HAWK 4000 Integrated Boiler Control System

The Hawk 4000 is a state-of-the-art boiler control system that integrates the functions of a Programmable Controller and Burner Management Controller, as well as other boiler operating and ancillary controls. The Hawk 4000 system incorporates a touch screen Human Machine Interface (HMI) featuring boiler parameter display, fault annunciation and alarm history, and access to boiler configuration and control functions. The Hawk 4000 system includes complete boiler firing rate controls for steam or hot water boilers. The Hawk 4000's advanced technology features utilize the latest communication methods, such as Modbus, Ethernet, and the Internet. The Hawk 4000 also has the capability of interfacing with various building/plant automation systems. Additional features include lead/lag capability; e-mailing and text messaging of alarms, remote monitoring, and HMI alarm history printing.

The Hawk 4000 Integrated Control System may be used on most types of steam or hot water boilers, including firetube, industrial watertube, and commercial watertube. It is designed to operate with a gas, oil, or combination burners using a single-point modulating control or a parallel-positioning fuel-air ratio control system.

In addition to installation on new boilers, the Hawk 4000 can be added as a retrofit to existing boilers. Contact your local authorized Cleaver-Brooks representative for details.

FEATURES AND BENEFITS

Advanced Technology

**Standard Features:**

- Integrates control function of burner sequencing and safety with firing rate, fuel-air ratio, and operating limit controls
- Incorporates a programmable controller
- Touch screen graphical human machine interface (HMI)
- Monitors and displays connected boiler parameters
- Optimizes boiler firing rate control
- Alarm/fault indication and history
- On-screen fault diagnostics
- Built-in two boiler lead/lag control
- Night/day setback control
- Thermal shock protection
- Remote modulation
- Remote setpoint
- Assured low fire cut-off
- Assured start permissive safety interlocking
- High stack temperature alarm and shutdown
- Display of boiler water level with CB Level Master
- Boiler efficiency calculations
- VSD Ethernet communications (with VSD and Ethernet IP adapter)
Optional Features:
- E-Mail and text message alarm/fault forwarding
- Fuel-air ratio control
- Building/plant automation system interface
- Remote monitoring and diagnostics
- O₂ monitoring and trim
- Internet parts and service lookup
- Lead/lag capability for multiple boiler systems
- Variable speed drive on combustion air fan
- Expanded annunciation

Safety Provisions and Diagnostics:
A. Integrated Burner Management
- Utilizes the CB780E or CB120E flame safety control
- Burner Control status, faults, and diagnostics displayed on HMI
B. Integrated Boiler Controls
- Operating and modulating controls
- Variable Speed Drive Ethernet communications
- Password protection of programmable controller logic
- Password protection of parallel positioning control (optional)

Powerful Display/Diagnostic Capabilities:
- Touch screen graphical human machine interface (HMI). 7” screen standard, 10” screen optional.
- HMI allows easy screen navigation to monitor various boiler parameters & diagnostics and to configure boiler controls.
- Displays alarms/faults, burner status, and flame signal from the flame safety control.
- Diagnostics in plain English and prioritized fault annunciation simplify troubleshooting. Last 100 faults are stored.
- Displays boiler steam pressure, water temperature, firing rate, Stack temperature, boiler efficiency, combustion air temperature (optional), Flue gas O₂ concentration (optional), combustion air fan motor speed and kw (with VSD option), combustion air pressure (with VSD option), water level (CB-Level Master), shell water temperature (steam boilers), and other control points.
- Displays boiler operating status (e.g. “Warm Up”, “Auto/Manual”, “Boiler On”, fuel selection, etc.).
- Displays boiler firing rate control parameters and settings.
- Provides remote monitoring and diagnostic capabilities (optional).
- Touch screen controls simplify screen navigation and boiler configuration
- Reliable and accurate controls using microprocessor-based programming
**Simplified Servicing:**
- Diagnostics and fault history, up to 100 faults, through touch screen display simplifies troubleshooting procedures
- E-Mail forwarding and texting of system fault codes
- Building automation interface/protocol translation (optional)

**PRODUCT OFFERING**

*Included in each Hawk 4000 system is the following:*
- Programmable controller
- Touch screen HMI
- Built-in Ethernet/IP capability via L35E or L33ER processor
- Various controller input/output modules
- Flame safety controller (CB780E or CB120E)
- Various temperature and pressure sensors
- E-mailing via Ethernet
- Parallel positioning programming (hardware for Air and 1 Fuel standard)

*Optional Features and Equipment (see individual specifications for these options):*
- Interface with building/plant automation system
- Lead/Lag control of multiple boilers
- Parallel positioning 2nd fuel hardware
- Variable speed drive for combustion air fan motor
- O₂ analyzer and/or external O₂ trim system
- Combustion air temperature sensor
- Economizer stack flue gas temperature, feed water temperature, oil temperature, and gas & oil pressure sensors
- Steam, water, and fuel flow monitoring

**ENGINEERING DATA**
- Supply voltage: 120 VAC (+10%/-15%) 50 or 60 Hz.
- Maximum total connected load: 1200 VA
- Operating temperature limits: 32 to 130°F
- 85% RH continuous, non-condensing, humidity
- 0.5G continuous vibration
Sample Specifications
Hawk 4000 Integrated Boiler Control System

PART 1  GENERAL  1.1  GENERAL
A. Each unit shall be factory equipped with a boiler control system providing technology and functions equal to the Hawk 4000 boiler control system.
B. Each Boiler Control System shall be factory equipped with a pre-configured Programmable Controller and Human Machine Interface (HMI).

PART 2  PRODUCTS  2.1  MAJOR SYSTEM COMPONENTS
A. Major system components shall include:
   1. Programmable controller
   2. Touch screen HMI
   3. Various controller input/output modules
   4. One burner management controller and wiring sub-base
   5. One flame scanner: Infrared, Ultra-Violet, or UV Self-Check
   6. One flame amplifier, to correspond with the selected flame scanner
   7. Various temperature and pressure sensors
   8. Parallel positioning hardware for air and 1 fuel
B. Major functions that the Boiler Control System shall provide:
   1. Automatic sequencing of the boiler through standby, pre-purge, pilot flame establishing period, main flame establishing period, run and post purge
   2. Flame proving and lockout on flame failure during pilot flame proving, main flame proving, or run
   3. Low fire damper/valve position for flame ignition trials
   4. Full modulating control of fuel and combustion air
   5. Utilize solid state controls and sensors to provide various control functions, such as:
      a. Modulating control
      b. Modulating control algorithm shall be Proportional-Integral-Derivative (PID) type
      c. Thermal shock protection based on water temperature and setpoint
      d. Various high and low limit alarms and shutdowns
   6. Touch screen graphical operator interface and monitoring
      a. Manual control of the boiler-firing rate utilizing control screens on the HMI to increment and decrement the firing rate
      b. On screen indication of burner management controller status and diagnostics
c. On screen real-time display of all connected process parameters
d. On screen display of system alarms and faults
e. On screen history of alarms and faults
f. On screen water level indication (optional) and alarm(s)
g. Alarm/Fault history

7. E-mail or text messaging of boiler alarms
8. Ethernet communications
9. Tamper resistant control logic and password protection.
10. Night/day setback control
11. Stack flue gas, combustion air (optional), and shell (water) temperatures
12. Outdoor reset for hot water boilers
13. Remote modulation or firing rate setpoint control
14. Assured low fire cut-off (ALFCO)
15. Assured start permissive safety interlocking

C. The Boiler Control System shall provide the following safety provisions for:

1. Integrated burner management
   a. Examine all load terminals to assure it is capable of recognizing the true status of the external controls, limits and interlocks. If any input fails this test, the burner management system should lockout on safety shutdown.
   b. Closed-loop logic test verifies integrity of safety critical loads (ignition, pilot, and main fuel valves) and must be able to lockout on safety.
   c. Pre-ignition interlocks (fuel valve proof of closure, etc.) and flame signal checked during Standby and Pre-Purge.
   d. Dynamic checking of the flame signal amplifier. The control flame signal amplifier must be able to recognize a no flame signal during this dynamic amplifier check.
   e. Safe start check and expand check to include monitoring flame signal during standby.
   f. High and Low fire switches checked for proper sequencing.
   g. Tamper-proof purge timing and safety logic.

2. Integrated boiler controls
   a. Operating and Modulating control
   b. Variable Speed Drive (if used) fault shutdown
   c. Password protection of programmable controller Logic
   d. Password protection of parallel positioning control (if used)

D. The Boiler Control System shall provide annunciation and diagnostics:

1. Active alarm annunciation
2. Provide historical alarm information for on screen display
3. Detects and isolates an alarm, and reports internal circuit faults
4. English text description of the system fault and troubleshooting procedures
5. Water level indication and low water shutdown alarm
6. Dynamic self-checking

E. The Boiler Control System shall be able to operate in these environmental conditions.
   1. Supply Voltage: 120 VAC (+10%/-15%) 50 or 60 Hz
   2. Maximum total connected load: 1200 VA
   3. Operating temperature limits: 32 to 130°F
   4. 85% RH continuous, non-condensing, humidity
   5. 0.5G continuous vibration

F. All Boiler Control System wiring shall be in accordance with the National Electrical Codes and local electrical codes.

G. Boiler Control System component functions shall be as follows:
   1. Burner Management Controller: Provides burner sequencing logic to meet FM/IRI/UL/cUL approval body requirements.
   2. Touch Screen Graphical Interface: Provides user interface to the control system, boiler overview screen with connected boiler parameter readouts, burner management control status screen, alarm banners, diagnostic screens for fault troubleshooting, alarm history screen, system firing rate screen and system configuration screens.
   3. Modbus communication network: provides communication between the programmable controller and burner management system, as well as between the PLC and fuel / air actuators.
   4. Various programmable controller input/output modules: Provides interface for discrete powered and/or isolated relay signals, as well as for analog signals, from and/or to other input/output devices.
   5. Stack temperature sensor: measures and transmits a signal to the programmable controller in relation to boiler exit flue gas temperature. It is used for indication and in the calculation of boiler efficiency; it can also be used for high stack temperature alarm and shutdown.