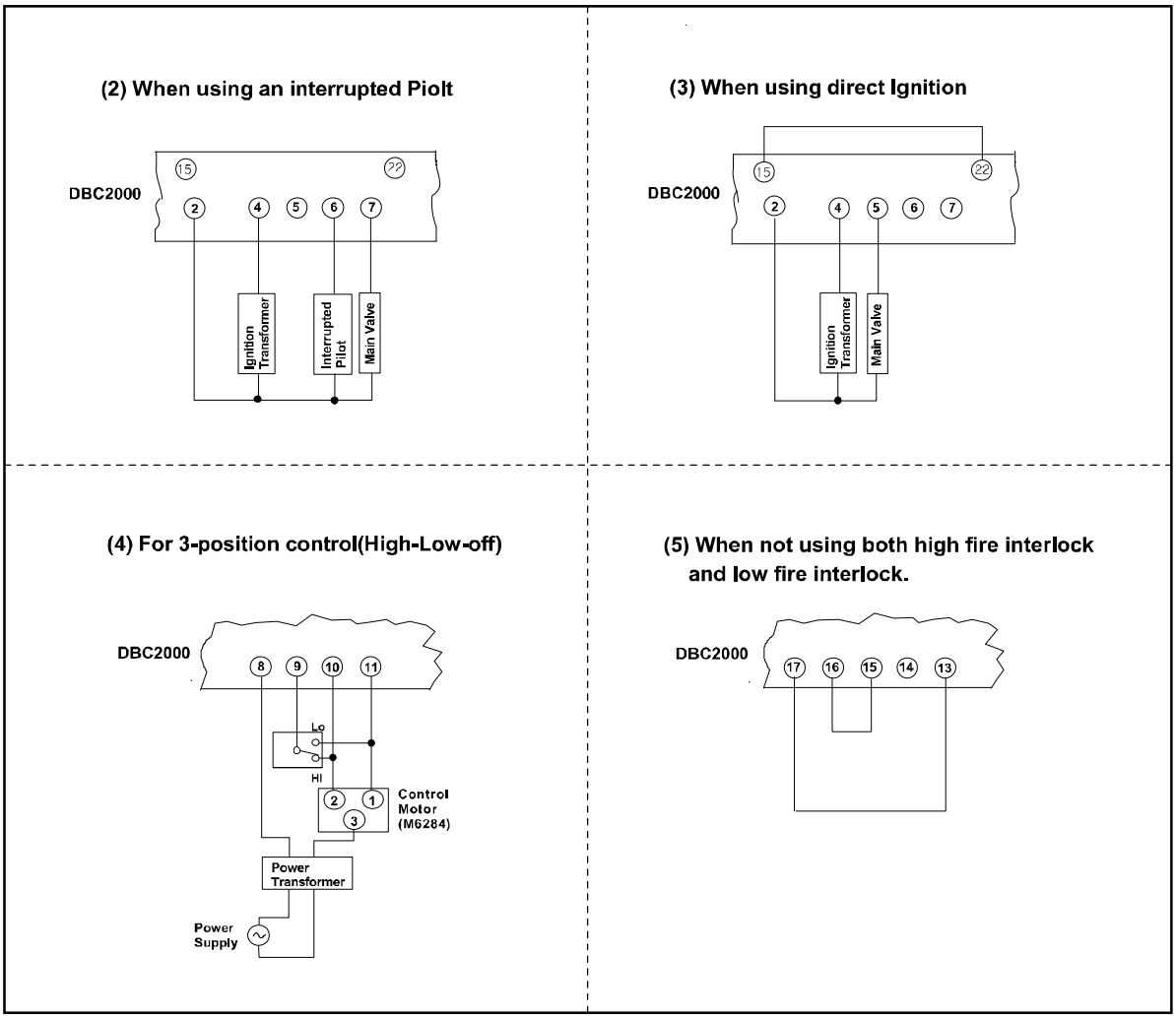


Fig. 3-3: Example2 of wiring to external equipment

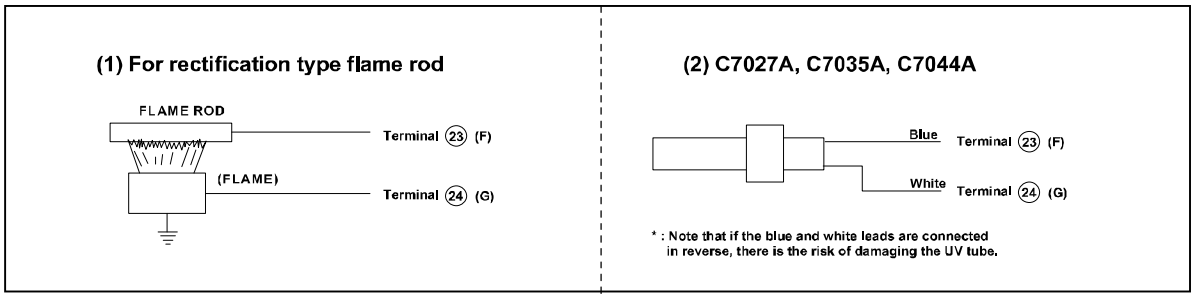


Fig. 4: Connection to flame detector

# OPERATION

## 1. NORMAL OPERATION

| Power SW and Controllers | Operation of BC2000 and device | Indicator LED * |
|---|---|---|
| Power SW ON,<br>Limit SW OM | The power supply voltage is applied across Terminal 1, and 2.<br>When no flame signal is present, the combustion airflow switch is opened (T14=OFF) and safety lockout circuit is closed (ON), it is possible to start. | ●○○○○○○○ |
| Controller ON | The blower is energized (T3). Firing rate goes to PURGE position. Air flow switch closes (T14=ON) as soon as air flow is present. | ●●○○○○○○ |
| | The pre-purge timer starts counting as soon as PURGE interlock is closed (T16=ON). | |
| | After the completion of pre-purge timing, firing rate goes to START position. | |
| | The ignition wait timer starts counting as soon as the START position interlock is closed (T17=ON). | |
| | After completion of the ignition wait timing, the Ignition sequence starts. The Ignition transformer is energized. The Intermittent and Interrupted pilot valve outputs are energized (T5 and T6). | ●○●○○○●○ |
| | When a flame is detected after the ignition trial has ended (Safety1), the pilot stabilization time starts. | ●○○●○○●○ |
| | After completion of the pilot-stabilization time, the Main valves are energized (T7=ON). Note: Enhanced Model: also (T12=ON).<br>The Main trial for ignition takes place (Safety2). | ●○○○●○●○ |
| | After completion of the main trial time, Interrupted pilot valve is deenergized (t5=OFF). The Main stabilization time starts. | ●○○○●○●○ |
| | After completion of the main stabilization time, the firing rate goes to modulation position and releases control to an external modulation device. | ●○○○○●●○ |
| Controller OFF | The intermittent pilot valve and main valves are deenergized (T6=OFF and T7=OFF). Note: Enhanced Model: also (12=OFF)". Firing rate moves to PURGE position.<br>The post-purge timing takes place. | ●●○○○○○○ |
| | After the completion of the postpurge time, the blower is deenergized and firing rate moves to START position. | ●○○○○○○○ |
| | After the air flow switch goes OFF, DBC2000E returns to the STANDBY condition, waiting for the next heat demand. | |

* For LED indication, ○ means 'off' ● means 'illuminated' ◐ means 'blinking'.
* The LEDs are arranged in the following order: Standby, Purge, Ignition, Pilot, Main, Modulate, Flame and Alarm atthe left front side of the DBC2000E.

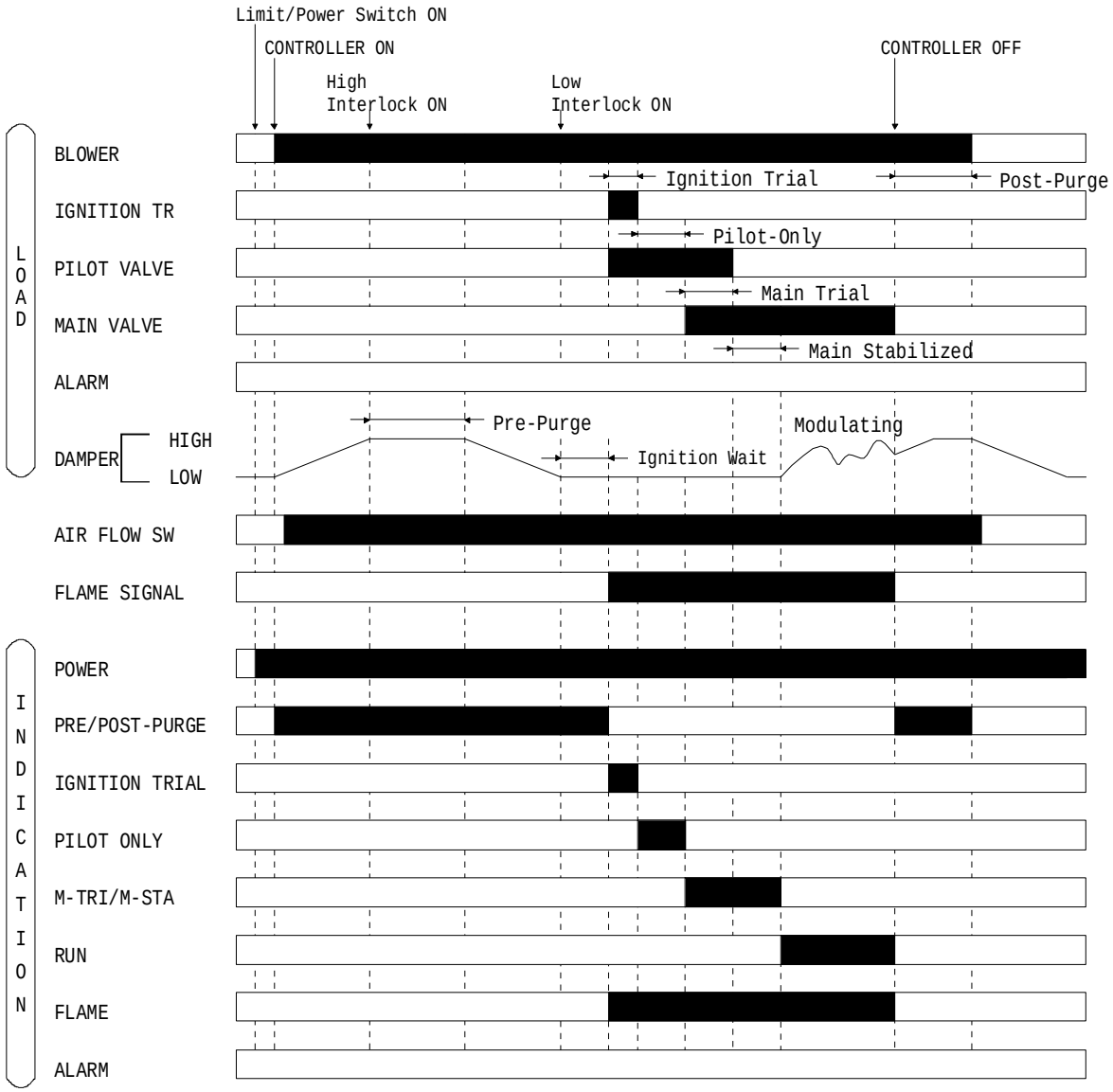


Fig. 5: Normal operation

## 2. ERROR TYPES AND SAFE SHUTDOWN

If a critical error related to safety operation (such as a loss of flame, opening of the air flow switch during the ignition trial and run sequence) is detected, the DBC2000 instantly goes into lock-out and goes to pre-purge status.
If a non critical error (such as opening of the air flow switch opening during post-purge) is detected, DBC2000 holds the sequence for lock-out time and then goes into lock- out.
For all types of errors, the status LEDs indicate the status information to the operator.
Fig. 6 to Fig. 13 show the sequence of DBC2000 in case of some error. And Table.5 shows the status of LEDs for each error.

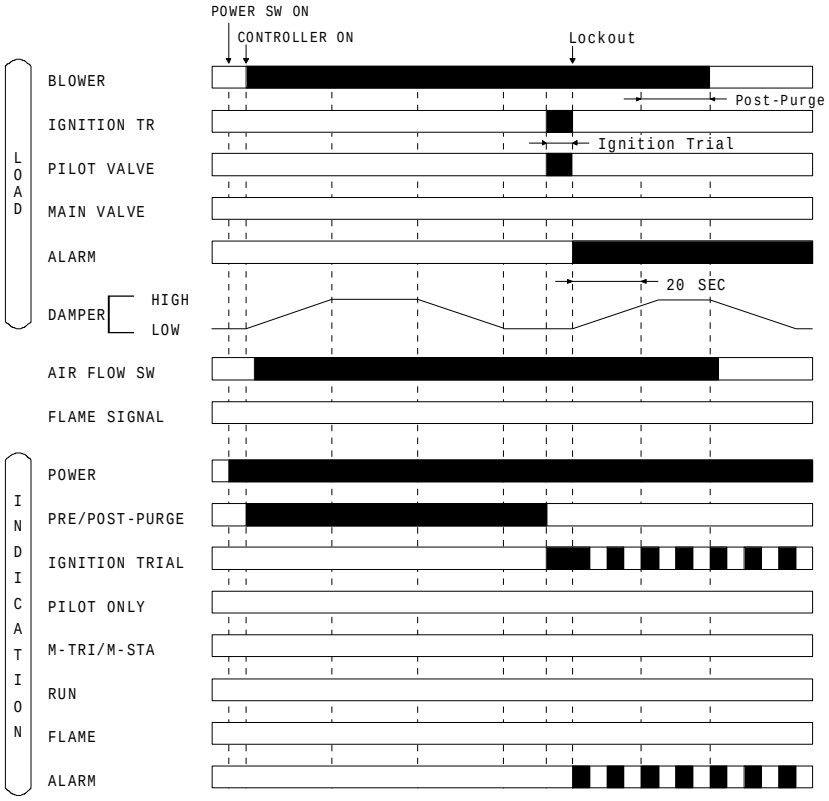


Fig. 6: Failure to ignite the pilot

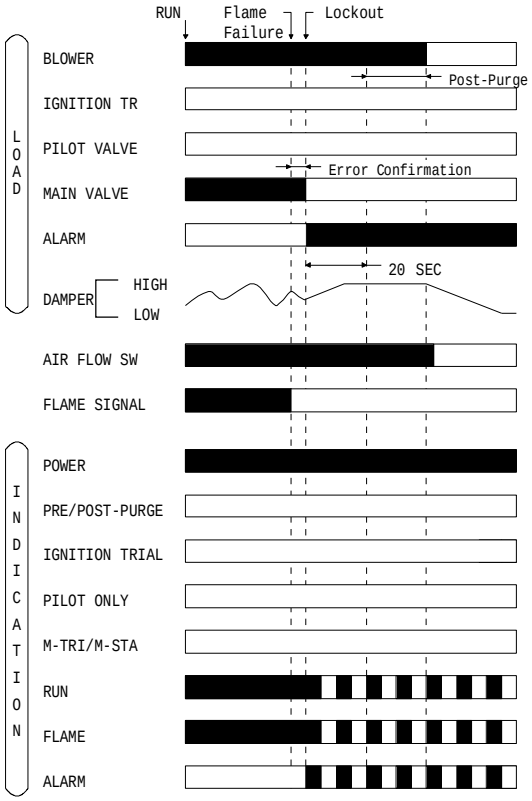


Fig. 7: Flame failure during run period

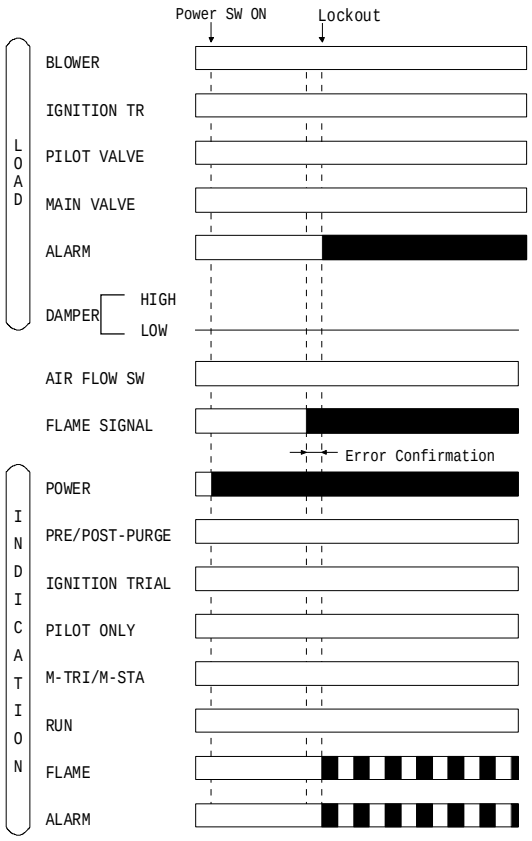


Fig. 8: When false flame signal is generated during standby

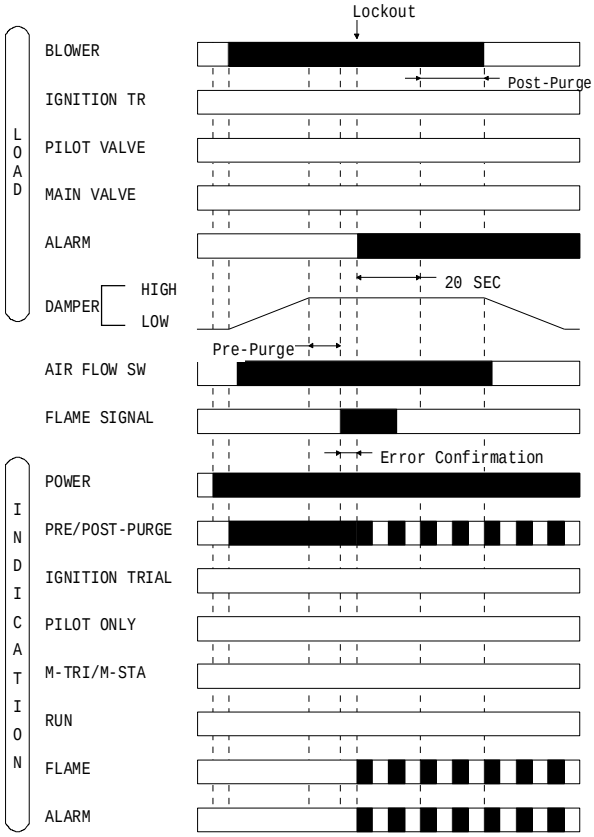


Fig. 9: When false flame is generated during pre-purge

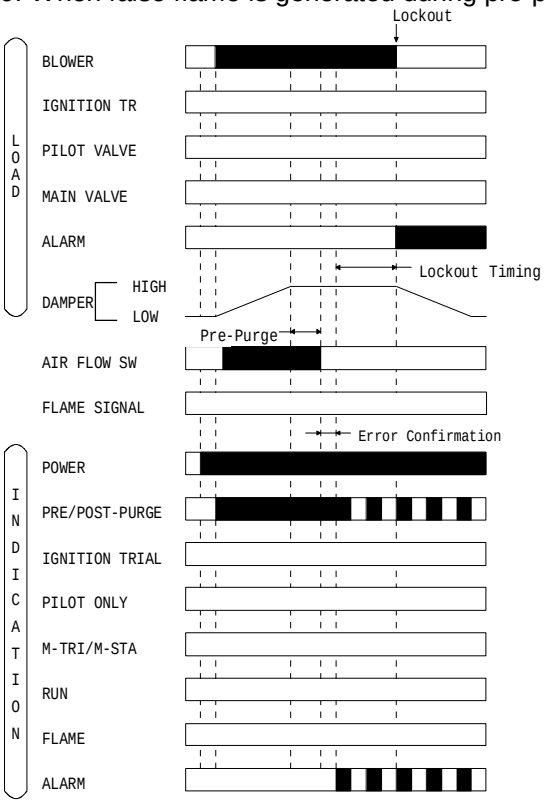


Fig. 10: When air flow switch goes OFF during pre-purge, and continues after the Lockout timing

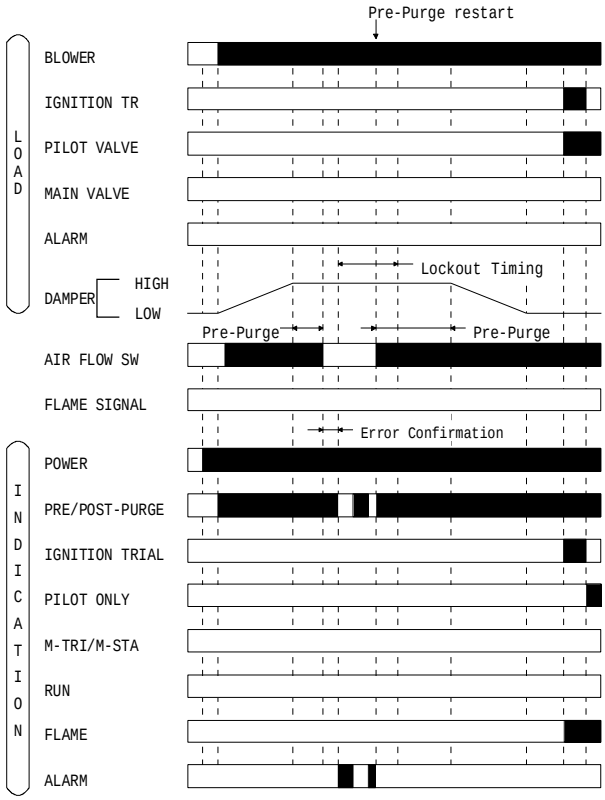


Fig. 11: When air flow switch goes OFF during pre-purge, and then ON again within Lockout timing

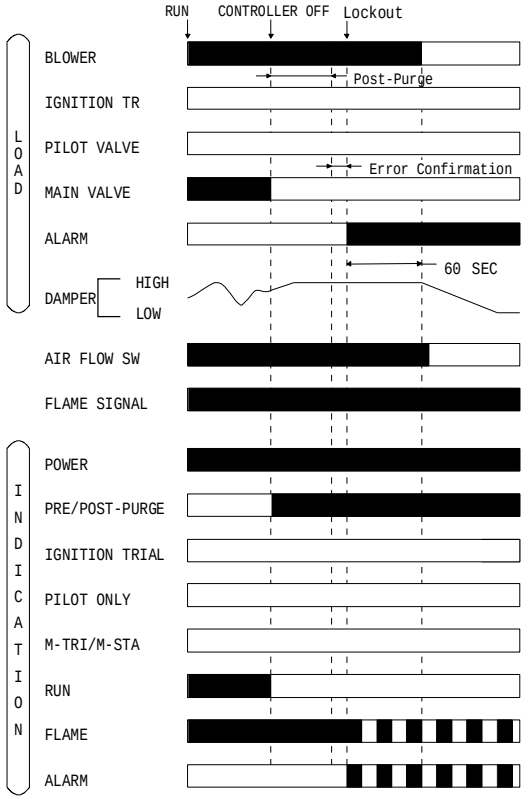


Fig. 12: When flame signal remains present after the end of heat demand

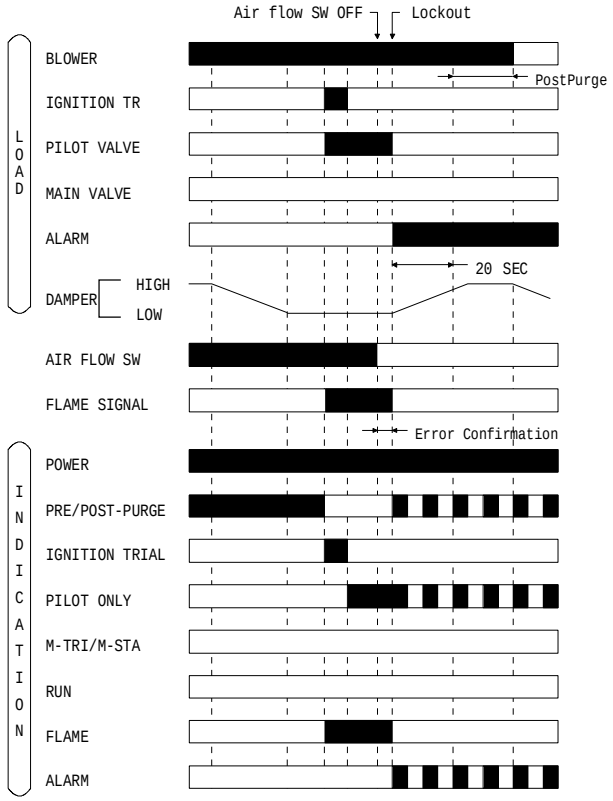


Fig. 13: When air flow switch goes OFF during Pilot stabilization

Table 5: Error condition and LED status

| Sequence | Error condition | Indicator LED status *1 |
|---|---|---|
| Standby *2 | Air flow switch remains ON (closed) for more than 5 minutes, or START position interlock switch remains OFF(opened) for more than 5 minutes. | ●◐○○○○○◐ |
| | Flame signal is present | ●○○○○○◐◐ |
| | Blower motor is energized | ●○○◐◐○○◐ |
| Pre-purge | Air flow switch remains OFF for more than 5 minutes. after the heat demand has started. | ●◐○○○○○◐ |
| | PURGE position interlock switch remains OFF for more than 5 minutes. after the heat demand started. | ●◐◐◐○○○◐ |
| | Both PURGE and START position interlocks ON at the same time during prepurge period | ●◐◐◐○○○◐ |
| | START position interlock remains OFF more than 5 minutes. after pre-purge has finished | ●◐◐◐○○○◐ |
| | Air flow switch goes ON within 5 minutes. after the heat demand started, but air flow switch goes OFF again. | ●◐○○○○○◐ |
| | Flame signal is present. | ●◐○○○○◐◐ |
| Ignition Standby | Air flow switch goes OFF | ●◐○○○○○◐ |

| | | |
|---|---|---|
| | Flame signal is present | ●◐○○○○◐◐ |
| Ignition Trial | Air flow switch goes OFF | ●◐◐○○○○◐ |
| | Ignition failure (flame signal is present during ignition-trial). | ●○◐○○○○◐ |
| Pilot | Air flow switch goes OFF | ●◐○◐○○○◐ |
| | No flame signal | ●○○◐○○◐◐ |
| Main ignition Trial | Air flow switch goes OFF | ●◐○○◐○○◐ |
| | No flame signal | ●○○○◐○◐◐ |
| Main ignition Stability | Air flow switch goes OFF | ●◐○○◐○○◐ |
| | No flame signal | ●○○○◐○◐◐ |
| Run | Air flow switch goes OFF | ●◐○○○◐○◐ |
| | No flame signal | ●○○○○◐◐◐ |
| Post-purge | No power is supplied to NO.3 terminal because of inter relay contact failure. | ●◐○◐◐○○◐ |
| | Flame signal is present for more than 10 seconds after heat demand has ended. | ●○○○○○◐◐ |
| | Air flow switch keeps ON more than 2 minutes after post-purge. | ●◐○○○○○◐ |

*1 For LED indication, ○ means ‘off’ ● means ‘illuminated’ ◐ means ‘blinking’.
The LEDs are arranged in the following order: Standby, Purge, Ignition, Pilot, Main, Modulate, Flame and Alarm at the left front side of the DBC2000E

.*2 If an error occurs during Standby, the DBC2000 will not lock-out but LEDs indicate the current error status.
In this case, the DBC2000 cannot start before the error is resolved.

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