Instruments and Controls

Inside:
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BurnerMate Universal
Industrial® Controller
The BurnerMate Universal offers complete boiler control in an economic, off-the-shelf, pre-programmed controller. Separate processors are used for flame safeguard and combustion control for NFPA 85 compliance. Configuration is done in the field using the LCD key pad, the optional touch screen, or our exclusive BMU_Edit software on your PC. BMU functions include:

- Advanced flame safeguard control including first out annunciation, nuisance trip protection, and lockout snapshot
- Combustion control (jackshaft, parallel positioning, with optional oxygen trim) using up to ten servos and up to four Variable Speed Drives (VSDs)
- Draft control
- Feedwater control: single, two-element, or three-element.
- Large 10” color touch screen with pre-programmed graphic pages

BurnerMate Light
The BurnerMate Light is an economical, state-of-the-art microcomputer-based burner management system with built-in first-out annunciator and combustion control designed for a single burner boiler or process heat application. The BurnerMate Light provides standby, purge, low fire ignition, main fuel light off, and release to modulate sequencing for oil and gas fired burners. O2 Trim available.

ZP Oxygen Probe
The BMU uses the same ZP probe as the BurnerMate TS PCC III, and UtilitySaver. The ZP controller/amplifier is built into the BMU chassis. The BMU allows for stack oxygen indication, and oxygen trim depending on the parameter selections made during commissioning.

BMU-SM & BMU-UM Servos
BMU servos are available in output torques from 3 ft-lb to 720 ft-lbs. Each includes an actuator positioner board, and integral feedback potentiometer. The feedback potentiometer is used to prove servo position thereby eliminating the need for auxiliary proof of position switches. Servos can be used for the following control functions; natural gas, fuel oil and/or “other gas” flow control valve(s).
Flame Scanner / Flame Relay

Model 5002-01
The 5002 Series Flame Scanners are intended for monitoring all gas, oil and coal-fired burners. The control is the basis for industrial or commercial burner management systems using microprocessors, PLC or relay based hardware. The 5002-01 interfaces with Preferred, Fireye, Honeywell, and other PCI flame safeguard controllers. The 5002/C version has a 4 to 20mA output in addition to an on/off flame present output.

UV & IR Flame Scanners

Model 5004-01
The 5004-01 scanner is an ultraviolet (UV) sensor for monitoring gas or oil flames. The Quanta-Flame flame safeguard checks the scanner for proper operation at the beginning and end of each flame cycle. It comes with a 6 foot shielded flexible cable with a military style connector, which plugs into the scanner base for quick and easy servicing.

Flame Safeguard

Model 5004-M78
The controller is a microcomputer based primary safety burner management system. The 5004-M-78 uses the Cleaver Brooks or Honeywell sub-base and the existing UV, IR & FR sensors.

Model 5004-M110
The 5004-M-110 flame safeguard is a direct replacement for most E-110 flame safeguard controllers. It is specifically designed to mount into existing 60-1386-2 and 60-1466-2 wiring sub bases. The 5004-M-110 control includes an integrated program module and flame sensor amplifier.

Model 5004-M85
The Preferred 5004-M-85 has just one processor with a built-in amplifier that accepts UV, IR, and self-checking UV scanner inputs, as well as flame rod inputs. It can also accept two scanners simultaneously on separate inputs.

Flame Safeguard Controller

Model 5004-890
The 5004-890 Flame Safeguard Controller is designed to directly replace the Honeywell RA890 F&G Controls. This controller sequences the burner through Ignition, Pilot Trial for Ignition, and Main Flame Trial for Ignition. The primary difference between the 5004-890 and the 5004-795 controller is the 890 series’ lack of blower motor terminals. The 5004-890 controller monitors the burner flame and running interlocks, shutting down the burner in the event of flame failure.
**Instruments and Controls**

**Flexfit Linkageless Control**
Leveraging the industry leading BMU platform, the FlexFit can be used in new installations OR be easily retrofitted into existing jackshaft control panels that use supported common flame safe guards. Fuel savings is accomplished with parallel positioning combustion control with optional oxygen trim. Variable Speed Drive for the FD Fan allows for greater electricity savings. In addition to flame safeguard and combustion control, the FlexFit also includes optional draft control. The FlexFit communicates to Building Automation Systems by Modbus or optional Ethernet. Because it is microprocessor-based and pre-engineered, the FlexFit is an economical alternative to more expensive PLC-based boiler controllers. The parts are in stock for immediate delivery and require no programming.

**Chief Dispatcher®**
**Modulating Lead/Lag Controller**
This advanced boiler sequencing, monitoring, and communication system provides lead lag control for up to ten boilers. The Chief Dispatcher® plant master optimizes boiler plant performance and helps extend boiler life for cast iron sectional, finned-tube, firebox, flexible tube, or firetube boilers.

**Feedwater Center**
The Feedwater Center is designed to improve the control of boiler feedwater by modulating up to four feedwater pumps and three transfer pumps. Deaerator temperature, level, and chemical pumps are controlled to improve boiler quality.

**Draft Controller**
**Model JC-22D**
The JC-22D Draft Monitor and Controller is a microprocessor-based draft controller, indicating instrument, and alarm monitor. Uncontrolled stack draft can cause burner instability, unreliable ignition, and affect fuel-air ratio control repeatability. Burner manufacturers typically recommend draft controls be installed in applications when stack height exceeds 75 feet or multiple furnaces are connected to a single stack.

**Draft Range Transmitter Assembly**
**Model JC-22XMTR**
The Model E-Link Draft Damper Assembly pre-mounts a Model SM-15 servo actuator and JC-22XMTR Draft Range Transmitter Assembly. Only a stack draft connection is required. The Model E-Link Draft Damper Assembly is part of a full scope control package that assures safe and efficient control with undivided system responsibility.
BMU E-Link Draft Damper Assembly
Model JC-22XMTR
The Model BMU E-Link Draft Damper Assembly and BMU with expanded controller form a complete draft control package. A complete draft damper assembly saves installation time and cost by factory mounting actuator and draft transmitter with high-pressure cutout switch and 5-second time delay relay. The Model BMU E-Link draft damper assembly includes a pre-mounted BMU-SM series actuator and JC-22XMTR draft range transmitter assembly.

Linear Actuator
Model JC-22-PL2-1006
JC-22-PL2-1006 is a linear actuator with an integral microprocessor-based draft controller and a solid state draft range pressure sensor. The JC22-PL2-1006 is a direct replacement for the Hays Cleveland model # 9502-1012-B-8. The JC22-PL2-1006 is housed in a durable metal enclosure with a removable cover. The JC22-PL2-1006 provides automatic modulation for any negative or positive draft application.

Model JC-22-DPCO-8
The JC-22-HDPCO-8 is a draft range differential pressure switch with red warning light and time delayed cutout relay contacts. The normally energized cutout relay contacts open when the differential pressure is higher than the setpoint for more than 8 seconds. The setpoint is field adjustable over the 0.05” to 9.0”wc range.

Smoke Opacity Monitoring System
Model JC-30D
The JC-30D Smoke Opacity Monitor is a microprocessor-based Indicating Instrument with a smoke duct mounted optical sensing assembly. The system provides a continuous opacity readout, alarm indication, and shutdown capability.

Flue Gas Temperature Monitor
Model JC-15D
The JC-15D Flue Gas Temperature Monitor is a microprocessor based indicating instrument with a heavy duty Thermocouple Assembly. Flue gas temperature is continuously displayed using a highly visible backlit LCD display. The JC-15D is used to monitor boiler efficiency (higher stack temperature translates into lower efficiency) and as a high stack temperature switch.

Digital Process Monitor
Model JC-10D
The JC-10D Process Indicator is a microprocessor based indicator alarm that can be field configured for a wide variety of applications. The instrument provides a highly visible backlit LCD display with easy to understand bar graph, scaled numeric display, and front panel alarm messages.
Fuel Sentry Tank Gauge and Leak Detection System

Model TG-EL-D4A
The U.L. Approved Fuel Sentry Model TG-EL-D4A Tank Gauge and Leak Detection System is a remote reading, microprocessor based, tank gauge, with six intrinsically safe sensor inputs that can monitor one or two tanks. The leak detection system is designed for use with double wall tanks, vaulted tanks, single wall tanks with spill basins, and double wall piping.

Multi-Tank Gauge and Leak-Detection System

Model TG-EL-D5
The Model TG-EL-D5 Multi-Tank Gauge and Leak-Detection System is a comprehensive tank-gauging and leak-detection system that can simultaneously monitor product levels and leaks.

Wire Float Level Sensor

Model TG-EL-WF
The TG-EL-WF Wire Float Level Sensor is extremely accurate, easy to install, and ideal for low “Head Room” installation applications. The float is connected via a flexible stainless steel cable to a multi-turn, take-up reel within the sensor head. The flexible cable and the flanged tank connection allow rapid installation, even in restricted spaces. An integral test mechanism permits high level alarm and full tank calibration checks without removing the sensor from the tank.

Model TG-EL-HLT
The TG-EL-HLT sensor transmits a 4-20 mA Head signal to a Preferred Instruments TG-EL-D4A or TG-EL-D5 tank gauge, or to a wide variety of PLC, BAS, SCADA and other similar systems.

Leak Detector

Model HD-A2-C
The Model HD-A2-C Leak Detector uses a combination electro-optic technology, which reliably distinguishes between water and oil. The detector contains an infrared optical liquid detector and a set of stainless steel conductivity rings. Oils are detected by the optical liquid detector and water is detected by both the optical liquid detector and the conductivity rings.
Cutting-edge control solutions that produce savings for combustion and process applications.

**Multiple Loop Controller**  
**Model PCC-IV & DCS-IV**  
This Model PCC-IV multiple loop process controller has large I/O quantity, integral oxygen sensor, highly visible front panel, intuitive “Blockware,” redundant memories, 4-20 mADC input and outputs, 24 VDC transmitter power supply, and built-in industry standard communications, allowing the PCC-IV to integrate with complex systems while maintaining a minimum number of external components.

The DCS-IV Multiple Loop Controller can be supplied to provide draft and drum level control loops and balance of plant monitoring with up to 15 analog inputs, 6 analog outputs, 5 triac pair outputs, 6 relay outputs, 13 digital 120 VAC inputs or combinations of these.

**Plant Wide Controller**  
The Plant Wide Controller (PWC) is a sequencing, ease of operation, communication and expansion capabilities with boiler plant control application expertise. Off-the-shelf, standard applications for boiler modulating lead/lag, cooling towers and air compressors can be expanded to include additional monitoring or control additional pumps, variable speed drives and valves. The PWC is a complete plant monitoring, control and communication interface.

**OIT Touchscreen**  
**Model OIT-10**  
All of the control functions of the BurnerMate Universal can be accessed through the LCD key pad. 10” and 15” color touch screen display are available for enhanced graphics and communications. Supported communication protocols include; 10/100 Base Ethernet, Modbus TCP/IP, Modbus RTU, SCADA/BAS connection, and BMU connection.

**Servo Actuator**  
**Model SM & UM**  
The Model UM Servo Actuator provides directly connected and precise modulating control of fuel valves and combustion air & flue gas control dampers. The actuator opens, modulates, and closes the valves and/or dampers in accordance with the integrated combustion control and burner management system programs.
Flexible System Controller
Model FSC-120
The FSC-120 is a general purpose programmable logic controller that is programmed with Function Block logic. A single FSC can be used to control a process, or multiple FSC’s can be networked together for coordinated distributed control. The most common application of the FSC is to monitor and control emergency generator fuel oil supply pumping and storage systems.

Automatic Fuel Oil Transfer Pump Set
Model ATPSF
The Automatic Fuel Oil Transfer Pump Set is a state of the art system duplex pump sequencing and monitoring system. This system includes automatic lag pump back-up features that improve fuel system availability and safety. A pump set mounted LCD display is used to monitor day tank and pump set status and alarms. The microprocessor-based monitoring panel can be configured to monitor and control transfer pumps, return pumps, tank level gauges, and tank leak detectors.

Day Tank
The Model DT Day Tanks provide a local supply of distillate or diesel fuel for boilers, emergency generators or other stationary engine driven or oil fired equipment.

designed for
Mission Critical Systems
Increase a facility’s “up” time.
Reliability reduces costly outages.
Easy to troubleshoot from any Node.
Redundant dual communication network.
Custom Solutions
from our Engineers.

Cutting-edge control solutions that produce savings for combustion and process applications.

SCADA
Distributed Control
This system's architecture allows integration of multiple boiler plant systems, including high and low pressure steam generators, high and low temperature hot water generators, chilled water plants, and municipal service facilities.

SCADAWeb
- Multiple OIT Control screens brought to your desk
- Data from multiple sources on single screen
- Process monitoring
- Alarm alerting
- Remote control monitoring
- No Internet Needed
- Quick Installation
- Simple Configuration
- Synchronized Updates
- Fast Bootup
- Optional Reporting

SCADA\FLEX
- SCADAWeb features, Plus:
  - Interface to other equipment at site
  - Records data
  - Process visualization (HMI)
  - Local or remote operating modes
  - Historical Trending
  - Alarm Management and printing
  - Develop software allows continue development on site

SmartSCADA
- Scada/Flex features, Plus:
  - Computer analysis of incoming data
  - Energy management
  - Optimize operational performance
  - Increase uptime reliability
  - Remembers/compares data/efficiency
  - Identify problems before they occur
  - Alerts sent to service company and plant manager
**Preferred Cloud**

The Preferred Cloud Server monitors boiler rooms, flame safeguard controllers and combustion controls to notify facility owners of trouble the moment it happens. Knowing when a boiler trips in real time enables owners to dispatch a technician to diagnose and potentially fix a problem before excessive loss of steam pressure or water temperature.

**Monitor key points**
- Fuel Consumption
- Boiler Efficiency
- Boiler Runtime
- Lockout Notification & Alarms

**Supported Boiler Controls:**
- Preferred Utilities
- Honeywell
- Fireye
- Cleaver Brooks
- Siemens
- Others available upon request

An internet connection is required for remote monitoring and notifications; cellular connection options are available. Additional transmitters and equipment may be required to monitor boiler efficiency and fuel consumption.

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Collect Data points from all the devices in your boiler plant. Connect via Modbus TCP/IP or Serial

Securely Connect to the Preferred Cloud

Customer Provided Internet Connection or

Secured Cellular Network

Receive Notifications of problems and monitor your system from anywhere

Web Monitoring

Email Notifications

Mobile Monitoring and Notifications
Burner Management and Combustion Control Systems
Engineered to your specifications in PLC, Micro-processor, Multiloop, or Combination Platforms. Control systems available in Class 1 Div 2 and Safety Integrated level designs.

Full System Integration
The capabilities of Preferred Instruments extend beyond boiler controls. We know how to integrate boiler controls into complex systems. Our expertise has given our engineers a wealth of experience designing thousands of complete boiler plant control systems.

Quality Assurance Compliance
Before we release any product, it must pass our rigorous standard assurance testing program. Our extensive testing and real-life simulation program provides you with a line of accessories that will eliminate the need for start-up experiments.

Free Product Training
Preferred offers regular technical and product training sessions at our Danbury, Connecticut headquarters.

In addition to standard training, we also provide “upon-request” sessions throughout North America. Technical and product training helps save time and money. Please visit our web site for the latest training schedule.
Check out our **Online EnergySaver Payback Analysis**!

Burner control upgrades and/or burner upgrades can provide significant fuel and electricity cost savings. How can an engineer, installer, or facility estimate realistic cost savings in order to evaluate the payback from an upgrade investment? Preferred has the answer. We built the Preferred Utilities EnergySaver Payback Analysis Web App to estimate savings based on site specific data.

To use the app, go to: [http://www.PREFERRED-MFG.com](http://www.PREFERRED-MFG.com) and click on Payback Analysis.

On these two pages, we’ll use the Payback Analysis Web App to show typical savings for a 600 Bhp boiler for various upgrade scenarios:

1) Retain existing burner, Upgrade from Jackshaft to Linkageless with: Only O\(_2\) trim, Only FD VSD, and combined O\(_2\) and VSD
2) Same as 1), but show the effects of various load profiles.
3) Upgrade to a new burner with Linkageless O2 trim and VSD controls, comparing two proposed burners

Linkageless control is the most cost effective, operationally effective, and safest method to implement O\(_2\) trim and FD fan VSD control. Compared to a well maintained jackshaft burner, Linkageless control in and of itself does not provide any savings. It is the O\(_2\) trim and FD Fan VSD that provide the savings in these examples.

**Burner/Boiler Data:**
Enter the data for the site. For this article, all scenarios will use the following data:

- **Boiler Output** units can be Bhp, klbs/hr, or MBtu/hr.
- **FD Fan Damper Type** is ‘Non-Vortex’ for most firetube burners, and ‘Vortex’ for most register burners.
- **O\(_2\) Measurement** should be ‘%O\(_2\) Dry’ if an extractive, or portable analyzer is used.

**FD Fan Motor Data:**
‘Existing’ and ‘Proposed’ motor Hp and motor efficiency entries are provided to consider the benefits of replacing the existing motor. The Proposed motor can have different Hp and/or efficiency ratings. If the existing motor efficiency is unknown, select the motor manufactured date range. A typical value for that motor size is displayed. Both the existing and proposed full load motor efficiencies must be manually entered.

**Load Profile:**
In this section, enter the % of firing hours for each load range (total must be 100%).
The following three load profiles will be used to illustrate the combined effects of O\(_2\) trim and FD Fan VSD speed control. Enter the equivalent number of days that the burner is not firing in the boiler data section above.
**Light Load**

<table>
<thead>
<tr>
<th>Firing Rate (%)</th>
<th>20%</th>
<th>40%</th>
<th>60%</th>
<th>80%</th>
<th>100%</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boiler Output</td>
<td>120.0</td>
<td>240.0</td>
<td>360.0</td>
<td>480.0</td>
<td>600.0</td>
<td>(Bhp)</td>
</tr>
<tr>
<td>% of Firing hours at this Output</td>
<td>10</td>
<td>25</td>
<td>30</td>
<td>25</td>
<td>10</td>
<td>100</td>
</tr>
</tbody>
</table>

**Medium Load**

<table>
<thead>
<tr>
<th>Firing Rate (%)</th>
<th>20%</th>
<th>40%</th>
<th>60%</th>
<th>80%</th>
<th>100%</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boiler Output</td>
<td>100.0</td>
<td>200.0</td>
<td>300.0</td>
<td>400.0</td>
<td>500.0</td>
<td>(Bhp)</td>
</tr>
<tr>
<td>% of Firing hours at this Output</td>
<td>5</td>
<td>10</td>
<td>20</td>
<td>50</td>
<td>15</td>
<td>100</td>
</tr>
</tbody>
</table>

**O₂ and Flue Temperature Profile:**

Measure the existing O₂ and flue temperature levels at each of the five loads and enter.

- **Existing Stack Oxygen:**
  - 9
  - 7.3
  - 5.6
  - 5.0
  - 5.0
  - %O₂ Dry

- **Proposed Stack Oxygen:**
  - 8.5
  - 6.5
  - 4.2
  - 3.5
  - 3.5
  - %O₂ Dry

- **Existing Stack Temperature:**
  - 425
  - 450
  - 470
  - 490
  - 515
  - (F)

Enter projected O₂ levels based on the new burner O₂ specs, or based on a temporary existing burner best efficiency re-tuning. Be sure to re-tune a jackshaft burner to the previous O₂ levels to insure safe combustion year round (due to changing air density and humidity effects). The data below is for a typical 125 psi steam boiler without an economizer.

**Savings:**

For the Medium Load profile above, the results are:

(fuel savings based) CO₂ reduction: 86 (tons/yr)

<table>
<thead>
<tr>
<th>Annual Fuel Cost</th>
<th>Existing</th>
<th>Projected</th>
<th>Savings</th>
</tr>
</thead>
<tbody>
<tr>
<td>725,279</td>
<td>717,151</td>
<td>8,128</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Annual Fan Electricity Cost</th>
<th>Existing</th>
<th>Projected</th>
<th>Savings</th>
</tr>
</thead>
<tbody>
<tr>
<td>12,073</td>
<td>4,846</td>
<td>7,228</td>
<td></td>
</tr>
</tbody>
</table>

**Total Savings/Year:**

15,356

The charts below show O₂ trim savings complement VSD cost savings for various load profiles.

At higher loads, the O₂ trim fuel savings are high and the VSD electric savings are low.

At lower loads, the O₂ trim fuel savings are low and the VSD electric savings are high.

**Summary**

Fuel costs, electricity costs, motor Hp, motor efficiencies, and burner O₂ levels vary significantly from site to site. The Preferred Utilities Boiler EnergySaver Payback Analysis web app makes it easy to evaluate potential savings due to controls and/or burner upgrades.

To access, go to: [http://www.PREFERRED-MFG.com](http://www.PREFERRED-MFG.com) and click on Payback Analysis or scan the QR code!