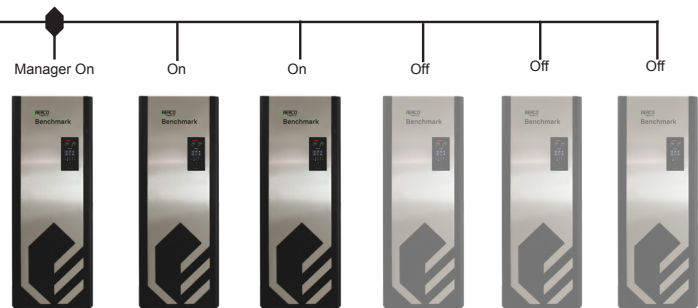# Technical Data Sheet

Edge® Controller With Boiler Sequencing Technology (BST)

Load Sharing Strategy Maximizes Energy Efficiency

It requires less energy for a group of modulating boilers, each firing at "part load," to heat a building, than for a single boiler operating at "full fire" to carry the entire workload. To meet building demand, the BST will employ as many boilers as available, each operating at its most efficient firing rate. Importantly, because the BST reacts in real-time to, up to 16 boilers, changes in the number of boilers available, users can take a unit offline for maintenance at any time or bring on back-up boilers for extremely cold conditions without changes to the BST. And as individual boilers are added or deleted, the energy delivered is automatically adjusted to prevent fluctuations in the header temperature of the plant.

Typical Staging Example Demonstrates "Part Load" Efficiency

The first boiler unit comes online and will gradually increase its air-fuel valve position to meet demand. When it reaches 50% – a second unit is called into service.

The two boilers will split the load – each firing at 30% air-fuel valve position to meet demand. If additional heat is required, a third unit is called into service.

Three boilers, each firing at 30% air-fuel valve position, satisfies the demand more efficiently than either two units at 50% or one unit at 100%. This same principle applies to much larger plants.

Features

- Increase system turndown to maximize operating efficiency
- Control Up to 16 Boilers
- Automatic load matching precisely meets demand changes
- "Bumpless" energy transfer
- Multiple configuration options
- User-friendly software makes programming easy
- Full system information VFD display on manager unit
- Controls external 24V AC/DC motorized modulating valve
- Easy integration to BAS or EMS via BACnet or Modbus

- Single point BAS or EMS data gathering for up to 20 BAS system operating parameters and 18 operating parameters of each boiler
- Available standard on all AERCO Benchmark boilers. No additional panel necessary.
- Can incorporate different unit capacities for optimized efficiency.
- Utilizes a header and/or outdoor sensors directly connected to the BST manager unit, optional Modbus header sensors, or remote network sensors.
- With integrated minimum number of Open valves, the BST can reduce plant pump energy during low load and standby and improve boiler condensing ability.

Control System Supports Efficient Boiler Plant Operation

The AERCO Edge with Boiler Sequencing is a flexible controller designed to maximize energy savings in modular boiler plants. The BST can stage and coordinate the operations of up to 16 boilers and is uniquely designed to maximize uptime reliability and the operating efficiency of condensing equipment capable of unmatched modulation. For boiler plants greater than 16 boilers, the AERCO Control System (ACS) panel is required.

Able to regulate overall plant output with precise accuracy, a boiler plant with ±4°F header temperature variation is assured under normal load conditions. It offers sequential or parallel operation flexibility, and user programmable modes of operation that can be changed in the field. The Edge automatically rotates the lead unit to help equalize boiler runtime or number of cycles.

Fully Compatible with BAS or EMS Systems via BACnet or Modbus

For facilities that have taken a building-wide approach to energy efficiency, the Edge supports easy integration with Building Automation Software (BAS) or Energy Management Software (EMS) programs via BACnet MSTP, BACnet IP, Modbus RTU & Modbus TCP. A standards-based integrated protocols used throughout the buildings controls market, BACnet or Modbus integration will enable facility managers to monitor all operations from any building control platform. BAS or EMS can poll 20 System Operating Parameters, and 18 unit Operating Parameters per boiler through a single connection, including (for greater detail consult Edge Communication Manual GF-214).

BST System Parameters

- BST mode
- BST setpoint
- BST auto master
- BST Unit outlet temp
- BST num units enabled
- BST units faulted
- ManagerUnit Address
- BST header temp
- BST outdoor temp
- BST fire rate output
- BST Unit Ignited
- BST Active Setpoint
- Next turn on fire rate
- BST setpoint mode

Boiler Parameters

- Comm addr
- Unit Status
- Fault status
- Outlet temp
- Inlet temp
- Exhaust temp
- Air temp
- Flame strength
- Fire rate out
- Boiler Isolation Valve State
- Network remote setpoint
- Run cycles
- Run hours
- O_2 Level

Configuration Options	Typical Applications
Indoor/Outdoor Reset A change in the outside air condition results in a Process Application proportionate change in header temperature – a function of the adjustable reset ratio (0.3 – 3.0).	Indoor/Outdoor Reset Hydronic Heating Process Application
Constant Setpoint Delivers fixed supply water temperature at set points of 50°F-220°F (dependent upon boiler maximum temperature limit).	Water Source Heat Pump Domestic Water Generation Supplemental Heat Recovery Equipment Swimming Pool Heating
0-5V/0-20 mA Signal Header temperature responds linearly to an external 4-20mA control signal.	Computer Controlled Building Management Industrial Process Greenhouse Application
Network Communications Enables EMS or BAS system to drive boiler plant setting for header set point temperature via Modbus connection to BST. Also provides communication link between the boiler and the BST to allow direct communication. This enables the EMS/BAS to query and capture faults of BST and 20 BST System operating parameters as well as 18 operating parameters of each individual boiler.	Computer Controlled Building Management EMS Data Logging & Trend Analysis

NOTE: Supply Header Temperature Sensor Is Sold Separately (See Benchmark and Edge Control Panel O&M)

Robust Features Simplify Control

- **Application Flexibility** – Different configuration options meet the needs of any closed loop system and can be changed in the field.

- **Time Delay Between Boiler Start** – An adjustable time delay between boiler starts allows for a smooth energy input without spikes in electrical, gas or venting conditions.

- **Automatic Allowance for Maintenance** – By continuously monitoring the number of boilers available for operation, the system will automatically operate the next boiler needed to meet demand if a unit malfunctions or is taken off-line for maintenance.

- **Adjustable Offset** – The BST includes a 7-day programmable clock to support night setback and/or daily setback periods. The BST will shift from the original set point to a higher or lower temperature.

- **Two Interlock Circuits** – Monitor pumps, combustion air dampers, or other equipment using two interlock circuits that must be completed before plant operations begin.

- **Power Off Memory** – By using non-volatile memory, programs are retained through a shut down of more than two years. No batteries required.

- **Simple Installation** – The Edge control system operates on boiler unit's standard power supply. Twisted pair, shielded wire connections between the Manager boiler unit and client individual boilers is required to support communications. An RS-485 interface is required to link an BAS communication wiring supports a distance of up to 4,000 feet between BAS and boilers.

- **Flexible & Expandable** – The BST can support up to 16 AERCO boilers – which can be fully integrated with any EMS or BAS software via BACnet or Modbus. AERCO also offers Gateway product for LON and Johnson Controls N2.

- **"Bumpless" Energy Transfer** – When staging boilers sequentially, the BST can bring additional units online at an adjustable percentage of input selected by the user.

- **Accuracy** – The BST uses PID (Proportional & Integral + Derivative) and Dynamic Up/Dynamic Down Modulation control algorithm to provide a dynamic response to all changes in plant operation. Header temperatures, as well as percentage boiler input, are precisely controlled with virtually no overshoot or short cycling of equipment. A header temperature of ±4°F is assured during continual plant operation.

- **Lead and Lag Boiler** – The BST will select the Lead and Lag boilers by either Unit Size or Run Hours depending on user setting. The Lead and Lag boilers can also be manually selected by the user.

- **Anti-Cycling Features** – These features prolong the system's stay at specific state (firing/off) - reducing the number of cycles while maintaining accurate temperature control.
  - Shutoff Delay Temp
  - Deadband high
  - Low-flow Mode
  - Demand offset
  - Deadband low

- **Low-Flow Mode** – is an innovative and exclusive feature in the AERCO BST control that detects a "low-flow" condition in a multi-boiler system. When the AERCO BST determines that a low-flow condition exists, it will slowly shut down one boiler at a time in an attempt to raise the Fire Rate of the remaining boilers. If the low-flow condition persists and only a single boiler remains ignited, the AERCO BST will use the "Outlet Temperature Sensor" of the remaining ignited boiler to control the temperature. The Outlet Temperature Sensor is mounted in the individual boiler and drastically increases the response time to precisely control temperature. The distant header sensor is ignored in this mode of operation.

- With integrated minimum number of Open valves, the BST can reduce plant pump energy during low load and standby and improve boiler condensing ability.

- Modulate variable speed boiler pumps based on Firing rate.

- Modulate BST valves to balance the plant flow based on boiler specific flow rate.

- **Setback Setpoint Gradual Decrease** – Whenever boilers are running at a high rate and the Setback-Setpoint feature is activated, the sudden decrease in setpoint will cause the PID to drastically cut back on fire rate. This sudden decrease in fire rate will often cause the boilers to drop below their Stop Levels causing them to turn off, thereby causing excessive cycling and loss of heating capacity while the boilers can re-ignite. The Setback-Setpoint gradual decrease feature will decrease the setpoint, lowered by the activation of the Setback-Setpoint feature, at a slow rate thereby allowing the PID to recover and prevent any boilers from shutting down if not required to do so.

- **Warm-Up and Low-Fire-Delay Fire Rate Hold** – When an extra boiler is ignited to meet demand, the fire rate of all ignited boilers will be held at their present level until the newly ignited boiler has completed Warm-up and Low Fire Delay. When the newly ignited boiler has completed Warm-up and Low Fire Delay, all boiler fire rates will decrease to approx 30% Fire Rate. All boiler fire rates will then rise together to the required fire rate to meet demand.

- **Setpoint Approach Rate control** – To avoid header temperature overshoots, whenever the header temperature nears the setpoint temperature at a rate too quickly to prevent a temperature overshoot, the BST fire rate will temporarily decrease in order to lower the temperature rise momentum. This feature will help avoid temperature overshoots due to variable flow as well as other conditions.

- **Next Turn On Valve Position** – When all ignited boilers reach or exceed the BST Next on VP value, another boiler will be ignited to share the load (if one is available). The default value is 50%. This feature is also useful if a user wishes to always have as few boilers on at any one time. Setting the BST Next on VP value to a high number (Example 100%) will only ignite a new boiler if all currently ignited boilers reach their total BTU capacity (100%).

- **Backup Manager Function** - In the event the manager unit experiences a panel failure or communication loss, the BST system will automatically transfer the manager function to the next manager unit in the system plant. This ensures maximum efficiency and intended plant operation in face of the events mentioned above.

Specifications

Standard Listings & Approvals: UL, CUL