POWER FLAME, INC.

DC-3 Draft Control System

FEATURES & BENEFITS

- Combines six control & monitoring functions.
- Saves fuel and improves safety.
- Multiple draft control functions.
- Flue gas temperature indicator/transmitter.
- Electronic draft gauge.
- Draft range transmitter.
- Menu-driven setup.
- ISA Sequence M FGT alarm.
- Integral low draft/high pressure cutoff switch.
- Economical: long-term returns on low initial investment.
- DEP, CUL & UL Approvals.
- Modbus Serial Communications.
- Field configurable for all control & monitoring functions.
- Processor diagnostic LED's.

INTRODUCTION

The Power Flame DC-3 Draft Control System is a state of the art product that combines, in one package, all the components of draft control, flue gas monitoring and safety:

- High performance microprocessor for accurate draft control.
- Draft sensor (No external transmitter is required.)
- Draft range signal for monitoring.
- Electronic draft reading.
- Flue gas temperature transmitter and reading.
- Flue gas temperature alarm.
- Low draft or high pressure cutoff switch.

The solid-state design eliminates repair expenses associated with draft controls that use mechanical switching mechanisms or general purpose controllers.

STANDARD PACKAGE

The DC-3's many standard features provide a simple operator interface and accurate control. The unit is field-configured by means of the front panel pushbuttons (enter, increase, decrease, reset) and simple jumper changes on the processor board. Draft control logic functions include non-sequencing, sequencing, pre- and post- purge, and adjustable start. The bright, two-line, vacuum-fluorescent display shows the control parameters, alarms and sensor values in engineering units. Since the draft pressure is displayed on the draft controller, there is no need for a separate mechanical gauge and its piping. The draft signal is retransmitted as 4-20 mA DC for a range of –2.0 to + 2.0" w.c. A 3-mode selector switch (close/auto/open) allows manual damper positioning.

The integral draft sensor is a piezoresistive, silicone element capable of measuring positive or negative pressure directly. The sensor is temperature-compensated and produces an electrical signal directly proportional to the pressure in the boiler. The controller output through zero-crossover-switching relays is selectable for bi-directional, switched 117v AC or 24v AC to operate the damper electric actuator. Adjustable dead band and damping circuits filter out process noise, eliminating cycling.

The DC-3 interfaces with any burner management system. The 10 amp burner interface relays ensure reliable service.

Processor diagnostic LED displays are employed for troubleshooting, alarms and operations. The LED's show many DC-3 status functions such as processor running, increase/decrease control action, modulate mode, alarms and status with burner management system.

WHY DRAFT CONTROL?

Draft control is essential to both fire tube and water tube boiler applications. Boilers with stack heights of 25–30 feet (or even boilers with stub stacks) benefit from proper draft control and monitoring: it improves heat transfer and combustion efficiency, reduces room heat loss, improves flame stability, reduces pilot light failure and improves flame retention. Efficiency improves dramatically when a Power Flame DC-3 Draft Control System is applied!

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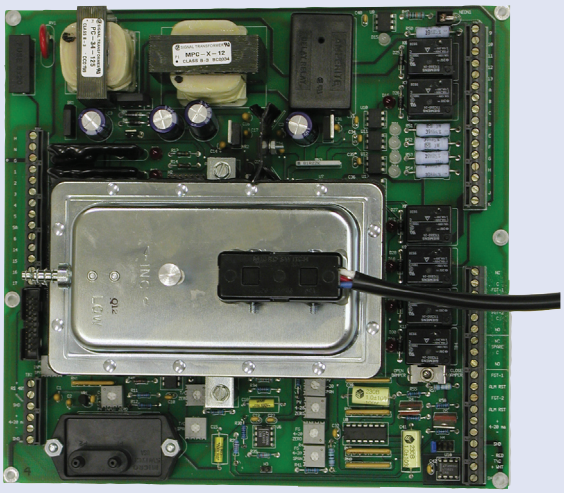
CONTROL FUNCTIONS & UPGRADES

The standard DC-3 package provides suitable draft control for any fire tube or industrial water tube boiler. The DC-3 is fully field-configurable: simply set the jumpers on the processor board to select the appropriate sequence of operation to interface with the burner management system and final control actuator. The DC-3 is supplied factory-configured to one of the following four model designations, which can be reconfigured onsite.



Model DC-3-1- Non-Sequencing Action:

This model modulates the damper actuator (with Hays Cleveland Actuator F-09140-010-1 or equal) but is non-sequencing and does not interface with a burner management system.

Model DC-3-2- Sequencing With Adjustable Start Actuator Positioning:

This model permits adjustable start to a pre-selected “light-off” position (with Hays Cleveland Actuator F-09140-010-1 or equal) and interfaces with the burner management system to open and close the damper. When the safe flame is established the actuator modulates over the complete range.

Model DC-3-3- Sequencing with Adjustable Start & Post-purge:

This model functions the same as the DC-3-2 but with post-purge capability. When the damper is at the adjustable start position during boiler startup (with Hays Cleveland Actuator F-09140-010-1 or equal) the post-purge timer is energized. The DC-3 maintains the damper open for 20 seconds upon boiler shut down before closing the draft damper.

Model DC-3-4- Sequencing With Adjustable Start, Post Purge & Pre-Purge:

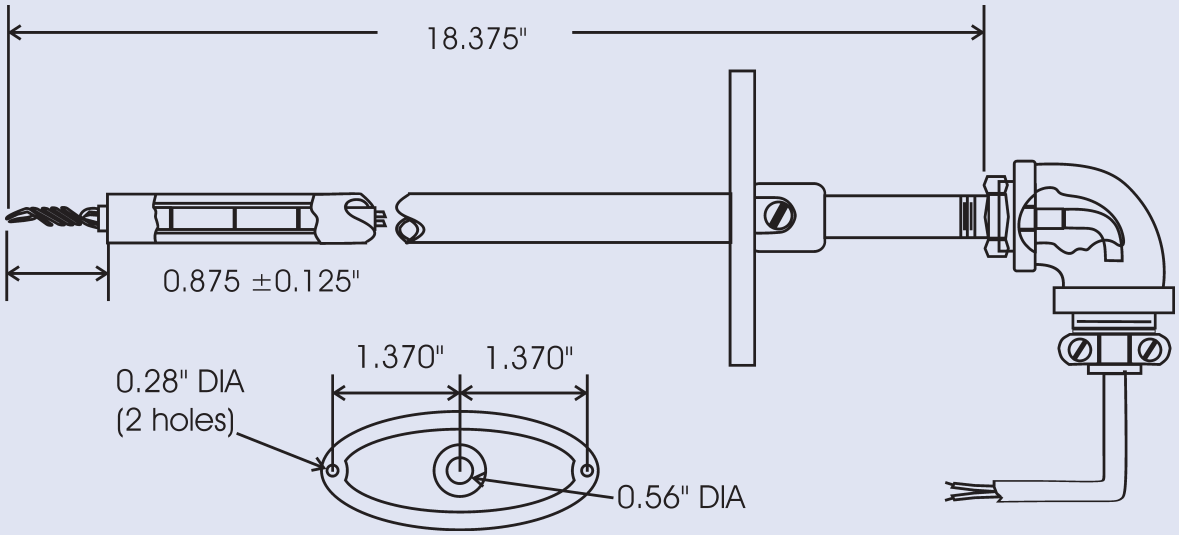
This model functions the same as the DC-3-3 but with pre-purge (adjustable 20 to 120 seconds) and with post-purge adjustable 0 to 120 seconds. When the boiler is starting up through the burner management system limits, the DC-3 fully opens the damper (with Hays Cleveland Actuator F-09140-010-1 or equal) and the pre-purge timer starts. When the pre-purge time expires, the actuator closes to the adjustable start position. Upon boiler shutdown the post-purge function commences as set with the adjustable timer.

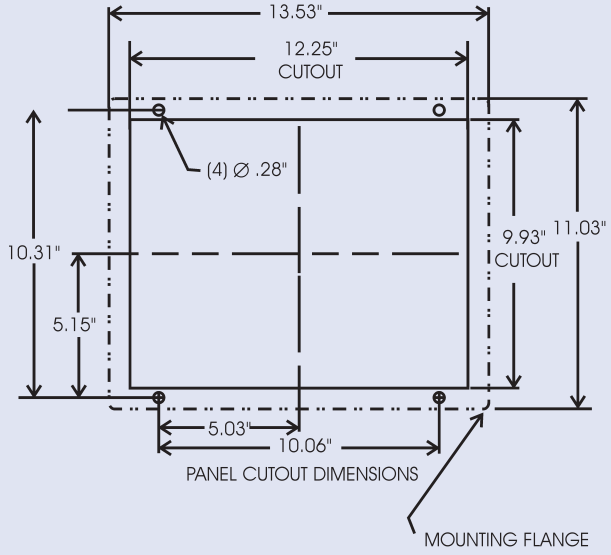
OPTIONS

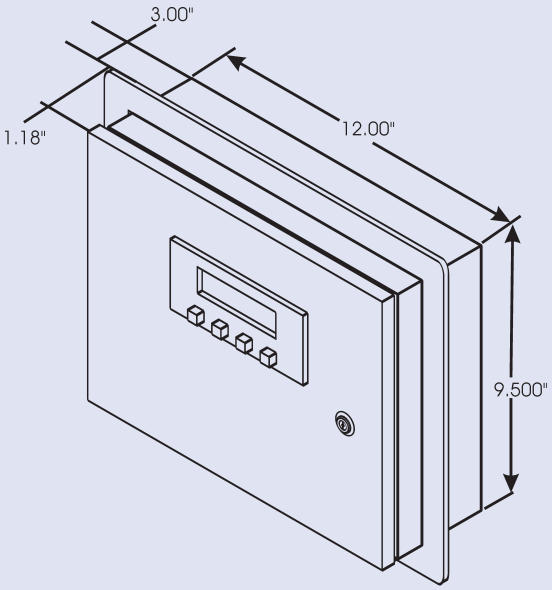
Optional **Low Draft/High Pressure Switch** and **Flue Gas Temperature Alarm & Indicator Transmitter** add several instrument functions to the basic DC-3 without increasing the panel space required. Installation is much simpler than if separate instruments are used, and the panel connections are centralized for further convenience.

Low Draft/High Pressure Switch: traditional installations required a separate safety switch and separate piping for it. The DC-3 has an optional integral switch which is UL-approved. It prevents the firing of the boiler when the draft (whether natural or induced) is insufficient. On balanced draft systems, the switch cuts off firing when the draft falls below a selected minimum set point. On pressure-fired systems, the switch cuts off firing when the pressure rises above a selected maximum set point. In either case, nuisance shut-downs due to momentary “puffs” or fluctuations are avoided by means of an 9±3 second delay relay in the DC-3. The set point for the switch is adjustable between .05±.02" to 12.0" w.c.

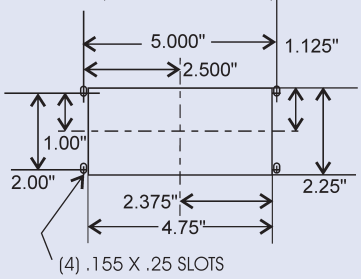
Flue Gas Temperature Alarm & Indicator Transmitter: Traditionally, these functions have been accomplished with separate instruments . The DC-3 includes them, reducing investment costs. This option meets the ISA Sequence M requirements for monitoring flue gas temperature and causing an alarm to occur when the flue gas exceeds safe limits. A Type J thermocouple is used and the temperature range (32 to 999F or 0 to 537C, selectable) is displayed on the front panel and re-transmitted as a 4-20 mADC signal. Dual alarm outputs (Lo/Hi and Hi/Hi) are standard for visual alarm and burner shutdown. Alarm set points are independently adjustable. Alarm 1(Lo/Hi) reset is automatic, while alarm 2 (Hi/Hi) is available with local or remote manual reset, or automatic reset. Thermocouple fault is displayed on the front panel, and the output goes to maximum.

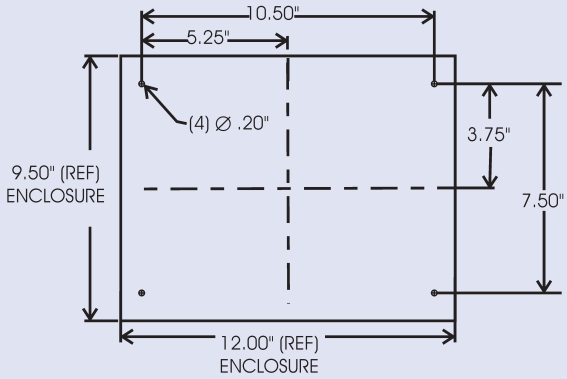






CUTOUT DIMENSIONS FOR OPEN MOUNT MODELS
(SEE ALSO FIGURE 3.)





SURFACE MOUNTING DIMENSIONS

SPECIFICATIONS

General

Power requirements: 120v AC ± 10%, 50/60 Hz.
Ambient temperature range: 32–130F (0–54C) for electronics unit.
Fuse: One, @ 1 amp.
Housing for enclosed models: NEMA 1.
Relative Humidity: 0-90%, non-condensing.
Shipping Weight: Varies with options.
For enclosed models, 7.5–8.5 lbs.
For open-mounted models, 6.5–8.0 lbs.
Add 3–4 lbs. for thermocouple assembly, if ordered.
Approvals: DEP, UL & CUL.

Draft Controller

Set point: adjustable -2.00" to +2.00" w.c. (field selectable for + or – set points).
Damping: adjustable, 0.0 to 15 seconds in 1.5 second increments.
Proportioning Band: adjustable, 0.03" to 0.2" w.c.
Period: fixed, 0.2 seconds.
Deadband: adjustable +/- 0.01" to 0.08" w.c.
Pressure media: dry clean gases that will not degrade polyester, vinyl, silicone or silicone-based adhesive.
Voltage output: switched, selectable by applying the voltage to the input terminal with an external voltage source.

Draft Gauge

Display range: -2.00" to +2.00" w.c., fixed.
Retransmit: 4–20 mA DC directly proportional to the draft range, where:
4 ma = -2.00" w.c. and 20 ma = 2.00" w.c.
750 Ω maximum. (Output is grounded but not isolated.)

Flue Gas Temperature Gauge (optional)

Sensor:
Thermocouple, Type J, Iron and Constantan, is standard.
Suitable for use in oxidizing or reducing environments.
Thermocouple length: 50' or 100'.
Probe insertion up to 18".
Units: ºF or ºC.
Range: 32–999F or 0–537C.
Retransmit: 4–20 mA DC, directly proportional to the flue gas temperature, where 32F = 4 mA DC and 999F = 20 mA DC. 750 W maximum. Accuracy = ±5°F. (Output is grounded but not isolated.)
Alarm:
Settings: 2 alarms, Lo/Hi and Hi/Hi, independently adjustable, 32–999F or 0–537C.
Contact rating: 10 amps, 120V AC, SPDT, non-inductive.
Reset: Alarm 1: automatic. Alarm 2 manual or automatic.
Indication:
Visual display indicator for Alarm 1 and Alarm 2.
“Open Thermocouple” indication: in the event of thermocouple failure, the over-range reading is displayed on the meter.

Low Draft/High Pressure Cutoff Switch (optional)

Range: .05–12" w.c. (draft or pressure, determine by selecting a port).

Modbus Communication

RTU.
9600 or 19200 Baud rate.
N/8/1 (no parity, 8 databits, 1 stop bit).

NOMENCLATURE

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A Draft Control Logic Operations
- A=1 Non-Sequencing.
- A=2 Sequencing with Adjustable Start Positioning Capability.
- A=3 As above but includes Post Purge Capability.
- A=4 As above but includes Full Open Damper Pre-Purge Capability.

B Application Options
- B=0 Code For Non-Sequencing, Code A=1.
- B=1 Gas/Oil Application.
- B=2 Stoker Application (only with A=2, above).

C Working Range Options
- C=1 Positive Control.
- C=2 Negative Control.

D Safety Draft/Pressure Cutout Options
- D=0 No Air Switch.
- D=1 High Pressure/Low Draft Switch (9±3-sec. timer).

E Flue Gas Temperature (FGT) Indicator/Transmitter Options
- E=0 No FGT selected.
- E=1 FGT Monitoring with adjustable insertion (up to 18") Type J Thermocouple with 50' cable.
- E=2 FGT Monitoring with adjustable insertion (up to 18") Type J Thermocouple with 100' cable.
- E=3 FGT Monitoring with adjustable insertion (up to 18") Type J Thermocouple with special length cable.
- E=4 FGT Monitoring with customer-supplied Type J Thermocouple.

F Flue Gas Temperature (FGT) Alarm 2 (Hi/Hi) Reset Selection
- F=0 No FGT selected.
- F=1 Local Manual Reset of FGT Hi/Hi Alarm.
- F=2 Remote Manual Reset of FGT Hi/Hi Alarm.
- F=3 Auto Reset of FGT Hi/Hi Alarm.

G Mounting Options
- G=1 Surface-mount NEMA 1 enclosure.
- G=2 Panel-mount NEMA 1 enclosure.
- G=3 Open-mount Package.

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