PLANT WIDE CONTROLLER
APPLICATION GUIDE

PREFERRED INSTRUMENTS
A Division of Preferred Utilities Manufacturing Corporation
Preferred Utilities Manufacturing Corporation is an engineering-based manufacturer of combustion control and data acquisition systems, instrumentation, burners, fuel handling systems, nuclear power plant outage reduction tools and component parts for industrial, institutional, and commercial power plants. Our core business is Power Plant upgrades including component/system supply and its integration. Our headquarters is located in Danbury, CT, with Regional Managers that support independent sales representative organizations that cover all other major markets throughout the United States.

**Intent**

This discussion is for low temperature (< 230°F) hot water systems. The Plant Wide Controller can also be applied to high temperature hot water (HTHW) boiler or condensing boiler based systems. This is not a guide on how to design hot water piping system, rather it is a guide on recognizing some of the possible concerns that a control system faces.

Note: This guide should not be used to instruct engineers or customer on how to design their hot water hydronic heating system.

**Confidential Notice**

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## Technical Terms and Symbols
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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. Multiple communication protocols allow simultaneous communication to alphanumeric pagers, laptops via standard telephone lines and Building Automation System or SCADA Systems using a control network. The PWC is a complete plant monitoring, control and communication interface.

Easy Installation: The PWC integrates a powerful Programmable Function Controller (PFC), I/O boards, hardwired and LCD HMI, power distribution, 24VDC power supplies, external communications, isolation relays into a single wall mountable controller. No external control devices are required.

Easy to Operate: Large LCD Display, intuitive operation, setup, alarm / event summary and historical trend displays allow quick process assessment and maintenance monitoring.

Easy to Configure: PWC configuration tools maintain the look and feel of the PCC-III and offer advanced features. The PWC uses an intuitive “Blockware” configuration language with multiple block outputs and special purpose “Super” blocks that greatly simplify complex logic such as Outdoor Air Reset and boiler sequencing.

The PWC can be configured for an unlimited number of control applications. These configurations are the most common:

- Lead/Lag Controller for Improved Steam or Hot Water System Availability: Automatic Sequencing ensures that the number of boilers in service meets hot water or steam demand. Tripped equipment is automatically replaced with a standby unit.

- Boiler Monitoring: Flue gas temperature, smoke opacity and boiler draft may be monitored and trended. Warning alarms and burner safety shutdown interlocks may be included.

- Unmanned Boiler Plants: Provides for off-site monitoring and control using internal modem or RS485 interface. Serves as a single plant monitoring point for Building Automation Systems and personal alphanumeric pagers.

- Cooling Tower Optimization: Multiple Tower Cells are sequenced and fan speed controlled with wet bulb optimization. Substantial fan and chiller electrical savings can be realized.

- Improved E-Gen Fuel System Availability: Fuel pump standby sequencing, day tank level control and fuel storage tank level and leak monitoring.

- Improved Steam System Availability: Condensate transfer and feed pump standby sequencing, Deaerator and Surge tank level monitoring, alarm and remote communications.

- Coordinated Hot Water System Operation: Pumps, isolation valves, distribution pumps and temperature monitoring for reduced thermal stress and energy consumption.

- Fresh Air Dampers, Air Compressors and Fans: Sequencing, monitoring, and control are based on the number of boilers online. A single damper failure will not prevent a boiler from firing.

Custom configurations are available to suit virtually any application.
**Overview**

Tank Level Gauges: The PWC interfaces with wire float, ultrasonic, pressure-based, and other types of tank gauges. Multiple tanks can be monitored through one PWC.

Tank Level Switches: Digital inputs are provided to monitor tank high and low level contacts, pump off, pump on, and overfill contacts.

Leak Detection: Digital inputs are available for multiple leak detection inputs including interstitial or annular space leak detection, as well as engine room leak detection.

Transfer Pump Control: Multiple headered transfer pumps can be start/stopped, or put on a timed rotation schedule to even wear among pumps.

Pump Proving: Inputs from multiple pump flow switches can be configured to prove pumps are running normally.

Return Pump Control: When gravity return systems are not practical, the PWC can activate return pumps to prevent overfilling of day tanks.
Specifications

PWC shown with door open, pump motor starters and circuit breakers with step down transformer installed on a removable subplate.

Expandable - Plug-in I/O expansion modules are easy to install. “Blockware” configuration language allows control strategies to be easily adapted to on-site conditions.

“Hand-Off-Auto” Relay Output Board. Toggle switch directly activates output in “Hand” and “Off.”

CPU Board:
- Analog Inputs: Quantity: 2
  Type: 4-20 mADC or -20°F to +300°F Thermistor
- Relay Output: Quantity: 1
  Type: SPDT, 8A, ½ HP, 120VAC

Hand-Off-Auto Relay Output (HOA-ROUT) Board:
- Relay Output: Quantity: 5
  Type: SPST, 8A, ½ HP, 120VAC
- Toggle Switches: Quantity: 5
  Type: Hand-Off-Auto (hardwired) SPDT, 8A, ½ HP, 120VAC
- LED Indicators: Quantity: 10
  Type: “Call for Operation” and “Output Status”

Auto/Manual Analog Output (A/M-AOUT) Board:
- Analog Output: Quantity: 5
  Type: 4-20 mADC or 0-135 ohm (any combination)
- Toggle Switches: Quantity: 5
  Type: Auto-Manual
- Control Dial: Quantity: 5
  Type: 0-100% (Manual Potentiometer)
- Bargraphs: Quantity: 5
  Type: 0-100%, 10 segment

Discrete Input (DIN) Board:
- Digital Inputs: Quantity: 15
  Type: 120 VAC, optically isolated
- LED Indicators: Quantity: 15
  Type: Status Indication

Analog Input (AIN) Board:
- Analog Input: Quantity: 8
  Type: Universal, Switch Selectable as:
  - 4-20 mADC, 2 wire
  - Thermistor, -20°F to 300°F
  - Thermocouple Type J, 0-1200°F, 0-5 VDC, or Potentiometers
  - Pulse, 0.01 – 4000 Hz, 0-15 VDC
- LED Indicators: Quantity: 8
  Type: Status Indication

Relay Output (ROUT) Board:
- Relay Output: Quantity: 8
  Type: (2) SPDT, (6) SPST-NO, 8A, ½ HP, 120 VAC
- LED Indicators: Quantity: 8
  Type: Status Indication
Specifications

**Mechanical**
- Case Size: 35" H x 20" W x 10 D
- Enclosure Type: Wall mounted
- Case: 7 Slot, (CPU + 6 I/O Slots)
- Weight: 55 lbs.

**Environmental**
- Operating Temp: 32° to 122° F (0° to 50° C)
- Storage Temp: -20° to 150° F (-28° to 65° C)
- Humidity Limits: 15 to 95% (noncondensing)
- Enclosure: NEMA 4

**Performance**
- Accuracy: 0.025% Analog I/O
- Resolution: 16 bit input/12 bit output
- Microprocessor: 32 bit, 128k EEPROM
- Execution Cycle: Five per second
- Time/Date Clock: (battery backed)

**Operator Control Panel**
- LCD Graphic Display: 2.9" H x 5.1" W
- Keyboard: Membrane, tactile feedback

**Historical Data (Optional)**
- Displays: 8 or 40 minute or 2, 8 or 24 hour charts
- Memory: Non-Volatile, 128MB 48 points every second for 30 days

**Configuration**
- Standard Lead/Lag: Menu style
- “Fill-In-The-Blanks” setup.
- Control Language: Function block style,
- 60 functions, 600 Blocks
- Security: 2 password levels
- Custom Blockware
- Configuration Software: PWC_Edit™ spread sheet based or PWC_Draw™ graphical, editor.
  (Windows PC Required)

**Communication**
- Control Network:
  - Protocol: Modbus (ASCII or RTU mode)
  - Speed: 1200 to 38,400 baud
  - Type: RS485, optically isolated
- Telephone Modem (optional): Internal Card 33,600 baud, RJ-11
  - Jack, Data and Pagers
- Programming Port
  - Speed: 9600 to 38,400 baud
  - Type: RS232, DB9F connector

**Electrical**
- Input Power: 120 VAC (+/- 15%), 12A total, 0.7A internal
- Built in surge suppressors
- Internal Power Supply: 24 VDC @ 300 mADC for external use
Application Note: 5 Steam Boilers, Warm Standby, Low Fire Hold, Modulating

Control Functions
- Boiler Sequencing based on Load
- Lead Auto-Rotates on Time, or Manually selected
- Custom sequence can be entered by the Operator
- Lead Boiler Modulates, Series Modulation
- Lag Boilers “Base Loaded” for Efficiency
- Base Load rate changes when required to meet Load
- For Process Loads, next Standby Boiler is kept warm
- Holds at low fire until Boiler is Warm, then ramps up
- Parallel Modulation also available
- Failure of any Boiler automatically causes a backup unit to start.
Application Note: 10 Steam Boilers, Warm Standby, Low Fire Hold, Modulating

### Plant Wide Controller (PWC)

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</table>

### Control Functions

- Boiler Sequencing based on Load
- Lead Auto-Rotates on Time, or Manually selected
- Lead Boiler Modulates
- Lag Boilers Base Loaded for Efficiency
- Base Load rate changes when required to meet Load
- For Process Loads, next Standby Boiler is kept warm
- Holds at low fire until Boiler is Warm, then ramps up
- Parallel Modulation also available
- Failure of any Boiler automatically causes a backup unit to start.

### Steam Boilers
Application Note: 15 Steam Boilers, Off - Low - High Modulation

Plant Wide Controller (PWC)

Control Functions
* Boiler Sequencing based on Load
* Lead Auto-Rotates on Time, or Manually selected
* Lead Boiler Modulates (Low - High - Low - ...)
* Lag Boilers Base Loaded at High for Efficiency
* Low Fire Hold Timer
* Failure of any Boiler automatically causes a backup unit to start.
Application Note: 5 Steam Boilers, Fresh Air Dampers, Warm Standby, Low Fire Hold, Modulating

Control Functions

* Boiler Sequencing based on Load
* Lead Auto-Rotates on Time, or Manually selected
* Custom sequence can be entered by the Operator
* Lead Boiler Modulates
* Lag Boilers Base Loaded for Efficiency
* Base Load rate changes when required to meet Load
* For Process Loads, next Standby Boiler is kept warm
* Holds at low fire until Boiler is Warm, then ramps up
* Parallel Modulation also available
* Fresh Air Dampers Sequenced based on Blr Qty fired
* Failure of any Boiler or Damper automatically causes a backup unit to start.
Application Note: 5 Steam Boilers, Fresh Air Dampers, Warm Standby, Low Fire Hold, Plant Efficiency Monitoring

Control Functions
* Boiler Sequencing based on Load
* Lead Auto-Rotates on Time, or Manually selected
* Custom sequence can be entered by the Operator
* Lead Boiler Modulates
* Lag Boilers Base Loaded for Efficiency
* Base Load rate changes when required to meet Load
* For Process Loads, next Standby Boiler is kept warm
* Holds at low fire until Boiler is Warm, then ramps up
* Parallel Modulation also available
* Fresh Air Dampers Sequenced based on Blr Qty fired
* Failure of any Boiler or Damper automatically causes a backup unit to start.

Plant Wide Controller (PWC)

Fresh Air Dampers

Outside Air Temperature

Foodwater Header Flow Meter

(existing?) Gas Company Flow Meter

(existing?) Oil Supply Flow Meter

(existing?) Oil Return Flow Meter

(existing?) Make-up Water Flow Meter

Pulse Al

* Heating Degree-Days Calculation & Totalizing
* Fuel Usage Totalization
* Fuel Usage per Degree Day Calculation & Trending
* Input-Output Efficiency Trending
  (assumes Steam Flow = Feedwater flow - x % Blowdown)
* Make-up Flow Totalizing & % Make-up Trending
  (helps detect steam trap and piping leak problems)
Application Note: 5 Steam Boilers, Fresh Air Dampers, Chemical Feed Pumps, Modulating

Plant Wide Controller (PWC)

Control Functions
- Boiler Sequencing based on Load
- Lead Auto-Rotates on Time, or Manually selected
- Custom sequence can be entered by the Operator
- Lead Boiler Modulates
- Lag Boilers Base Loaded for Efficiency
- Base Load rate changes when required to meet Load
- Fresh Air Dampers Sequenced based on BHR Qty fired
- Failure of any Boiler or Damper automatically causes a backup unit to start.
- Chemical Feed pump only runs when boiler runs
- Chemical pump speed varies in proportion to firing rate
Application Note: 4 Steam Boilers, Fresh Air Dampers, Pumps, and VFD Gas Booster

Plant Wide Controller (PWC)

Control Functions
- Boiler Sequencing based on Load
- Lead Auto-Rotates on Time, or Manually selected
- Custom sequence can be entered by the Operator
- Lead Boiler Modulates
- Lag Boilers Base Loaded for Efficiency
- Base Load rate changes when required to meet Load
- Feedwater Pumps Sequenced based on Load
- Fresh Air Dampers Sequenced based on Blr Qty fired
- Oil Pump starts before oil fired boiler starts
- Gas Booster VFD prevent surging & minimizes kWh
- Failure of any Boiler, Damper, Pump, or Booster automatically causes a backup unit to start.
Hot Water System Application - PWC-AN-HW1

Control Functions
- Sequencing with Parallel Modulation
- Balancing Valve Stops Flow through Down Blows
- Prevents Return and Supply Temp. Blending
- Support Software Temp. Shift Schedule
- Pump Sequencing per Boiler Load

Piping Layout Disadvantages
- Can’t use VFD on Primary Pump to save kW
- Can’t do Off-Line Warm-Up

Plant Wide Controller (PWC)

Application Note: 3 Hot Water Blrs, 200 F, Primary Loop, Heated Pumps, Constant Flow Loads
**PWC Application Guide**

**Plant Wide Controller (PWC)**

**Hot Water System Application - PWC-AN-HW2**

**Application Note:** 3 Hot Water Blsr, 220 F, Primary Loop, Headered pumps, Constant Flow Loads

**Control Functions**
- Boiler:
  - Sequencing with Parallel Modulation
  - Balancing Valve Stops Flow thru Down Blsr
  - Prevents Return and Supply Temp. Blending
  - Outlet Temp. Firing Rate Cutback
  - High Boiler Outlet Temp cuts back Firing Rate to prevent tripping Boiler
- Supply Temperature Outdoor Reset
- Time/Date Supply Temp. Setback Schedule
- Pump Sequencing per Boiler Load
- Return Temp Hist Trending

**Piping Layout Disadvantages**
- Can't use VFD on Primary Pump to save kW
- Can't do Off-Line Warm-Up

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<th>State</th>
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**Outside Air Temp (OAT)**
Application Note: 3 Hot Water Blrs, 200 F, Primary Loop, Headed pumps, Blr Blend Pumps, Constant Flow Loads

Control Functions
* Boiler:
  Sequencing with Parallel Modulation
  Balancing Valve Steps Flow thru Down Blrs
  Bal. Valve 10% open during Warm-Up
  (Blend Pump Provides Flow for Warm-Up)
* Supply Temperature Outdoor Reset
* Time/Date Supply Temp. Setback Schedule
* Pump Sequencing per Boiler Load

Piping Layout Disadvantages
* Can't use VFD on Primary Pump to save kW
PWC Application Guide

Application Note: 3 Hot Water Bls, 220 F, Primary Loop, Boiler pumps, 3 Way Blend Valves, Constant Flow Loads

Plant Wide Controller (PWC)

Control Functions
* Boiler:
  Sequencing with Parallel Modulation
  Blend Valve Prevents Thermal Shock
  Blend Valve Allows Off-Line Warm-Up
* High Boiler Outlet Temp cuts back Firing Rate to prevent tripping Boiler
* Supply Temperature Outdoor Reset
* Time/Date Supply Temp. Setback Schedule
* Pump Sequencing per Boiler Load

Piping Layout Disadvantages
* Can't use VFD on Primary Pump to save IW
* No Spare Pumps
* If Pump Fails, Boiler is Down until Repaired

Boilers

Flow Balancing Valve

Face & Bypass Damper AHU (Air Handler Unit)
Application Note: 3 Hot Water Blrs, Primary Loop, Header pumps, Variable Flow Loads, Bypass Valve

Control Functions
* Boiler:
  - Sequencing with Parallel Modulation
  - Balancing Valve Stops Flow thru Down Blrs
* Supply Temperature Outdoor Reset
* Time/Date Supply Temp. Setback Schedule
* Pump Sequencing per Boiler Load

Piping Layout Disadvantages
* Can't use VFD on Primary Pump to save kW
* Can't Warm-up Boiler Off-Line
* Long Return Pipe Can Send a Cold Slug of Water into the Boiler Every Morning as Load Increases. Potential Thermal Shock
* $dP$ at End of Loop Drops as Load Increases
Application Note: 3 Hot Water Blrs, Primary Loop, Header pumps, Variable Flow Loads, End of Loop dP Control

Control Functions
* Boiler:
  Sequecing with Parallel Modulation
  Balancing Valve Stops Flow thru Down Blrs
* Supply Temperature Outdoor Reset
* Time/Date Supply Temp. Setback Schedule
* Pump Sequencing per Boiler Load
* Maintains Constant dP at far end of Loop

Piping Layout Disadvantages
* Can't use VFD on Primary Pump to save kW
* Can't Warm-Up Boiler Off-Line
* Long Return Pipe Can Send a Cold Slug of Water into the Boiler Every Morning as Load Increases. Potential Thermal Shock

Boilers  Semi-Constant Flow to Boilers (via Bypass Regulator)  Variable Flow  Heating Loads
Application Note: 3 Hot Water Blrs, 220 F, Primary Loop Boiler pumps, Secondary Header VFD Pumps

Plant Wide Controller (PWC)

Control Functions
* Boiler:
  - Sequencing with Parallel Modulation
  - Balancing Valve Stops Flow thru Down Blrs
  - Prevents Return and Supply Temp. Blending
  - Outlet Temp. FIRing Rate Cutback
* High Boiler Outlet Temp cuts back FIRing Rate to prevent tripping Boiler
* Supply Temperature Outdoor Reset
* Time/Date Supply Temp. Setback Schedule
* Distribution Pump Sequencing per Load
* Dist. Pump VFD minimizes kW, and maximizes system delta T
* Pump Speed: Zone dP over-rides Ret. Temp
* Secondary Speed cuts back to prevent reverse flow thru cross-over pipe and cooling of Secondary

Piping Layout Disadvantages
* No Spare Primary Pumps
* Can't do Off-Line Warm-Up
Applicatin Note: 8 Hot Water Boilers, Off - Low - High Modulation, Primary-Secondary Loop Pumps, Outdoor Reset

Control Functions
- Boiler Sequencing based on Load
- Lead Auto-Rotates on Time, or Manually selected
- Lead Boiler Modulates (Low - High - Low ...)
- Lead Boiler Pump kept running to keep water flowing past header temp. element
- Lag Boilers Base Loaded at High for Efficiency
- Supply Temperature Outdoor Reset
- Time/Date Supply Temp. Setback Schedule
- Low Fire Hold Timer for Warm-up
- Failure of any Boiler or Pump automatically causes a backup unit to start
- Secondary Pumps Alternate based on Timer

Plant Wide Controller (PWC)

Typical for all Boilers

Typical for both Pumps

Secondary Loop Pumps

Normal: Primary gpm greater than Secondary gpm
Abnormal: Secondary gpm greater than Primary gpm

Heating Loads Supply

Heating Loads Return

Off - Low - High Hot Water Boilers
Application Note: 8 Hot Water Boilers, Modulating, Primary-Secondary Loop Pumps, Outdoor Reset

Control Functions
- Boiler Sequencing based on Load
- Lead Auto-Rotates on Time, or Manually selected
- Lead Boiler Pump kept running to keep water flowing past header temp. element
- Parallel Modulation
- Low Fire Hold Timer for Warm-up
- Supply Temperature Outdoor Reset
- Time/Date Supply Temp. Setback Schedule
- Low Fire Hold Timer
- Failure of any Boiler or Pump automatically causes a backup unit to start.
- Secondary Pumps Alternate based on Timer

Plant Wide Controller (PWC)

Typical for all Boilers

Typical for all Pumps

Secondary Loop Pumps

Primary-Secondary "Crossover" Pipe

Modulating Hot Water Boilers
Application Note: 3 Hot Water BLRs, 220 F, Primary Header pumps, Secondary Header VFD Pumps, Blend Pumps

Plant Wide Controller (PWC)

Control Functions

* Boiler:
  * Sequencing with Parallel Modulation
  * Balancing Valve Stops Flow thru Down Blrs
  * High Boiler Outlet Temp cuts back Firing Rate to prevent tripping Boiler
  * Supply Temperature Outdoor Reset
  * Time/Date Supply Temp. Setback Schedule
  * Distribution Pump Sequencing per Load
  * Dist. Pump VFD minimizes kW, and maximizes system delta T
  * Pump Speed: Zone dP over-rides Ret. Temp
  * Secondary Speed cuts back to prevent reverse flow thru cross-over pipe and cooling of Secondary

Hot Water System Application - PWC-AN-HW10
Hot Water System Application - PWC-AN-HW11

Control Functions
- Boiler Sequencing with Parallel Modulation
- Blend Valve Stops Flow if Down Blows
- Blend Valve Prevents Throttle Shock
- High Boiler Outlet Temp Cuts Back Firing Rate
- Super Temp/Supply Temp Schedule
- Distribution Pump Sequencing per Load
- Pump Speed: Zone D.P. override
- Res. Temp. and Dist. Pump VFD minimizes kW, and
- Secondary Speeds back to prevent reverse flow
- Secondary plus system delta T

Plant Wide Controller
(PWC)

Outside Air Temp
(OAT)

Primary Pumps
Secondary Loop Pumps

Normal: Primary 1
Secondary 2
Secondary 3

Emergency: Secondary
greater than
Primary 1

Primary-Secondary Crossover Pipe

Electrical Panel

Pneumatics Panel

Boilers

Application Note: 3 Hot Water Blits, 220 F. Primary Boiler pumps, Secondary Header VFD Pumps, Blend Valves
Chiller System Application - PWC-AN-C1

Application Note: 3 Chillers, Dedicated Primary Pumps, Variable Speed Secondary Loop Pumps

Control Functions
- Chiller Sequencing based on Load
- Lead Auto-Rotates on Time, or Manually selected
- Custom sequence can be entered by the Operator
- Parallel Modulation by Integral Chiller Controls
- Failure of any Chiller automatically causes a backup unit to start.
- Distribution Pump Sequencing per Load
- Dist. Pump VFD control minimizes kW, and maximizes system delta T
- Pump Speed: Zone dP automatically over-rides Rot. Temp

Plant Wide Controller (PWC)

Chiller Water to from Cooling Tower
Primary Loop Pumps
Primary-Secondary "Crossover" Pipe
Secondary Loop Pumps
Abnormal: Secondary gpm greater than Primary gpm
Normal: Primary gpm greater than Secondary gpm

Typical for all 3 Chiller

Chillers
Variable Flow
Cooling Zones
Application Note: 3 Cell Cooling Tower, 2 Speed Fans, Dewpoint Optimization, Bypass, Make-up, Freeze Protection

Control Functions
* Condenser Supply Temp Setpoint based on Outdoor Dewpoint measurement
  Substantial Chiller Electrical Savings
  Also saves Cooling Tower Fan With
  Setpoint low limit prevents Chiller freeze-up
* Fan Speeds Sequenced based on Supply Temp
* Bypass valve maintains Minimum Condenser Supply Temp during cold weather
* Sump Level controls Make-up
  * Sump Temperature activates Freeze Protection:
    - Header drain-back and Sump heater

Chiller System Application - PWC-AN-C2
Application Note: 3 Cell Cooling Tower, VFD Fans, Dewpoint Optimization, Bypass, Make-up, Freeze Protection

Control Functions
* Condenser Supply Temp Setpoint based on Outdoor Dewpoint measurement
  Substantial Chiller Electrical Savings
  Also saves Cooling Tower Fan kWh
  Setpoint low limiter prevents Chiller freeze-up
* Fan Speeds Sequenced based on Supply Temp
* Bypass valve maintains Minimum Condenser Supply Temp during cold weather
* Sump Level controls Make-up
* Sump Temperature activates Freeze Protection:
  Header drain-back and Sump heater
Vacuum Steam System Application - PWC-AN-VS1

Control Functions
- Field Adjustable curves for Outside Temperature vs. Valve Position
- Two independent curves for Day and Night Setback
- 7 Day Battery Backup Clock with 24 Date Holiday overrides
- Heat Start and Heat Stop Times automatically reset by Outside Air Temp.
- Motor timing adjustable to match actual valve travel
- Domestic Hot Water temperature Alarm
- Can be integrated into a boiler Lead/Lag Controller
- Can be expanded for multiple heating zones

Plant Wide Controller (PWC)

Substantial Energy Savings and Improved Tenant Comfort Levels
**PWC Application Guide**

**Vacuum Steam System Application - PWC-AN-VS1**

**Application Note:** 12 Zone Centralized Vacuum Steam Heat Control, Outdoor Reset, 7 day Setback

**Plant Wide Controller (PWC)**

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Substantial Energy Savings and Improved Tenant Comfort Levels

**Control Functions**

* Field Adjustable curves: Outside Temperature vs. Valve Position
* 24 independent curves for Day and Night Setback
* 7 Day Battery backed Clock with 24 Date "Holiday" Exception Memory
* Heat Start and Heat Stop Times automatically reset by Outside Air Temp.
* 30 Day Historical Memory for Graphic Trend Chart Displays
* Individual motor timing adjustable to match actual Valve travel
* Domestic Hot Water Temperature Scald Protection, Trending & Alarms

**Typical "Mechanical Room"**

- 10 psi Steam from Heating Plant
- Condensate Receiver with Vacuum System
- Condensate Return
- Steam to Building
- Domestic Hot Water Heater
- 10 - 17” Hg Steam (~ 190 - 169 F)

**Contact Information**

- (203)743-6741
- (203)798-7313
- www.preferred-mfg.com
Technical Terms

Automatic Rotation
“Automatic Rotation” changes the boiler selected as the ‘lead” based on time.

Base Load Auto-Shift
Also called “Helper Mode”. The objective is to minimize cycling boilers on and off due to short term load swings while maintaining peak boiler base load efficiency whenever possible. When the load increases and lead boiler modulates up to high fire, the lag boilers will automatically increase their base load firing rate to help maintain setpoint without starting up another lag boiler. When the load decreases, the lag boiler will resume firing at the normal base load for peak plant efficiency. If the load increase is long term, another lag boiler will be started. The control logic works similarly as the plant load drives the lead boiler.

Custom Selection
Using “Custom Selection” the operator can select an boiler lead / lag sequence desired. The sequence can be set 1,2,3,4 or 2,3,1,4 or 4,1,3,2 etc. Useful for plants with unequal size boilers.

Lag Boiler
The lag boiler is the next boiler to start and first to stop.

Lead Boiler
The lead boiler is the first boiler to start and the last boiler to stop.

Low Fire Shutdown
Boilers are brought to minimum fire position prior to shutting off.

Manual Selection
Under “Manual Selection” the operator selects an individual boiler to start or stop.

Outdoor Reset
For heating plants, the hot water setpoint can be adjusted based on the outside temperature.

Pulser AI
The PWC has Pulse inputs, 0.6 ppm - 4000HZ, 0-15 VDC. These inputs allow the PWC to receive inputs from pulse output devices that are low cost flow meter and KW meter options. Typically existing meters can be retrofitted with pulsers.

PID Control
“Proportional  + Integral + Derivative” Control algorithms continuously change the output signal until the setpoint equals the process (or desired) variable. Most accurate control logic available.

Setpoint
The hot water setpoint can be changed depending on the time of day, day of week, or week of year. Reducing the heater temperature (or Setback) during unoccupied time saves energy.

Series Modulation
The lead boiler is modulated according to load and the lag boilers are base loaded at a pre-determined value for peak efficiency.
Technical Symbols

Steam or Hot Water Boiler
Valve Symbol: Represents local firing rate controller. Includes Jackshaft, Parallel Positioning or Full Metering control of fuel and air. This function is not part of the PWC.

FSG: Flame Safeguard system, not part of PWC

TS: Temperature switch, aquastat or equal, typically supplied by the boiler manufacturer.

Motorized Fresh Air Damper
“M” = Damper motor Operator, typically spring return closed.
“ZS” = Damper open position proving switch

Codes normally require motorized fresh air damper to have an independent safety interlock to prevent operating boilers with insufficient fresh air, which can result in dangerous incomplete combustion. The PWC is not a safety interlock.

Plant Wide Controller I/O (Input/Output) boards and channels required for a particular application.

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<th>Type</th>
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<th>pts</th>
<th>spare pts</th>
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“Type”: The Type column identifies the PWC I/O Board required:

DI | 15 CH Digital Input
HOA | 5 CH Digital Input
RO | 8 CH Digital Input
AI | 8 CH Digital Input
AM AO | 5 CH Digital Input

“Slots”: The numbers of slots that each board type occupies (6 slots are available for I/O boards).

“pts”: I/O Points (channels)
PREFERRED INSTRUMENTS
A DIVISION OF PREFERRED UTILITIES

31-35 SOUTH STREET
DANBURY, CT 06810
T: (203) 743-6741
F: (203) 798-7313

WWW.PREFERRED-MFG.COM

MADE IN THE U.S.A.

Represented By:

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