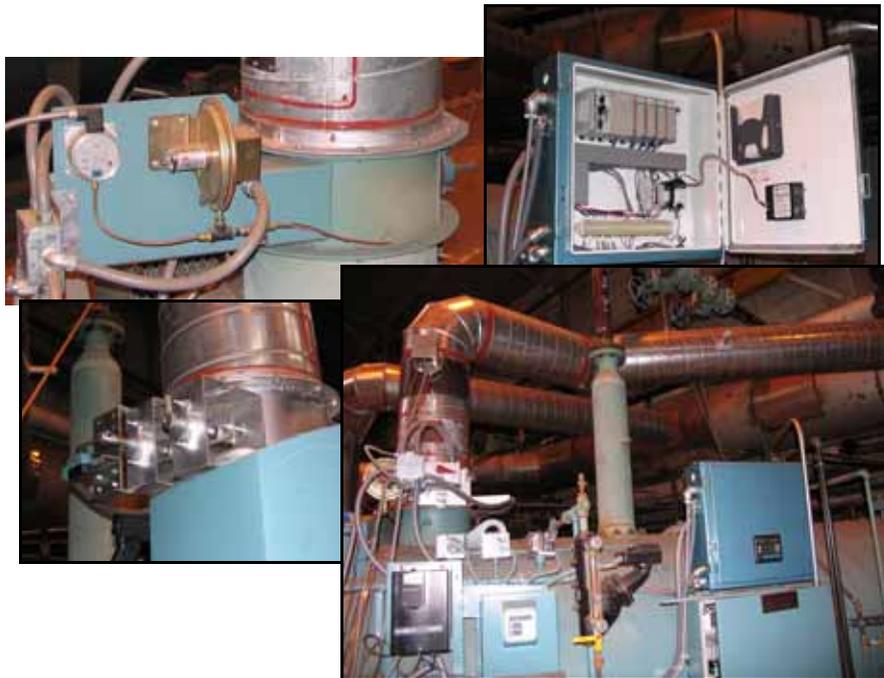


CLEAVER-BROOKS ***Draft Control***

Operation, Maintenance and Parts Manual

Hawk ICS and Stand Alone

Addendum to Manual Part # 750-229, 750-228 and 750-217



SAFETY PRECAUTIONS AND ABBREVIATIONS

Safety Precautions

It is essential to read and understand the following safety precautions before attempting to operate the equipment. Failure to follow these precautions may result in damage to equipment, serious personal injury, or death. A complete understanding of this manual is required before attempting to start-up, operate or maintain the equipment. The equipment should be operated only by personnel who have a working knowledge and understanding of the equipment.

The following symbols are used throughout this manual:



WARNING

This symbol indicates a potentially hazardous situation which, if not avoided, could result in serious personal injury, or death.



CAUTION

This symbol indicates a potentially hazardous situation which, if not avoided, could result in damage to the equipment.

Note: This symbol indicates information that is vital to the operation of this equipment.

Abbreviations

Following is an explanation of the abbreviations, acronyms, and symbols used in this manual.

AC	Alternating Current
AR	Automatic Reset
ASME	American Society of Mechanical Engineers
ASTM	American Society of Testing and Materials
BHP	Boiler Horsepower
BTU	British Thermal Unit
°C	Degrees Celsius
CFH	Cubic Feet per Hour
Cu Ft	Cubic Feet
DC	Direct Current
°F	Degrees Fahrenheit
FM	Factory Mutual
FS	Flame Safeguard
ft	Feet
GPM	Gallons per Minute
Hd	Head
HT	Height
HTB	High Turndown Burner
HZ	Hertz
In H ₂ O	Inches of Water
IRI	Industrial Risk Insurance
Lb	Pound
LWCO	Low-Water Cut-Off
M	Million
MFD	Micro-Farad
MR	Manual Reset
NEC	National Electric Code
No.	Number
pH	Measure of the degree of acid or base of a solution
P/N	Part Number
PPM	Parts Per Million
PR	Program Relay
psi	Pounds Per Square Inch
SAE	Society of Automotive Engineers
scfh	Standard Cubic Feet per Hour
T	Temperature
TC	Temperature Control
TI	Temperature Gauge

Draft Control

Operation, Maintenance and Parts Manual

Hawk ICS and Stand Alone

Addendum to Manual Part # 750-229, 750-228 and 750-217



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DO NOT OPERATE, SERVICE, OR REPAIR THIS EQUIPMENT UNLESS YOU FULLY UNDERSTAND ALL APPLICABLE SECTIONS OF THIS MANUAL.

DO NOT ALLOW OTHERS TO OPERATE, SERVICE, OR REPAIR THIS EQUIPMENT UNLESS THEY FULLY UNDERSTAND ALL APPLICABLE SECTIONS OF THIS MANUAL.

FAILURE TO FOLLOW ALL APPLICABLE WARNINGS AND INSTRUCTIONS MAY RESULT IN SEVERE PERSONAL INJURY OR DEATH.

TO: Owners, Operators and/or Maintenance Personnel

This operating manual presents information that will help to properly operate and care for the equipment. Study its contents carefully. The unit will provide good service and continued operation if proper operating and maintenance instructions are followed. No attempt should be made to operate the unit until the principles of operation and all of the components are thoroughly understood. Failure to follow all applicable instructions and warnings may result in severe personal injury or death.

It is the responsibility of the owner to train and advise not only his or her personnel, but the contractors' personnel who are servicing, repairing or operating the equipment, in all safety aspects.

Cleaver-Brooks equipment is designed and engineered to give long life and excellent service on the job. The electrical and mechanical devices supplied as part of the unit were chosen because of their known ability to perform; however, proper operating techniques and maintenance procedures must be followed at all times. Although these components afford a high degree of protection and safety, operation of equipment is not to be considered free from all dangers and hazards inherent in handling and firing of fuel.

Any "automatic" features included in the design do not relieve the attendant of any responsibility. Such features merely free him of certain repetitive chores and give him more time to devote to the proper upkeep of equipment.

It is solely the operator's responsibility to properly operate and maintain the equipment. No amount of written instructions can replace intelligent thinking and reasoning and this manual is not intended to relieve the operating personnel of the responsibility for proper operation. On the other hand, a thorough understanding of this manual is required before attempting to operate, maintain, service, or repair this equipment.

Because of state, local, or other applicable codes, there are a variety of electric controls and safety devices which vary considerably from one boiler to another. This manual contains information designed to show how a basic burner operates.

Operating controls will normally function for long periods of time and we have found that some operators become lax in their daily or monthly testing, assuming that normal operation will continue indefinitely. Malfunctions of controls lead to uneconomical operation and damage to the equipment. In most cases, these malfunctions can be traced directly to carelessness and deficiencies in testing and maintenance.

It is recommended that a boiler room log or record be maintained. Recording of daily, weekly, monthly and yearly maintenance activities and recording of any unusual operation will serve as a valuable guide to any necessary investigation.

Most instances of major boiler damage are the result of operation with low water. We cannot emphasize too strongly the need for the operator to periodically check the low water controls and to follow good maintenance and testing practices. Cross-connecting piping to low water devices must be internally inspected periodically to guard against any stoppages which could obstruct the free flow of water to the low water devices. Float bowls of these controls must be inspected frequently to check for the presence of foreign substances that would impede float ball movement.

The waterside condition of the pressure vessel is extremely important. Waterside surfaces should be inspected frequently to check for the presence of any mud, sludge, scale or corrosion.

The services of a qualified water treating company or a water consultant to recommend the proper boiler water treating practices are essential.

The operation of this equipment by the owner and the operating personnel must comply with all requirements or regulations of their insurance company and/or other authority having jurisdiction. In the event of any conflict or inconsistency between such requirements and the warnings or instructions contained herein, please contact Cleaver-Brooks before proceeding.

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Section 1 Hawk ICS Draft Control

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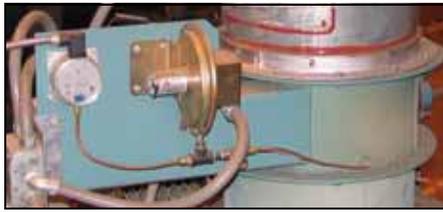


Figure 1-1 Draft Control Assembly



Figure 1-2 Actuator, Linkage and Control System

A. Introduction

The purpose of the Cleaver-Brooks Draft Control system is to maintain a constant draft (pressure), throughout the firing range of the boiler. This is achieved by modulating the draft damper in response to the deviation between the measured draft and an operator adjusted set point.

Draft Control is typically used in systems where multiple boilers share a common stack and outlet ductwork, or in a single boiler application with high natural draft.

B. Draft Damper Assembly

The Draft Damper Assembly consists primarily of the physical damper, connecting linkage, modulation motor, pressure transmitter, and pressure switch. A sample drawing for a 24" damper is shown on pages 1-7 and 1-8. **Take careful note of the direction of flow arrow.**

C. Draft Damper Assembly Installation

The damper assembly is installed per the notes and instructions shown on the Draft Damper Assembly drawing (see Section 4 Parts).

Primary components such as the position limit switch, pressure transmitter, and modulation motor are factory mounted on the damper assembly.

The damper assembly torque requirement increases as the damper assembly diameter increases, requiring more powerful modulation motors for the larger diameter dampers. This relationship is shown in **Table 1-1**.

There are seven (7) assemblies available based on stack diameter.

NOTE: *Damper must be installed in the vertical position.*

Table 1-1 Damper Assemblies and Torque Requirements

Assembly P/N	Size	Torque Rating	Mod Motor P/N
506-00544	12"	150 in-lb.	894-03568
506-00541	16"	150 in-lb.	894-03568
506-00543	20"	150 in-lb.	894-03568
506-00542	24"	150 in-lb.	894-03568
506-00545	32"	300 in-lb.	894-04077
506-00546	36"	535 in-lb.	894-04078
506-00547	42"	535 in-lb.	894-04078

Refer to Section 4 for the Draft Damper assembly and a complete parts list.

D. Draft Control System

The Draft Control System is available in two (2) versions:

- Version 1 - user-selectable option of the Advanced Hawk ICS control system.
- Version 2 - Stand-Alone system

Both versions are pre-programmed with two (2) control strategy options.

E. Control Strategy Options

Feedback Control is a direct acting, proportional + integral control algorithm where, in this case, stack draft is compared to a setpoint value and any resultant error is first multiplied by a proportional term and then integrated based on the incremental time away from setpoint.

There are two (2) user selectable Draft Control Strategies:

1. Feedback control (default)
2. Feedforward-Plus-Feedback control

Feedforward-Plus-Feedback control adds a secondary variable (firing rate demand) to the Feedback Control. The effect is that a change in the secondary variable pre-positions the damper to minimize the deviation between the **Process Variable (PV)** and the **SetPoint (SP)** during a load change.



Important

A Linkage Assembly w/ Potentiometer kit is required when ordering a Stand -Alone version with a Feedforward-Plus-Feedback control strategy. The kit provides a 0-10 VDC firing rate demand feedforward signal based on jackshaft position.

F. Initial Settings

Pressure Transmitter p/n 817-03928 is factory calibrated -1.0 "W.C. to 1.0 "W.C.

The Draft setpoint defaults at 0.0 "W.C. and is adjustable from the operator interface.

The range of Pressure Switch p/n 836-01130 is 0.2 "W.C. to 1.0 "W.C.

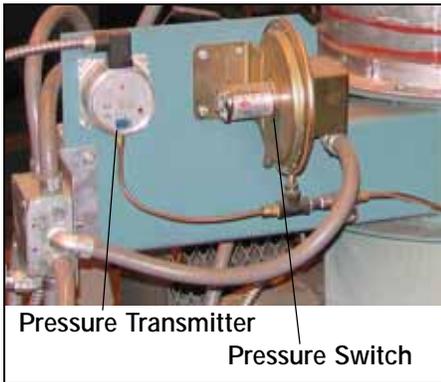


Figure 1-3 Draft Control Components

⚠ Important

The actual Draft Pressure switch trip point must be field set and its contacts wired into the Flame Safeguard non-recycle circuit.

The Feedforward-Plus-Feedback input 4-point characterization is factory set linear as shown in **Table 1-2**.

Table 1-2 Feedforward-Plus-Feedback input/ Output

Pt.	Input	Output
1	0.0	0.0
2	33.0	33.0
3	66.0	66.0
4	100.0	100.0

G. Electrical Connections

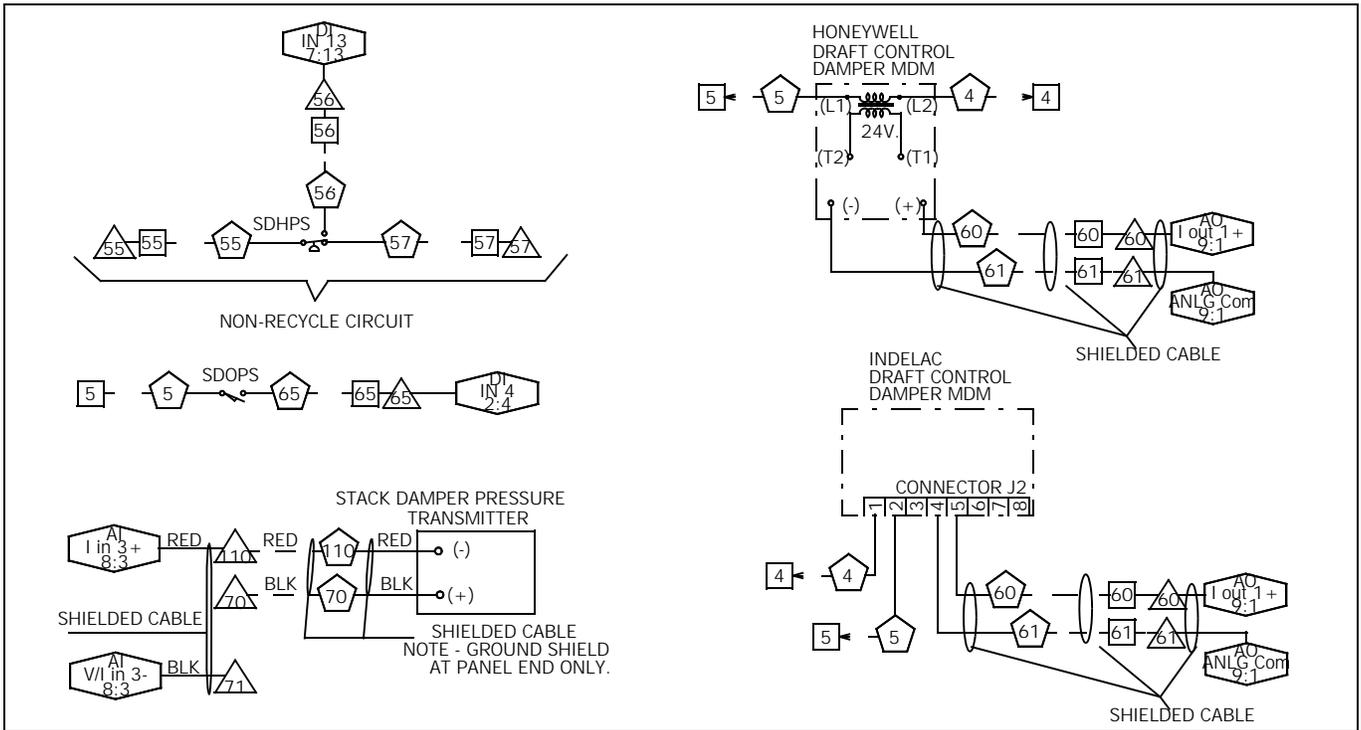


Figure 1-4 Advanced Hawk ICS

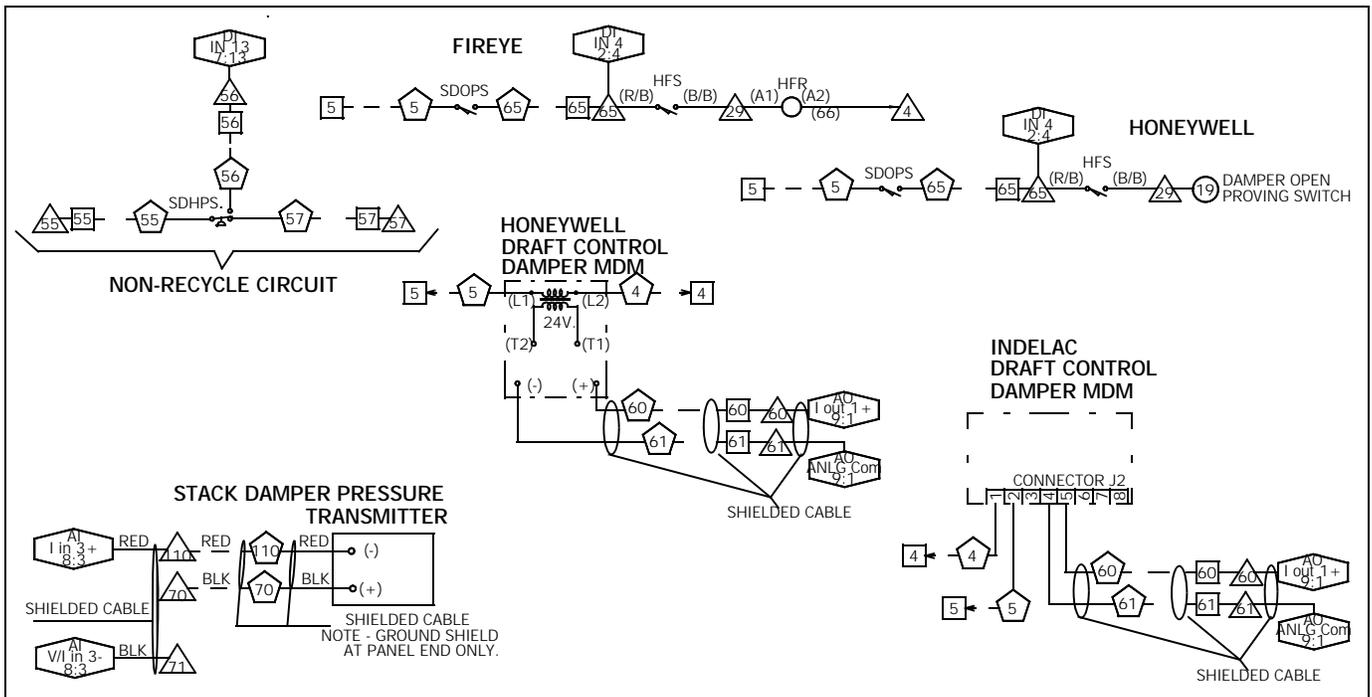
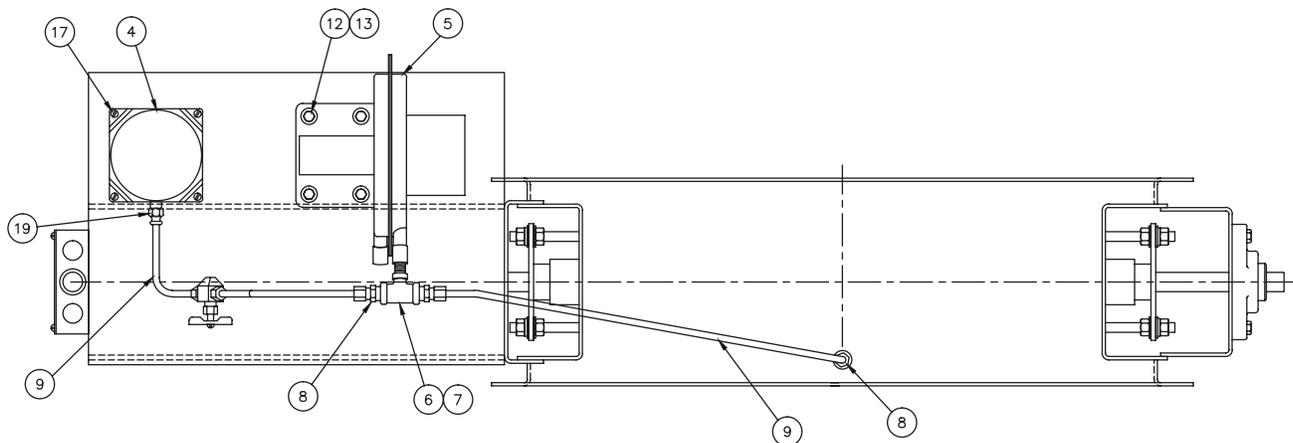


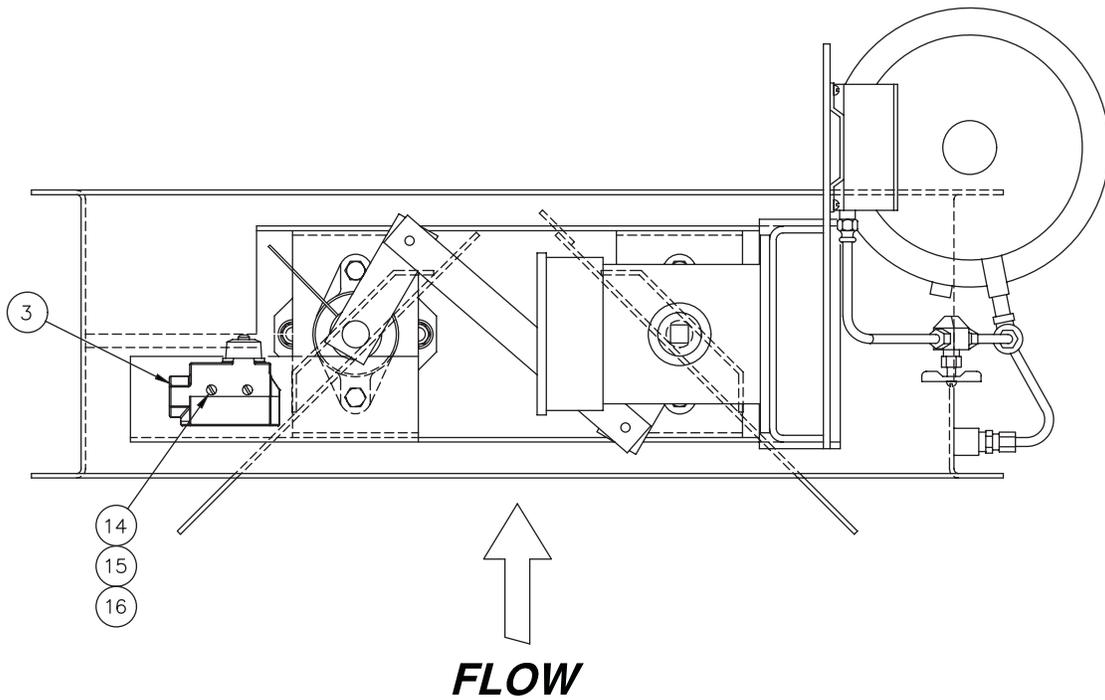
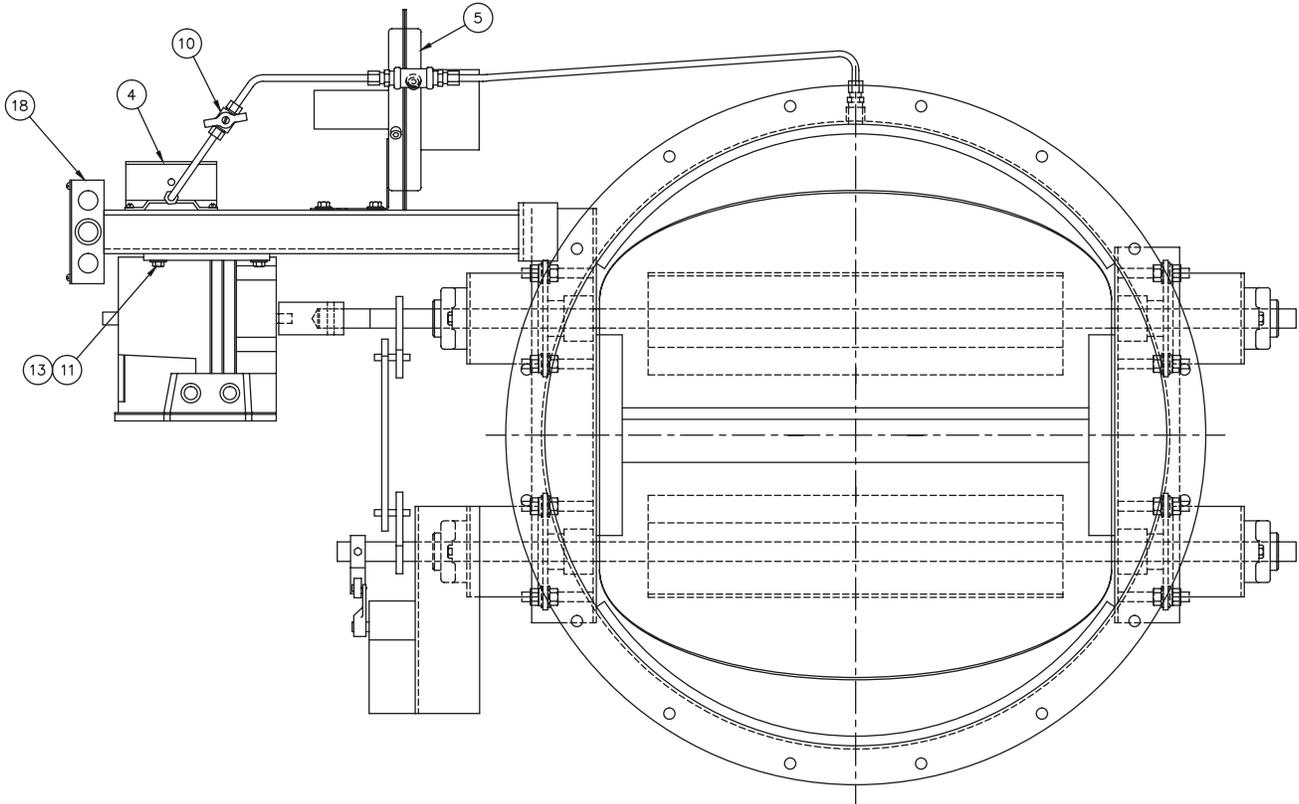
Figure 1-5 Intermediate Hawk ICS

Item	Qty.	Part Number	Description
1	1	See Table	Stack Draft Damper Assembly
2	1	894-03568	Mod Motor
3	1	836-00661	Limit Switch
4	1	817-03928	Pressure Transmitter
5	1	836-01130	Pressure Switch
6	1	857-00116	Pipe Nipple, Close, 1/8" NPT Sch. 40 Carbon Steel ASTM A120
7	1	847-00771	Tee, Reducing, 1/4" x 1/4" x 1/8" 150# M.I.
8	3	845-00764	Male Connector, 1/4" O.D.C. x 1/4" NPT - Brass Compression Type
9	2	939-00025	Tubing, 1/4" O.D.C. x 0.030 Wall - Soft Annealed Temper
10	1	940-07087	Valve, Needle, 1/4" O.D.T. With Compression Ends - Brass
11	4	868-00137	Capscrew, Hex Hd., 1/4-20 UNC x 1" Lg. ASTM A307 Gr. A
12	4	868-00135	Capscrew, Hex Hd., 1/4-20 UNC x 1/2" Lg. ASTM A307 Gr. A
13	8	952-00269	Washer, Flat, 1/4" Cad. Plated
14	2	860-00091	Screw, Machine, Rd. Hd. #10-32 UNF x 1-1/2" Lg.
15	2	952-00202	Lock Washer, #10 Cad. Plated
16	2	869-00204	Nut, Hex., #10-32 UNF Cad. Plated
17	4	860-00042	Screw, Machine, Rd. Hd. #8-32 UNC x 3/8" Lg., Steel
18	1	848-00280	Junction Box, 4" x 4"
19	1	845-01093	Connector, Male, Prestolok Brass, 1/4" ODT x #10-32 UNF
20	2	SEE TABLE	INDICATOR, POSITION, FOR DUAL BLADE DAMPER

Assembly P/N	Size	P/N Item 1	P/N Item 20
506-00544	12"	427-00372	N/A
506-00541	16"	427-00363	N/A
506-00543	20"	427-00373	N/A
506-00542	24"	427-00371	N/A

Assembly P/N W/ EXT. POS. INDICATORS	Size	P/N Item 1	P/N Item 20
506-00555	12"	427-00372	114-00008
506-00556	16"	427-00363	114-00008
506-00557	20"	427-00373	114-00008
506-00554	24"	427-00371	114-00008





Section 2

Hawk ICS Draft Control Setup and Configuration

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A. Hawk ICS Draft Control

This section of the manual specifically covers the Draft Control option integrated into the advanced version of the Hawk ICS control system.

B. Setup and Configuration

From the Configuration Screen #1 (Figure 2-1), press the Factory Only screen select control. Enter password 2793 when prompted to do so.

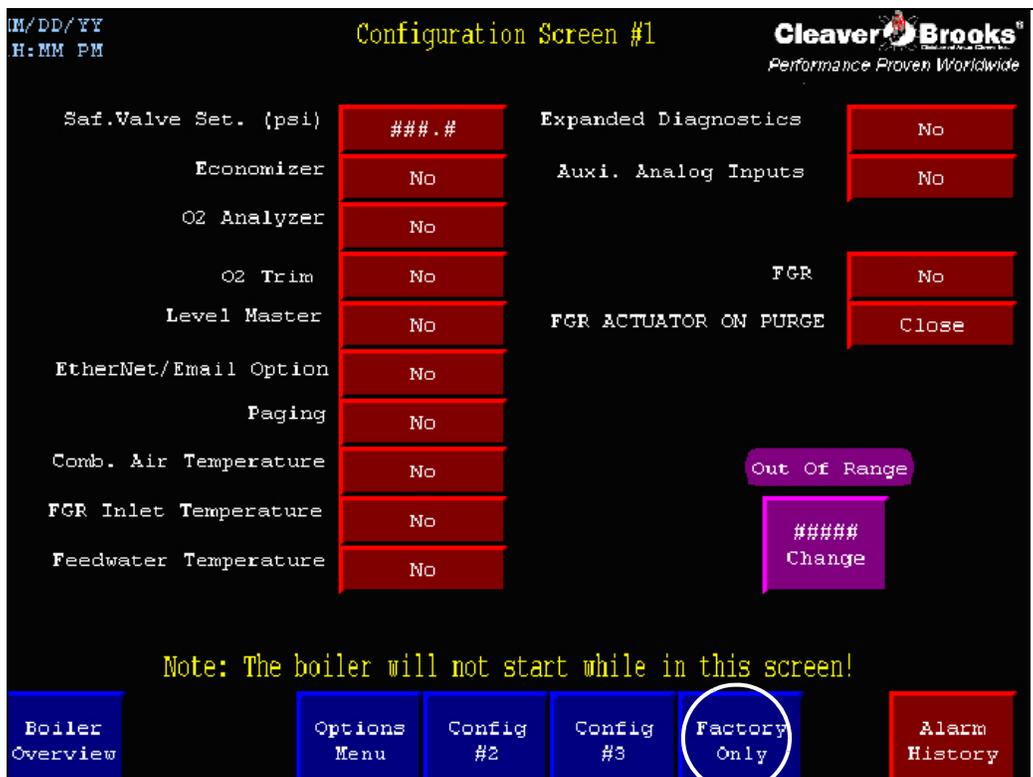


Figure 2-1 Configuration Screen #1

From the Factory Only screen (Figure 2-2), touch the Draft Control push button to activate.

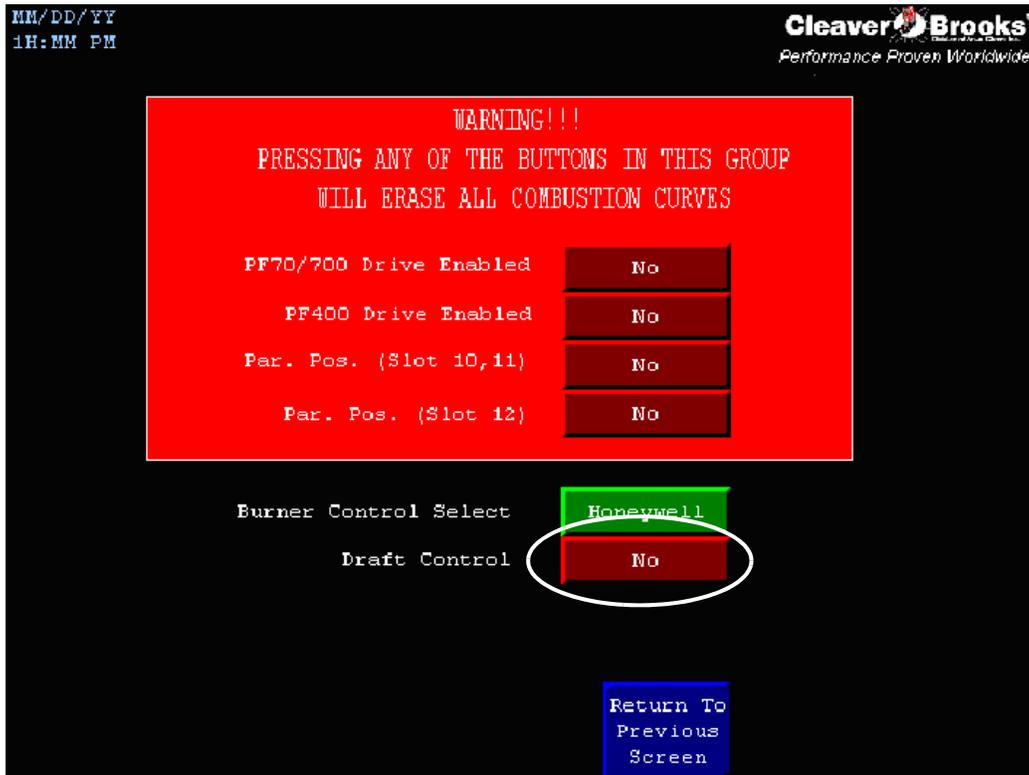


Figure 2-2 Factory Only Screen

The selection is confirmed when the “No” push button transforms to a “Yes” push button (Figure 2-3).



Figure 2-3 Draft Control Energized

After activating the Draft Control option, a Draft Control screen select will appear on the Screen Select Menu. Touch the control to navigate to the Draft Control screen. (Figure 2-4).



Figure 2-4 Screen Select Menu

C. Draft Control Screen

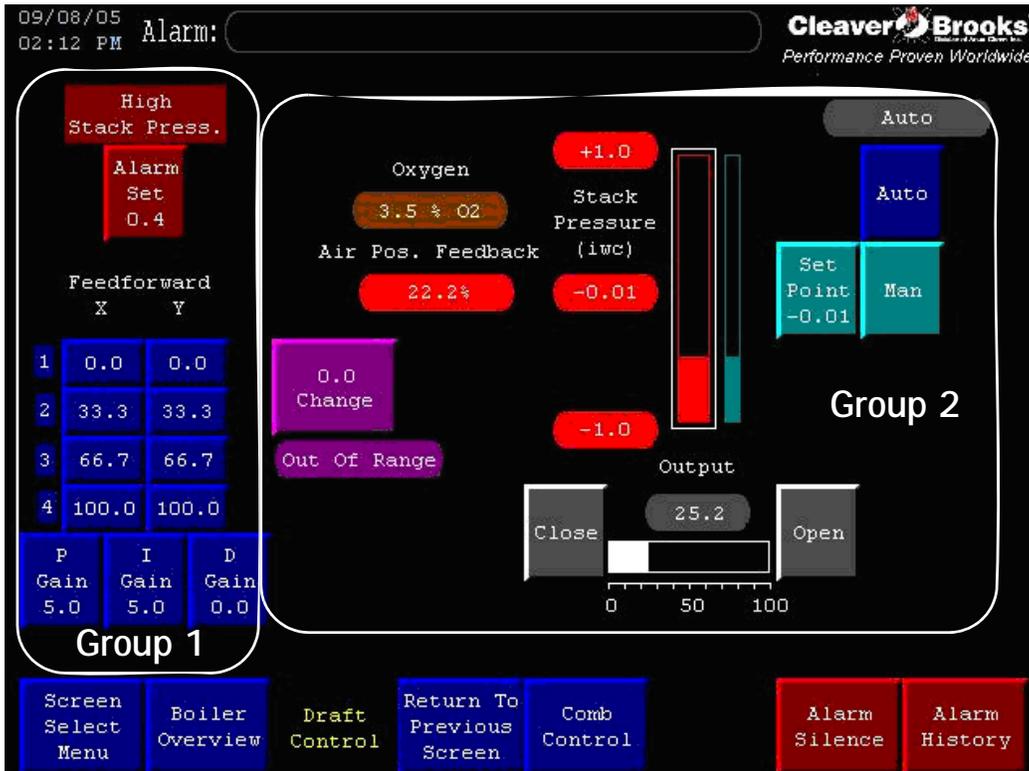


Figure 2-5 Draft Control Screen

There are two (2) control groupings shown on the screen. – a grouping on the left portion of the screen (Group 1) and a grouping on the right (Group 2). The row of buttons along the bottom of the screen are screen navigation controls.



Figure 2-6 Commissioning Controls detail

The controls appearing on the right side of the screen (**Figure 2-7**) are dedicated to the normal daily operation of the draft control and as such will be discussed second.

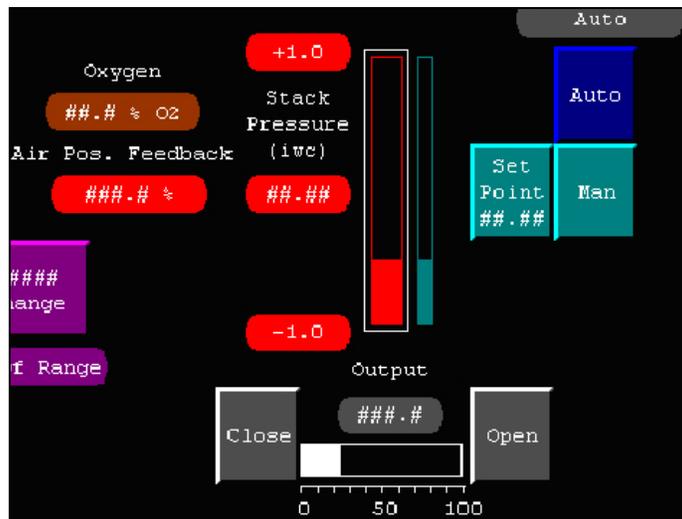


Figure 2-7 Operating Controls Detail

D. Commissioning Controls

High Stack Pressure Alarm Set

A HIGH Stack Pressure alarm will be generated if the Stack Pressure rises above this value. The value entered here should be approximately .25 to .5 IWC above the operating setpoint value. The initial operating setpoint value is 0.0 IWC and the operating setpoint range is -1.0 to 1.0 IWC. (**Figure 2-8**).



Figure 2-8 Alarm Set data

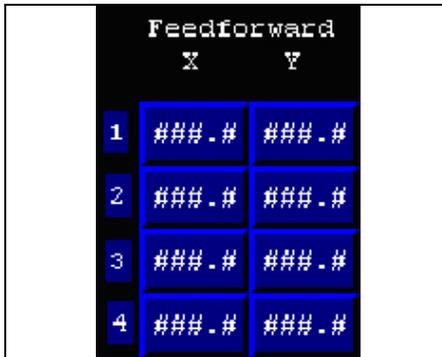


Figure 2-9 Feedforward

Feedforward

The touch controls are used to enter or change the value shown in Figure 2-9. The touch controls are used to characterize the feedforward signal (refer to page 1-3 for discussion of feedforward option). Four (4) points are provided that construct a 3-segment curve. The output value is calculated between these points. The factory set is linear.

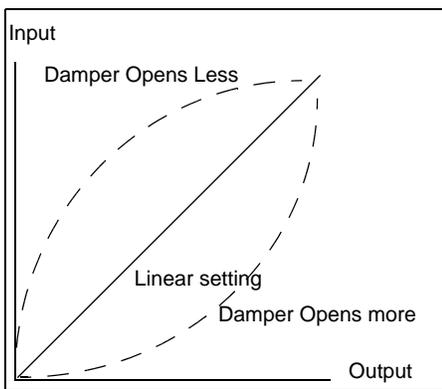


Figure 2-10

Table 2-1 Factory Set

Pt	Input	Output	More Output	Less output
1	0.0	0.0	0	0
2	33.0	33.0	47	21
3	66.0	66.0	82	46
4	100.0	100.0	100	100



Figure 2-11 Tuning Parameters

P Gain / I Gain / D Gain

The touch controls shown in Figure 2-11 are used to enter values for the proportional gain, integral gain, and derivative gain. Adjustments to these touch control Set Points tune the response of the control loop for general operating conditions.

E. Operating Controls

Percent Oxygen Indication (Figure 2-12)



Figure 2-12 Oxygen Detail

Only visible if an O2 analyzer is installed and the O2 Analyzer option is selected from Configuration Screen #1, for additional information in the Hawk ICS control system refer to manual number 750-197.

Air Pos. Feedback Indication (Figure 2-13)



Figure 2-13 Feedback detail

The Air Position Feedback signal is shown in Figure 2-13. This display shows the position of the Combustion Air Damper. This signal is the feedforward input variable and is displayed for information only.

Stack Pressure Indication (Figure 2-14)

The same value is represented graphically with the red vertical barograph. The stack pressure is measured in inches water column.

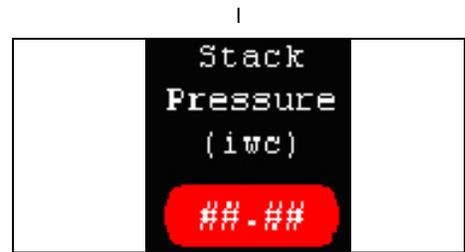


Figure 2-14 Stack Pressure

Set Point Adjust Touch Control (Figure 2-15)

The operating setpoint is adjusted using the control shown in Figure 2-15. Valid inputs are between -1.0 and +1.0 IWC.



Figure 2-15 Adjust SP

Auto/Manual Mode Indicator (Figure 2-16)

Provides a readout of the active mode state.



Figure 2-16 Mode Indicator

Auto/Manual Mode Push Buttons (Figure 2-17)

The Auto/Mode buttons allow the changing of the operational Mode.

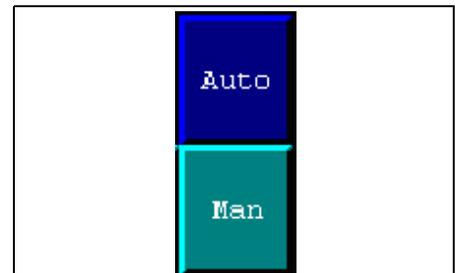


Figure 2-17 Mode PB

F. Output Indication

Output Open/Close Push buttons (Figure 2-18)

The output display shows the relative position of the stack damper, this is displayed in percent open.

The value displayed is the control output to the stack damper actuator. The same value is represented graphically by the white barograph.

The Open/Close push buttons control the position of the outlet damper when in manual mode.

The barograph shows the relative position of the stack damper.

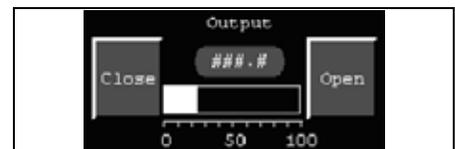


Figure 2-18 Output

G. Sequence of Operation

With the recycle limits closed (input I2/5 ON) and load demand present, the draft control output is forced to the maximum (100%), fully opening the outlet damper. With stack damper proven open switch closed (Input I2/4 ON) and external interlock is closed (Input I2/6 ON), the combustion air blower will start and the sequence enters the purge period. After purge is complete (Input I2/1 OFF), the draft control is released for modulation.

Upon burner shutdown and completion of post purge, the draft control output is forced to minimum (0%), closing the outlet damper.

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A. Stand-Alone Draft Control

This section of the manual specifically covers the stand-alone Draft Control System.

B. Interconnection Wiring Diagram

Refer to **Figure 3-2**, for the connections between the stand-alone Draft Control panel and the Stack Draft Damper Assembly.

C. Controller

The controller (**Figure 3-1**), or PLC, is a DIN rail mounted modular unit requiring 120 VAC power. There are two (2) communication ports, RS-232/485 and Ethernet.



Figure 3-1 Processor and Analog Output Module

The controller is equipped with the following standard I/O:

- Qty (2) voltage inputs, 0-10 VDC
- Qty (10) discrete inputs, 120 VAC
- Qty (6) discrete outputs, relay

In addition to the standard I/O, a 4 channel analog output expansion module (4-20 mA) is provided that connects to the controller via ribbon cable.

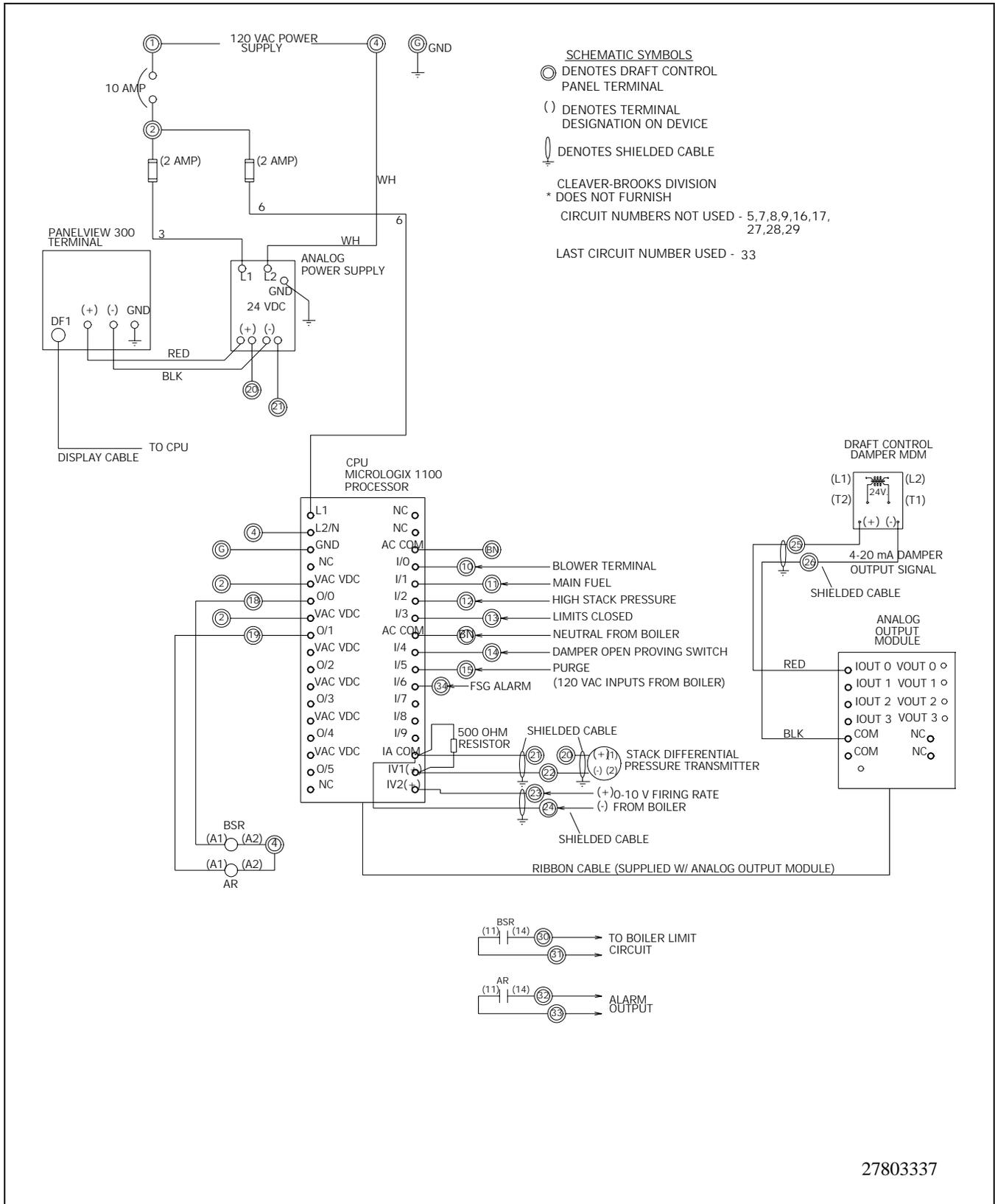


Figure 3-2 Draft Damper Electrical Connections

Item	Qty.	Part Number	Description
1	1	833-03166	PLC, Micro Logix 1100, AB #1763-L16AWA
2	1	833-03167	Analog Output Module, AB #1762-OF4
3	1	832-02204	500 OHM RESISTOR
4	1	Not Used	
5	1	Not Used	
6	1	Not Used	
7	1	Not Used	
8	1	848-00943	Cabinet, Nema 1, 20x16x8 W/ Sub-Panel
9	1	983-00083	Circuit Breaker, 6A
10	2	848-01321	Fuse Block, 1492-WFB4
11	2	832-02051	Fuse, 2A
12	2	833-03060	Relay
13	1	832-02037	Power Supply, 24VDC, 2.1A, #1606-XLP50E
14	24	832-02326	Terminal Block, 1492-J4
15	2	832-02259	Terminal Block Ground, 1492-JG3
16	2	832-02248	Terminal End Block, 1492-EAJ35
17	1	832-02249	Two Pole Jumper, 1492-CJLJ5-2
18	1	832-01951	Din Rail
19	1	832-02047	Wire Duct
20	1	884-00078	Ground Lug
21	1	833-02839	Panel View PV300, 2711-M3A18L1
22	1	826-00138	PV300 Cable
23	1	118-03641	Label,draft Control 3" Panelview
24	1	118-03639	Cleaver-Brooks Nameplate
25	1	118-03789	LABEL,UL,STAND ALONE DRAFT CONTROL SYSTEM,ACCU-DRAFT

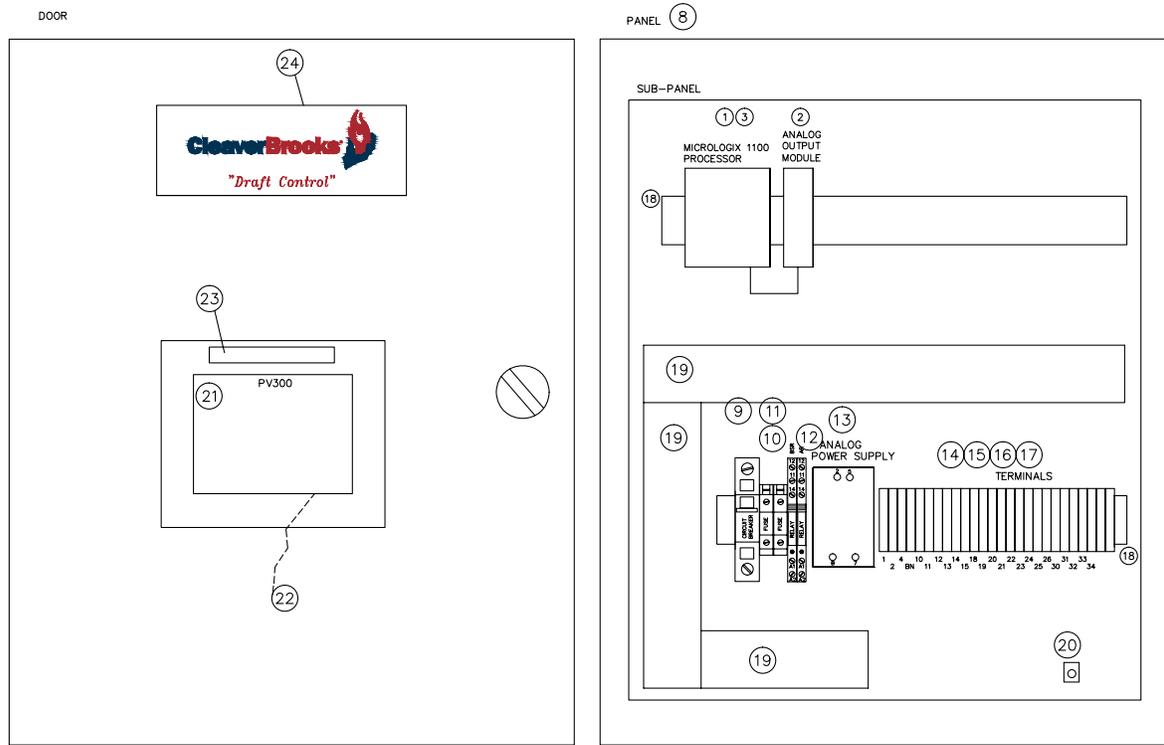


Figure 3-3 Draft Damper Control Panel

D. System I/O List

Table 3-1 System I/O List

Hardware Address	Description	Signal Source	Type
I/0	Blower On	Boiler Control System	DI, 120 VAC
I/1	Main Fuel Valves Energized	Boiler Control System	DI, 120 VAC
I/2	High Stack Pressure	Pressure Switch	DI, 120 VAC
I/3	Limits Closed	Boiler Control System	DI, 120 VAC
I/4	Damper Open Limit Switch	Damper Actuator	DI, 120 VAC
I/5	Purge	Boiler Control System	DI, 120 VAC
I/6	Common Alarm	Flame Safeguard System	DI, 120 VAC
O/0	Blower Start Permissive	Draft Control System	DO, Contact
O/1	Alarm Bell	Draft Control System	DO, Contact
VI/1	Stack Pressure	Pressure Transmitter	0-10 VDC
VI/2	Firing Rate Feedforward	Boiler Control System	0-10 VDC
Aux AO/O	Damper Actuator Output	Draft Control System	4-20 mA

E. System Setup

The splash screen shown in **Figure 3-4** is initially displayed on power up. Pressing the F4 key replaces this screen with the Menu Screen (**Figure 3-5**)



Figure 3-4 Menu Screen #1

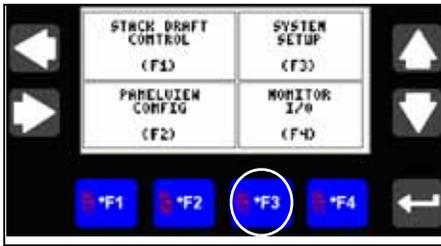


Figure 3-5 Menu Screen

The Menu Screen provides the user access to the following four (4) areas:

- Stack Draft Control (F1)
- System Setup (F3)
- Panelview Configuration (F2)
- Monitor I/O (F4)



Figure 3-6 System Setup Menu

By pressing the (F3) function key (Figure 3-5) the System Setup Menu screen is displayed. The System Setup Menu (Figure 3-6) is password protected.

Enter the numeric password 3232 when prompted to do so.

Three (3) input selections are shown – Alarm Setup, Firing Rate F(X) and Tuning .



Figure 3-7 Release Damper Options

Release Damper Option (F1)

The Stack Damper is released to modulate whenever either one of two possible events occur. One (1) is AFTER LIGHTOFF (default) and the second (2) is AFTER PURGE. Pressing the Touch Control F1 (Figure 3-7), toggles between these two events.

Press (F4) to go to Close Damper Time Delay.



Figure 3-8 Close Damper Time Delay Option

Close Damper Time Delay Option (F1)

The damper is automatically closed after the post purge period and the blower motor is stopped. Pressing the (F1) key allows the operator to enter a time delay value (Sec.) that keeps the damper open until the delay time expires. The maximum delay time is 600 Seconds (10 Min.).

Press (F4) to go to Deviation Alarm Setup.

Deviation Alarm Setup (F1)

The System generates an alarm based on the deviation between the actual stack pressure or Process Variable (PV) and the Set Point (SP). Set the maximum deviation limit in Inches Water Column (IN-WC) (F1), and the deviation alarm time delay in seconds (F2) from this screen (Figure 3-9).

Press (F4) to exit and return to the System Setup Menu.



Figure 3-9 Alarm Setup Screen

Tuning (F2)

Draft control loop tuning parameters are adjusted from the Tuning Screen (Figure 3-10). The Tuning screen is accessed from the System Setup Menu (Figure 3-6).

Pressing either (F1) or (F2) function key from the Tuning Screen displays a numeric keypad where a new value for either Gain or Reset can be entered. The new value must be within the range of 0-25.



Figure 3-10 Tuning Screen

Firing Rate F(X) (F3)

Firing Rate F(X) is an optional feature that when enabled changes the draft control strategy from a simple feedback control loop to a more complex Feedforward-Plus-Feedback control loop. The addition of feedforward improves system response to load fluctuations by effectively pre-positioning the outlet damper to the proper position for any given firing rate and in doing so, minimizing the difference of the stack draft Process Variable (PV) from the SetPoint (SP).

The optional Firing Rate F(X) is enabled by pressing the F1 key as shown on Figure 3-11.

The DISABLED message display changes to ENABLED when F1 is pressed. Pressing F1 again disables the option.

Once ENABLED, a Firing Rate Feedforward 4-point characterization can be entered. Four (4) input points and four (4) output points are provided that together construct a smooth firing rate feedforward curve. The input value is the Firing Rate. The output value is the output signal (%) to the outlet damper actuator when the measured draft is on set point at that Firing Rate.

The factory set is linear as shown in Table 3-2 and Figure 3-12.



Figure 3-11 Firing Rate

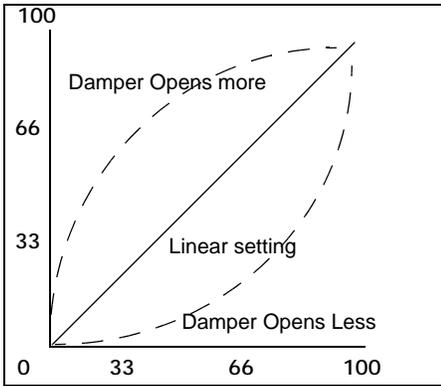


Figure 3-12 Damper Response to Firing Rate.

Table 3-2 Factory Set

Pt	Input	Output	More Output	Less Output
1	0.0	0.0	0	0
2	33.0	33.0	47	21
3	66.0	66.0	82	46
4	100.0	100.0	100	100

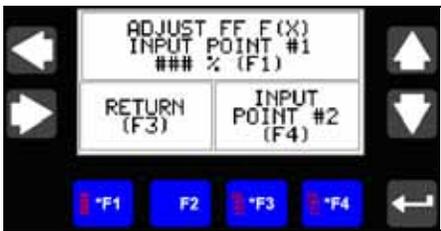


Figure 3-13 Firing Rate F(X) Input Screen

Eight (8) screens are provided to input a new value for each input (X) point and output (Y) point, starting with Input Point #1. To change Point #1, press the (F1) key and enter the new value with the pop-up numeric key pad (Figure 3-14).

Continue to set all Input and Output values to correspond to the operating conditions.

Press (F4) to move to the next point (Figure 3-13).

This concludes the System Setup.

F. Draft Control Screen

The purpose of the Stack Draft Control screen (Figure 3-15) is to monitor and/or control draft during periods of normal unit operation.

Feedforward Variable (FF)

The current value of feedforward variable which is the unit firing rate demand signal.

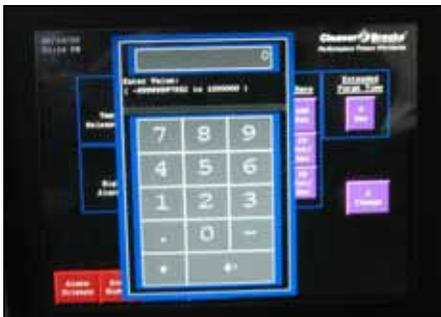


Figure 3-14 Pop-up Numeric Key Pad



Figure 3-15 Stack Draft Control Screen

Stack Draft (PV)

Actual value of the stack draft in inches water column.

Control Variable (CV)

The value of the signal to the draft damper.

Stack Draft Set Point (SP)

Set point value in inches water column.

Control Mode (MAN/AUT)

The active operating mode is indicated with white text on a black background. **Figure 3-16** indicates the control is operating in Automatic.



Figure 3-16 MAN/AUT Mode detail

Stack Draft Set Point (SP)

The set point value is increased by pressing the (UP) arrow and decreased by pressing the down arrow (**Figure 3-17**). Pressing either button once changes the set point value ± 0.05 \".

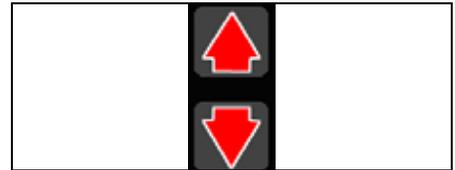


Figure 3-17 Raise/Lower SP detail

Control Variable (CV)

When the operating mode is manual the Control Variable can be increased by pressing the right (RT) arrow or decreased by pressing the left (LF) arrow (**Figure 3-18**).

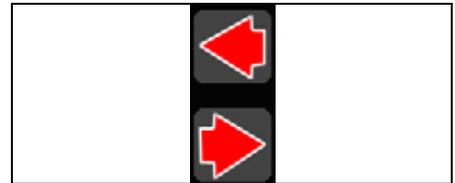


Figure 3-18 Raise/Lower Output detail



Figure 3-19 Alarm screen

G. Alarm Screen

All active alarms can be viewed from the Alarm screen (**Figure 3-19**) which is accessible from the Draft Control screen by pressing the (F3) function key (see **Figure 3-15**).

The following alarms are generated by the System:

Stack Draft Input Bad Quality

Stack Draft input signal is outside the range of the analog input channel i.e. less than 3.5 mA or greater than 20.5 mA.

PV/SP Deviation Alarm

The process variable/set point deviation is greater than a predefined limit value. (See Alarm Setup)

Stack Damper Proof Of Open

Stack Damper was commanded by the System to go to the full open position and either failed to do so or the full open limit switch is improperly set.

Feedforward F(X) Data Entry Error

A value entered in the Input or Output array of the Feedforward F(X) is less than the previous point's value. To correct, make sure each successive input point is greater than the previously entered point, and each successive output point is greater than the previously entered point.

HIGH Stack Draft (Pressure)

The alarm is triggered when the Stack Draft pressure switch detects a HIGH pressure condition. The switch NO (Normally Open) contact is wired into the System. The NC (Normally Closed) contact is wired directly into the flame safeguard non-recycle limit circuit. See Wiring Diagram

H. Monitor I/O Screen

The Monitor I/O screen (**Figure 3-20**) shows on one screen the current status of all of the discrete I/O wired to the System. The primary purpose of the screen is as a troubleshooting tool and also to support System startup and commissioning.

There are five (5) inputs (I/0 thru I/5) and one (1) output (O/0). The current status of each point is shown with a text message. For example in **Figure 3-20** Blower Status is displayed as OFF and when the Blower starts, the text message will change to ON.

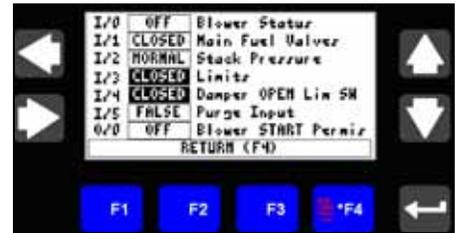


Figure 3-20 Monitor I/O Screen

I. Sequence of Operation

The following sequence of operation is only applicable when the control mode is set to Automatic. In Manual mode the operator has full control of the stack damper at all times i.e. during boiler startup, normal operation, and shutdown.

The Sequence is started automatically whenever one of the following events occurs:

1. The Burner switch is turned from the OFF position to the ON position while the recycle limit is closed and the Flame Safeguard alarm is de-energized.
2. The recycle limit closes while the Burner switch is ON and the Flame Safeguard alarm is de-energized.
3. The Flame Safeguard alarm is reset while the Burner switch is ON and the recycle limit is closed.

With the Limits input closed (I/3) and the Flame Safeguard common Alarm input open (I/6) the Outlet Damper is driven to the full open position. When the full open position is reached the Damper Proof Of Open limit switch closes (I/4) and the START Combustion Air Blower output is energized (O/0). The blower motor starts and the purge cycle timer begins to time out. After the purge cycle is complete the Draft Control System will either:

- Release for modulation if the Release option is set to AFTER PURGE.
- Hold full open if the Release option is set to AFTER LIGHTOFF and released when the Main Fuel Valves are energized (I/1).

Upon burner shutdown and completion of post purge, the Flame Safeguard System stops the blower. The Draft Control detects that the blower is now off (I/0) and drives the Outlet Damper to its minimum position (0%).

The Outlet Damper may remain open for a preset amount of time after the blower motor stops if required to do so. Refer to the Close Damper Time Delay Option associated with **Figure 3-8**.

Notes



Section 4

Parts

Draft Control Damper Bill of Material	4-2
Complete Draft Control Kits	4-2
Draft Control Assembly	4-3
Control Panel Micrologix	4-4
Control Panel Micrologix Bill of Material	4-6

Notes:

- 1) With The Damper Set In The Open Position, Install Limit Switch So That It Just Clicks And Tighten The Screws In Place.
- 2) Install Pressure Sensing Line To The High Pressure Port On Both The Pressure Transmitter And The Pressure Switch. The Low Pressure Ports Should Be Left Open.
- 3) Install Mod Motor With Damper Blades In The Open Position. Prior To Shipment Drive Damper Blades To Closed Position By Applying Power And Signal To Mod Motor. Once Closed Remove Power From Mod Motor.

Item	Qty.	Part Number	Description
1	1	See Table	Stack Draft Damper Assembly
2	1	894-03568	Mod Motor
3	1	836-00661	Limit Switch
4	1	817-03928	Pressure Transmitter
5	1	836-01130	Pressure Switch
6	1	857-00116	Pipe Nipple, Close, 1/8" NPT Sch. 40 Carbon Steel ASTM A120
7	1	847-00771	Tee, Reducing, 1/4" x 1/4" x 1/8" 150# M.I.
8	3	845-00764	Male Connector, 1/4" O.D.C. x 1/4" NPT – Brass Compression Type
9	2	939-00025	Tubing, 1/4" O.D.C. x 0.030 Wall – Soft Annealed Temper
10	1	940-07087	Valve, Needle, 1/4" O.D.T. With Compression Ends – Brass
11	4	868-00137	Capscrew, Hex Hd., 1/4-20 UNC x 1" Lg. ASTM A307 Gr. A
12	4	868-00135	Capscrew, Hex Hd., 1/4-20 UNC x 1/2" Lg. ASTM A307 Gr. A
13	8	952-00269	Washer, Flat, 1/4" Cad. Plated
14	2	860-00091	Screw, Machine, Rd. Hd. #10-32 UNF x 1-1/2" Lg.
15	2	952-00202	Lock Washer, #10 Cad. Plated
16	2	869-00204	Nut, Hex., #10-32 UNF Cad. Plated
17	4	860-00042	Screw, Machine, Rd. Hd. #8-32 UNC x 3/8" Lg., Steel
18	1	848-00280	Junction Box, 4" x 4"
19	1	845-01093	Connector, Male, Prestolok Brass, 1/4" ODT x #10-32 UNF
20	2	SEE TABLE	INDICATOR, POSITION, FOR DUAL BLADE DAMPER

Assembly P/N	Size	P/N Item 1	P/N Item 20
506-00544	12"	427-00372	N/A
506-00541	16"	427-00363	N/A
506-00543	20"	427-00373	N/A
506-00542	24"	427-00371	N/A

Assembly P/N W/ EXT. POS. INDICATORS	Size	P/N Item 1	P/N Item 20
506-00555	12"	427-00372	114-00008
506-00556	16"	427-00363	114-00008
506-00557	20"	427-00373	114-00008
506-00554	24"	427-00371	114-00008

Figure 4-1 Draft Control Damper Bill of Material

Notes:

For Proper Damper Assembly sizing please refer to the Vent Stack dimension for applicable boiler model in the Cleaver Brooks Boiler Book.

For complete Damper Assembly with Micrologix Control Panel (shown on Figures 4-5, 4-6 & 4-7) use applicable 880-kit listed below.

For Damper Assembly w/o Control Panel use applicable 506-Assembly listed below.

Complete Damper Assembly Kit (Includes Damper Assy & Control Panel)	Damper Assembly P/N (Less Control Panel)	Damper Size (Dia.)	P/N Item 1 Damper Assy.	P/N Item 2 Mod. Motor
880-01879	506-00544	12"	427-00372	894-03568
880-01880	506-00541	16"	427-00363	894-03568
880-01881	506-00543	20"	427-00373	894-03568
880-01882	506-00542	24"	427-00371	894-03568
880-01883	506-00545	32"	427-00374	894-04077
TBD	506-00546	36"	427-00375	894-04078
TBD	506-00547	42"	427-00376	894-04079

Figure 4-2 Complete Draft Control Kits

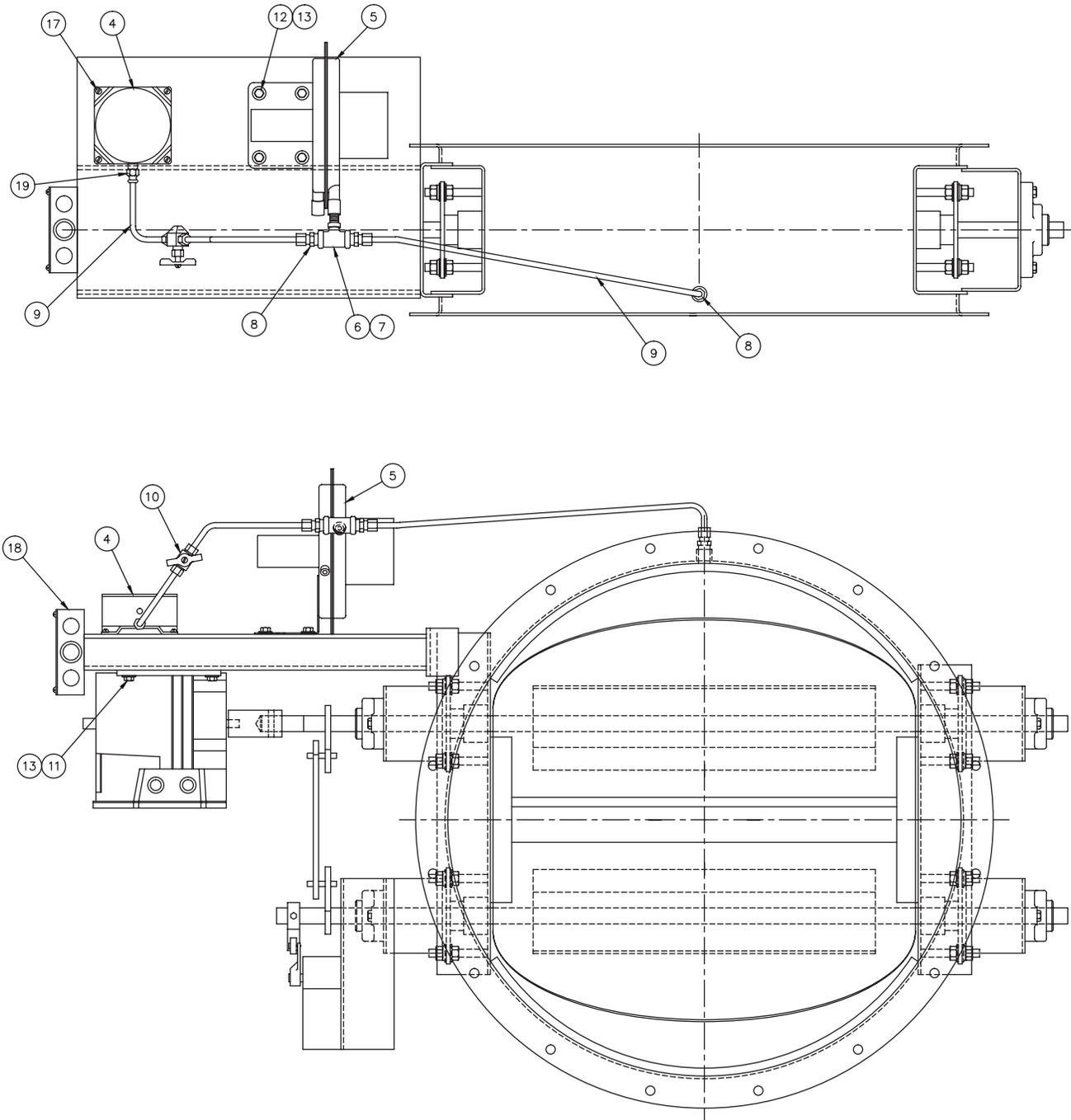


Figure 4-3 Draft Control Assembly

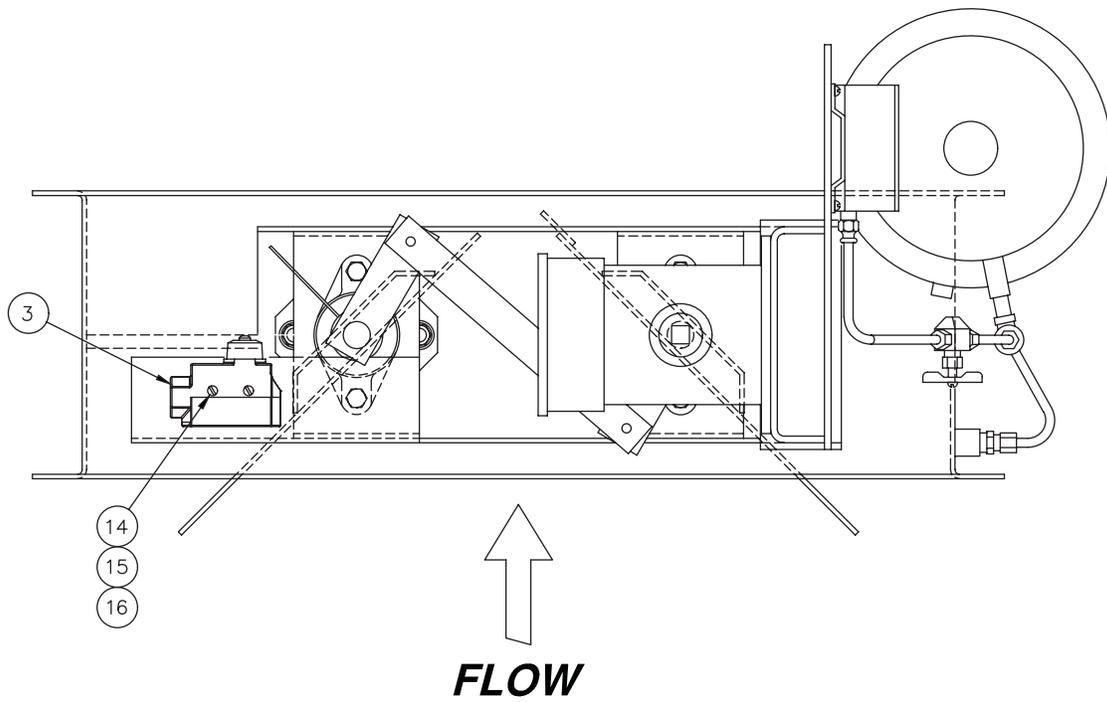


Figure 4-4 Draft Control Assembly cont'd

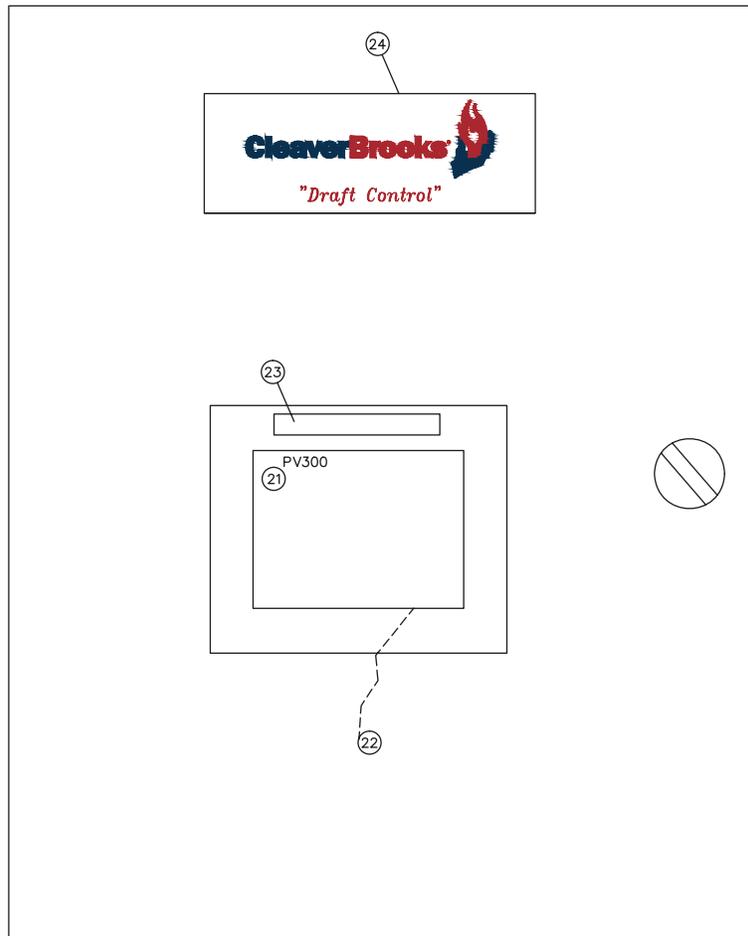


Figure 4-5 Control Panel Micrologix

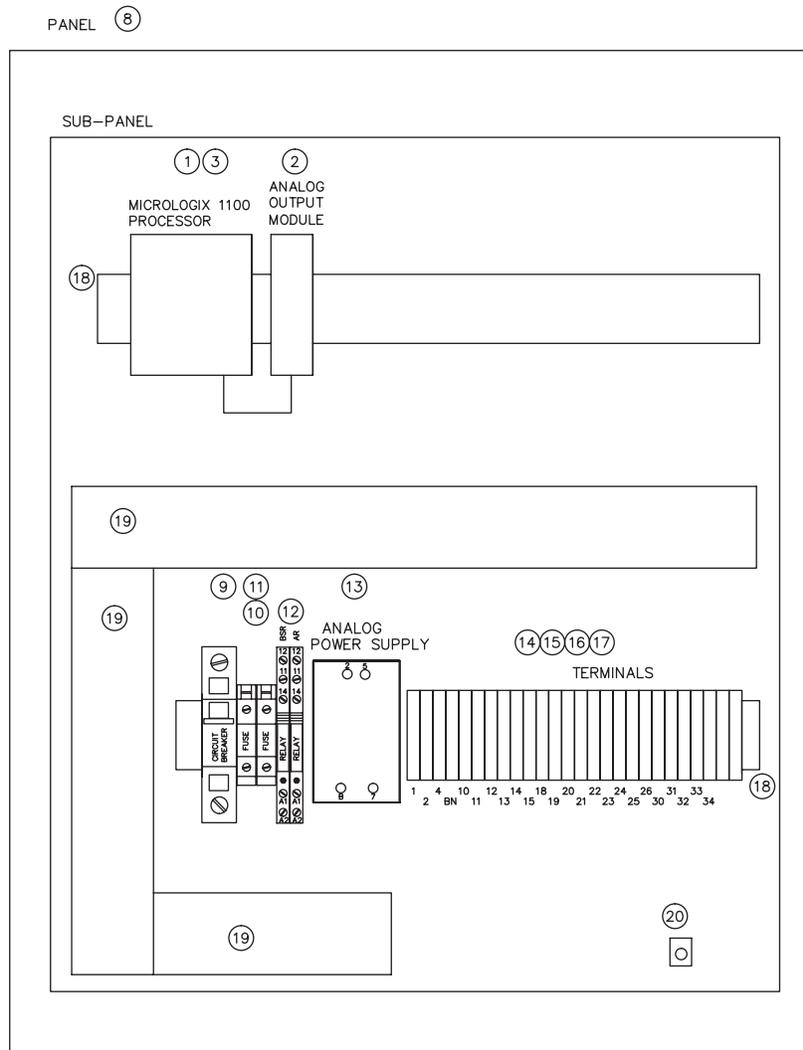


Figure 4-6 Control Panel Micrologix cont'd

Item	Qty.	Part Number	Description
1	1	833-03166	PLC, Micro Logix 1100, AB #1763-L16AWA
2	1	833-03167	Analog Output Module, AB #1762-OF4
3	1	832-02204	500 OHM RESISTOR
4	1	Not Used	
5	1	Not Used	
6	1	Not Used	
7	1	Not Used	
8	1	848-00943	Cabinet, Nema 1, 20x16x8 W/ Sub-Panel
9	1	983-00083	Circuit Breaker, 6A
10	2	848-01321	Fuse Block, 1492-WFB4
11	2	832-02051	Fuse, 2A
12	2	833-03060	Relay
13	1	832-02037	Power Supply, 24VDC, 2.1A, #1606-XLP50E
14	24	832-02326	Terminal Block, 1492-J4
15	2	832-02259	Terminal Block Ground, 1492-JG3
16	2	832-02248	Terminal End Block, 1492-EAJ35
17	1	832-02249	Two Pole Jumper, 1492-CJLJ5-2
18	1	832-01951	Din Rail
19	1	832-02047	Wire Duct
20	1	884-00078	Ground Lug
21	1	833-02839	Panel View PV300, 2711-M3A18L1
22	1	826-00138	PV300 Cable
23	1	118-03641	Label,draft Control 3" Panelview
24	1	118-03639	Cleaver-Brooks Nameplate
25	1	118-03789	LABEL,UL,STAND ALONE DRAFT CONTROL SYSTEM,ACCU-DRAFT

Figure 4-7 Control Panel Micrologix Bill of Material



e-mail: info@cleaverbrooks.com
Web Address: <http://www.cleaverbrooks.com>