FEEDWATER CENTER

Overview

Boiler feedwater control systems are often the most archaic controls in the steam plant. Poor boiler waterside control contributes to scaling, corrosion, and eventually hot spots and tube failures. The Preferred Feedwater Center can control the surge tank, Deaerator (DA) tank, transfer pumps, and feedwater pumps (on-off or VSD) to improve water quality and feedwater system reliability.

Better Feedwater Delivery Control
- “Smart” Pump Sequencing
- Pump Speed demand based Start-Stop
- Header Pressure based Start-Stop
- Lead-Lag Sequence
- Field Adjustable Parameters

Easy to Use
- “Overview”, “Alarm”, “Historical Trend” and “Setup” displays enable informed initial setup and process assessment.
- In a single NEMA 4 wall-mounted enclosure, the Feedwater Center integrates a modem for off-site monitoring, RS485 Modbus communications and 24 VDC power supplies.
- Optional 10” Operator Interface Touchscreen (OIT) provides graphical overviews as well as Ethernet TCP/IP and BacNet IP communication to BAS systems.

Easy to Order, Stock and Field Upgrade
- Complete system is ordered using a single part number.
- “Plug In” option boards can be used to upgrade a system in the field.

With the optional 10” color touch screen, trend screens are provided to make it easy to tune level and temperature loops. Display brings plant overviews, outdoor reset, alarms and event status and setup displays right to the operator’s touch.
FEEDWATER CENTER
Overview

Feedwater Center Control System
shown with optional 10” color touch screen OIT

Smart Pump Sequencing
In “headered mode,” pumps are automatically sequenced on/off to ensure that the number of pumps in service meets the demand. If any pump fails to start when called, the Feedwater Center immediately starts another pump to replace the faulted pump. The operator may manually select the lead pump or allow the lead pump to rotate automatically. Additionally, the total number of pumps in service may be set automatically or manually by the operator or all pumps may be shutdown by a building automation system (BAS) ‘enable/disable’ contact input.

Easy Installation & Setup
The Feedwater Center integrates Modbus communications, relays, 24 VDC power supplies, and outdoor reset functions into a single wall mountable controller. Simple menu-style fill-in-the-blanks setup displays minimize commissioning and training time.

LCD Graphic Display
LCD graphic display brings plant overviews, outdoor reset, alarms and event status and setup displays right to the operator’s touch.

Alarms & Event Summary
Up to 200 alarms, system events and operator actions are listed in “first in first out” order with a time/date stamp. Alarms include system fault, pump failure and both over and under temperature conditions.

Hard Manual Backup
Hardwired control switches and dials provide simple manual control for easy troubleshooting and service. Each pump has an individual speed demand bar graph, a manual speed demand output knob, and an auto/manual switch.

Modbus Communication Interface
A factory configured RS485 MODBUS interface is available for building automation or SCADA system monitoring and control.

Optional Features
The Feedwater Center has many features that can be added or removed according to your needs. This controller was designed to accommodate the needs of any 1-4 pump system. It is able to run with a surge and a deaerator tank (or one of each, or none). It accommodates 0-3 transfer pumps and 0-4 feed water pumps. The JC-FWC-FC can be used in headered pump applications as well as individual feed water pumps to each boiler. The JC-FWC-FC can have all of these following sensors;

Temperature:
- Condensate Return Line
- DA Tank

Pressure:
- DA Tank
- Feedwater Header
- Steam Header
- Make Up Water

Level:
- 1 DA Tank
- 1 Surge Tank

Flow:
- Make Up Water Flow
- Condensate Return Flow

As well as controlling the speeds of up to three transfer pumps and four boiler feed pumps. The Feedwater Center controls a number of valves in order to maintain levels/pressures/flow rates within the system.

The following valves can be maintained:
- DA Level Valve
- DA PSI Control Valve
- Surge Tank Make Up Water Valve
- Chemical Feed Pump Valve

This system is easily configured by using the menu driven initial set-up screens. No programming knowledge is required.
Touch Screen Overview

The optional 10” Operator Interface Terminal (OIT) touch screen provides graphical representation of current system status. Pump status, level indication, and valve position are all readily available on the system overview page.

Setup Parameters

All parameters are available through the setup pages on the touch screen. System features and control logic are adjusted depending on the initial setup parameters.

Alarm Page

The alarm and events screen lists all current alarms and all recent control events. This screen helps diagnose boiler before they impact boiler operation.

Tuning Page

Tuning pages allow the user to view control loops for tuning purposes. Historical data is saved to a compact flash card and can be viewed through a PC.
FEEDWATER CENTER

Overview

The Preferred Feedwater Center is available in four models, each with different capabilities. To select the correct model for each application, consult the hardware configurations, input/outputs provided, and sample specifications on the following pages.

<table>
<thead>
<tr>
<th>Catalog Number</th>
<th>Description</th>
<th>PWC Hardware Configuration</th>
</tr>
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<tbody>
<tr>
<td>JC-FWC-FC</td>
<td>Full Control</td>
<td>PWCN4-CDRO000A</td>
</tr>
<tr>
<td>JC-FWC-NV</td>
<td>No VSDs</td>
<td>PWCN4-CDROxxA</td>
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<tr>
<td>JC-FWC-NS</td>
<td>No Surge Tank/Transfer Pumps</td>
<td>PWCN4-CDH00xA</td>
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<tr>
<td>JC-FWC-NVS</td>
<td>No VSDs and no Surge Tank/Transfer Pump</td>
<td>PWCN4-CDHxxxx</td>
</tr>
</tbody>
</table>

Below is a complete list of the inputs and outputs for each of the four Feedwater Center models.

### Digital Inputs

- **FW Pump Running** 4 4 4 4 120 VAC - (e.g. current sensing relay)
- **Boiler Running/Call For Water** 4 4 4 4 120 VAC - BLR Run/Drum Level Switch
- **TP Pump Running** 3 3 120 VAC - CSR/Aux Contact Motorstarter
- **DA Low Level Cut-off Switch** 1 1 1 1 120 VAC - Level Switch
- **ST Low Level Cut-off Switch** 1 1 1 1 120 VAC - Level Switch
- **Water Softener Alarm** 1 1 1 1 120 VAC - Contact From Softener
- **Disable** 1 1 1 1 120 VAC - Contact From BAS

### Analog Inputs

- **DA Level** 1 1 1 1 4-20mA Level Transmitter
- **DA Temperature** 1 1 1 Thermowell (part numbers 70610, 70611)
- **DA PSI** 1 1 1 4-20mA PSI Transmitter (part number 7060X)
- **FW Header PSI** 1 1 1 1 4-20mA PSI Transmitter (part number 7060X)
- **Steam PSI** 1 1 1 4-20mA PSI Transmitter (part number 7060X)*
- **Makeup Flow** 1 1 1 4-20mA Flow Meter
- **Makeup Pressure** 1 1 1 4-20mA PSI Transmitter (part number 7060X)
- **Condensate Return Temperature** 1 1 1 Thermowell (part numbers 70610, 70611)
- **Condensate Return Flow** 1 1 1 4-20mA Flow Meter
- **Surge Tank Level** 1 1 4-20mA Level Transmitter

### Digital Outputs

- **FW Pump Start** 4 4 4** 4** Dry Contact (close to start)
- **TP Pump Start** 3 3 Dry Contact (close to start)
- **Water Softener Regen Cycle** 1 1 1** Dry Contact (close to start)

### Analog Outputs

- **FW Pump Speed** 4 4 4-20mA Output
- **TP Pump Speed** 3 4-20mA Output
- **ST MU Water Valve** 1 1 4-20mA Output
- **Chem Feed Pump** 1 1 4-20mA Output
- **DA PSI Control Valve** 1 1 4-20mA Output
- **DA Level Control Valve** 1 1 4-20mA Output

*Steam PSI transmitter must be scaled similar to the Feedwater PSI transmitter

**HOA switches provided on -NS and -NVS models
**FEEDWATER CENTER**

**Specifications**

**Mechanical:**
- Enclosure Size: 35" H x 20" W x 10" D
- Enclosure Type: Wall mount, NEMA 4
- Mounting Hole Pattern: (4) 5/16" dia.
- Weight: 70 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 Display: 2.9" H x 5.1" W
- Keyboard: Membrane, tactile feedback

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

**Communication**
- Control Network: Modbus (ASCII or RTU mode)
- Protocol: 1200 to 38,400 baud
- Type: RS485, optically isolated
- Programming Port: 38,400 baud
- Type: RS232, DB9F connector

**Electrical**
- Input Power: 120 VAC (+/- 15%), 12 A total,
  0.7A internal
- Built-in surge suppressors
- Internal Power Supply: 24 VDC @ 300 mADC for external use
FEEDWATER CENTER MODEL JC-FWC-FC
Feedwater Delivery Controller

Application
The Feedwater Center Model JC-FWC-FC includes all available features and capabilities required to control feedwater delivery systems including DA level and pressure control, surge tank level control, transfer pump control, feedwater pump control, chemical feed pump control and water softener regeneration.

Up to 4 Feedwater Pumps
Pumps use “smart” sequencing to ensure the proper number of pumps are running to satisfy the feedwater demand.
1. Application
Supply a fully integrated Feedwater Control system to coordinate the operation of (up to) four VSD controlled Feedwater pumps, Deaerator level and pressure control, (up to) three transfer pumps, water softener regeneration and chemical feed. The control system shall be microprocessor-based and suitable for wall mounting.

2. Pump VSD Modulation
The control system shall provide a PID based control scheme. As demand increases, the speed of the pump will increase. Each running pump will modulate in unison. Modulation signals shall be 4-20 mADC and shall be electrically isolated channel-channel and channel-ground.

3. Headered Feedwater Pressure Setpoint
The Feedwater pressure setpoint must be field selectable between steam header based or manual. In steam header based mode, the Feedwater pressure setpoint must be calculated based on an adjustable deviation from the actual steam header pressure. In manual, the operator may set the Feedwater Header Pressure Setpoint via a front panel display.

4. Pump Sequence
The control system shall use both Feedwater header pressure (Deaerator level for transfer pumps) and pump speed to start and stop the pumps and minimize the total number of pumps in operation. The controller shall start and stop pumps when the Feedwater header pressure is outside an adjustable pressure limit band for longer than an adjustable short time delay. To anticipate and minimize header pressure deviations, the control system shall start or stop the next pump if the “lead” pump has been near maximum or minimum speed for longer than the adjustable time delay. The control system shall monitor each pump’s flow switch and shall rapidly and automatically replace any pump that fails to prove flow. The lead pump shall either automatically rotate on a time of day/ day of week (or month) schedule, or shall be manually selected by the operator. The control system shall be field adjustable to “per boiler” mode which would run one feedwater pump per boiler. Additionally, the control system shall be field adjustable to choose between headered or boiler specific piping to determine which pumps should be started. A 120 VAC Discrete input is to be provided as a Deaerator low level signal that disables all Feedwater Pumps. A 120 VAC Discrete input is to be provided as a surge tank low level signal that disables all transfer pumps.

5. Deaerator Control
The control system shall output a demand signal based on DA Level. When used with transfer pumps, this is the speed at which the transfer pumps must run. Without transfer pumps, this would drive a level control valve. The control system shall drive a Deaerator pressure control valve based on Deaerator pressure.

6. Surge Tank Control
The control system shall output a command to a fresh water makeup valve based on surge tank level. Field adjustable level for valve at 0% open and valve at 100% open shall be provided.

7. Chemical Feed Control
The control system shall monitor makeup water flow and send that flow signal to a chemical feed pump.

8. Soft Water Regeneration Control
The control system shall initiate a soft water regeneration cycle based on time, or upon receiving a soft water alarm. The operator shall also be able to initiate the soft water regeneration cycle manually.

9. Monitor Points
The control system shall monitor Deaerator temperature, fresh water makeup pressure, condensate return flow and condensate return temperature for display purposes.

10. Operator Controls, Trends, Indications and Alarms
The control system shall include a 16 line x 40 character (or greater) LCD display for boiler sequence control and status, alarm and event summaries, and setup menus for easy operation, tuning and troubleshooting. Alarms, events and operator actions shall be logged with time/ date stamp and English language description.

11. Communication
The Control System shall have the ability of simultaneously communicating to a Data Acquisition System (DAS), Building Automation System (BAS) or Building Management System (BMS) via RS485 Modbus protocol and to a personal computer. The individual boiler limits, lockout, start/stop, warm standby, and firing rate status shall be easily read. Header setpoint, plant firing rate, boiler quantity called to start, boiler selected as lead and all setup parameters shall be readable and writable.

12. Quality Assurance
The control system shall be manufactured and labeled in accordance with UL508 requirements (CSA C22.2 #14 for use in Canada). Inspection and labeling shall be supervised by UL or other OSHA approved Nationally Recognized Test Lab (NRTL). The control system shall be a Preferred Instruments, Danbury, CT, Model JC-FWC-FC.
FEEDWATER CENTER MODEL JC-FWC-NV
Feedwater Delivery Controller

Application
The Feedwater Center Model JC-FWC-NV includes all available features and capabilities required to control feedwater delivery systems including DA level and pressure control, surge tank level control, transfer pump control, feedwater pump control, chemical feed pump control and water softener regeneration.

Up to Four Feedwater Pumps
Pumps use “smart” sequencing to ensure the proper number of pumps are running to satisfy the feedwater demand.
FEEDWATER CENTER MODEL JC-FWC-NV
Feedwater Delivery Controller - Specification

1. Application
Supply a fully integrated Feedwater control system to coordinate the operation of (up to) four Feedwater pumps, Deaerator level and pressure control, (up to) three transfer pumps, water softener regeneration and chemical feed. The control system shall be microprocessor-based and suitable for wall mounting.

2. Headered Feedwater Pressure Setpoint
The Feedwater pressure setpoint must be field selectable between steam header based or manual. In steam header based mode, the Feedwater pressure setpoint must be calculated based on an adjustable deviation from the actual steam header pressure. In manual, the operator may set the Feedwater header pressure setpoint via a front panel display.

3. Pump Sequence
The control system shall use Feedwater Header Pressure (Deaerator Level for Transfer Pumps) to start and stop the pumps and minimize the total number of pumps in operation. The controller shall start and stop pumps when the Feedwater header pressure is outside an adjustable pressure limit band for longer than an adjustable short time delay. The control system shall monitor each pump’s flow switch and shall rapidly and automatically replace any pump that fails to prove flow. The lead pump shall either automatically rotate on a time of day/day of week (or month) schedule, or shall be manually selected by the operator. The control system shall be field adjustable to “per boiler” mode which would run one feedwater pump per boiler. Additionally, the control system shall be field adjustable to choose between headered or boiler specific piping to determine which pumps should be started. A 120 VAC Discrete input is to be provided as a Deaerator low level signal that disables all Feedwater pumps. A 120 VAC Discrete input is to be provided as a surge tank low level signal that disables all transfer pumps.

4. Deaerator Control
The control system shall output a demand signal based on DA level. When used with transfer pumps, this is the speed at which the transfer pumps shall run. Without transfer pumps, this would drive a level control valve. The control system shall drive a Deaerator pressure control valve based on Deaerator pressure.

5. Surge Tank Control
The control system shall output a command to a fresh water makeup valve based on surge tank level. Field adjustable level for valve at 0% open and valve at 100% open shall be provided.

6. Chemical Feed Control
The control system shall monitor makeup water flow and send that flow signal to a chemical feed pump.

7. Soft Water Regeneration Control
The control system shall initiate a soft water regeneration cycle based on time, or upon receiving a soft water alarm. The operator shall also be able to initiate the soft water regeneration cycle manually.

8. Monitor Points
The control system shall monitor Deaerator temperature, fresh water makeup pressure, condensate return flow and condensate return temperature for display purposes.

9. Operator Controls, Trends, Indications and Alarms
The control system shall include a 16 line x 40 character (or greater) LCD display for boiler sequence control and status, alarm and event summaries, and setup menus for easy operation, tuning and troubleshooting. Alarms, events and operator actions shall be logged with time/date stamp and English language description.

10. Communication
The control system shall have the ability of simultaneously communicating to a Data Acquisition System (DAS), Building Automation System (BAS) or Building Management System (BMS) via RS485 Modbus protocol and to a personal computer. The individual boiler limits, lockout, start/stop, warm standby, and firing rate status shall be easily read. Header setpoint, plant firing rate, boiler quantity called to start, boiler selected as lead and all setup parameters shall be easily read and written.

11. Quality Assurance
The control system shall be manufactured and labeled in accordance with UL508 requirements (CSA C22.2 #14 for use in Canada). Inspection and labeling shall be supervised by UL or other OSHA approved Nationally Recognized Test Lab (NRTL). The control system shall be a Preferred Instruments, Danbury, CT, Model JC-FWC-NV.
FEEDWATER CENTER MODEL JC-FWC-NS
Feedwater Delivery Controller

Application
The Feedwater Center Model JC-FWC-NS includes all available features and capabilities required to control feedwater delivery systems including DA level and pressure control, feedwater pump control, chemical feed pump control and water softener regeneration.

Up to Four Feedwater Pumps
Pumps use “smart” sequencing to ensure the proper number of pumps are running to satisfy the feedwater demand.
1. Application
Supply a fully integrated Feedwater control system to coordinate the operation of (up to) four VSD controlled Feedwater pumps, Deaerator level and pressure control, water softener regeneration and chemical feed. The control system shall be microprocessor-based and suitable for wall mounting.

2. Pump VSD Modulation
The control system shall provide a PID based control scheme. As demand increases, the speed of the pump will increase. Each running pump will modulate in unison. Modulation signals shall be 4-20 mA and shall be electrically isolated channel-channel and channel-ground.

3. Headered Feedwater Pressure Setpoint
The Feedwater pressure setpoint must be field selectable between steam header based or manual. In steam header based mode, the Feedwater pressure setpoint must be calculated based on an adjustable deviation from the actual steam header pressure. In manual, the operator may set the Feedwater header pressure setpoint via a front panel display.

4. Pump Sequence
The control system shall use both Feedwater header pressure and pump speed to start and stop the pumps and minimize the total number of pumps in operation. The controller shall start and stop pumps when the Feedwater header pressure is outside an adjustable pressure limit band for longer than an adjustable short time delay. To anticipate and minimize header pressure deviations, the control system shall start or stop the next pump if the “lead” pump has been near max or min speed for longer than the adjustable time delay. The control system shall monitor each pump’s flow switch and shall rapidly and automatically replace any pump that fails to prove flow. The lead pump shall either automatically rotate on a time of day/ day of week (or month) schedule, or shall be manually selected by the operator. The control system shall be field adjustable to “per boiler” mode which would run one feedwater pump per boiler. Additionally, the control system shall be field adjustable to choose between headered or boiler specific piping to determine which pumps should be started. A 120 VAC Discrete input is to be provided as a Deaerator low level signal that disables all Feedwater pumps.

5. Deaerator Control
The control system shall trigger a demand signal based on DA Level. When used with transfer pumps, this is the speed at which the transfer pumps must run. Without transfer pumps, this would drive a level control valve. The control system shall drive a Deaerator pressure control valve based on Deaerator pressure.

6. Chemical Feed Control
The control system shall monitor makeup water flow and send that flow signal to a Chemical feed pump.

7. Soft Water Regeneration Control
The control system shall initiate a soft water regeneration cycle based on time, or upon receiving a soft water alarm. The operator shall also be able to manually start the soft water regeneration cycle.

9. Monitor Points
The control system shall monitor Deaerator temperature, fresh water makeup pressure fresh water makeup flow, condensate return flow and condensate return temperature for display purposes.

10. Operator Controls, Trends, Indications and Alarms
The control system shall include a 16 line x 40 character (or greater) LCD display for boiler sequence control and status, alarm and event summaries, and setup menus for easy operation, tuning and troubleshooting. Alarms, events and operator actions shall be logged with time/ date stamp and English language description.

11. Reliability
Include hardwired backup stations to permit manual operation of the plant should the control system require service. Manual operation must be possible when the microprocessor is not functioning. Hardwired “hand-off-auto” control switches must be wired directly into every boiler start/ stop circuit. Each 4-20 mA or 0-135 ohm modulating control output must include a hardwired manual backup station with auto/ manual switch, output control knob and output level indicator ( bargraph, analog meter or digital display).

12. Communication
The control system shall be capable of simultaneously communicating to a Data Acquisition System (DAS), Building Automation System (BAS) or Building Management System (BMS) via RS485 Modbus protocol and to a personal computer. The individual boiler limits, lockout, start/stop, warm standby, and firing rate status shall be easily read. Header setpoint, plant firing rate, boiler quantity called to start, boiler selected as load and all setup parameters shall be easily read and written.

13. Quality Assurance
The control system shall be manufactured and labeled in accordance with UL508 requirements (CSA C22.2 #14 for use in Canada). Inspection and labeling shall be supervised by UL or other OSHA approved Nationally Recognized Test Lab (NRTL). The control system shall be a Preferred Instruments, Danbury, CT, Model JC-FWC-NS.
FEEDWATER CENTER MODEL JC-FWC-NVS
Feedwater Delivery Controller

Application
The Feedwater Center Model JC-FWC-NVS includes all available features and capabilities required to control feedwater pumps.

Up to Four Feedwater Pumps
Pumps use “smart” sequencing to ensure the proper number of pumps are running to satisfy the feedwater demand.

JC-FWC-NVS, Full Control for systems without surge tank or VSD controlled pumps
1. **Application**
Supply a fully integrated Feedwater control system to coordinate the operation of (up to) four Feedwater pumps. The control system shall be microprocessor-based and suitable for wall mounting.

2. **Headered Feedwater Pressure Setpoint**
The Feedwater pressure setpoint must be field selectable between Steam header based or manual. In steam header based mode, the Feedwater pressure setpoint must be calculated based on an adjustable deviation from the actual Steam header pressure. In manual, the operator may set the Feedwater header pressure setpoint via a front panel display.

3. **Pump Sequence**
The control system shall use Feedwater header pressure to start and stop the pumps and minimize the total number of pumps in operation. The controller shall start and stop pumps when the Feedwater header pressure is outside an adjustable pressure limit band for longer than an adjustable short time delay. The control system shall monitor each pump’s flow switch and shall rapidly and automatically replace any pump that fails to prove flow. The lead pump shall either automatically rotate on a time of day/day of week (or month) schedule, or shall be manually selected by the operator. The control system shall be field adjustable to “per boiler” mode which would run one feedwater pump per boiler. Additionally, the control system shall be field adjustable to choose between headered or boiler specific piping to determine which pumps should be started. A 120 VAC Discrete input is to be provided as a Deaerator low level signal that disables all Feedwater pumps.

4. **Operator Controls, Trends, Indications and Alarms**
The control system shall include a 16 line x 40 character (or greater) LCD display for boiler sequence control and status, alarm and event summaries, and setup menus for easy operation, tuning and troubleshooting. Alarms, events and operator actions shall be logged with time/date stamp and English language description. The control system shall include a minimum of 200 point memory.

5. **Reliability**
Include hardwired backup stations to permit manual operation of the plant should the control system require service. Manual operation must be possible when the microprocessor is not functioning. Hardwired “hand-off-auto” control switches must be wired directly into every boiler start/stop circuit. Each 4-20 mA/DC or 0-135 ohm modulating control output must include a hardwired manual backup station with auto/manual switch, output control knob and output level indicator (bargraph, analog meter or digital display).

6. **Communication**
The control system shall have the ability of simultaneously communicating to a Data Acquisition System (DAS), Building Automation System (BAS) or Building Management System (BMS) via RS485 Modbus protocol and to a personal computer. The individual boiler limits, lockout, start/stop, warm standby, and firing rate status shall be readable. Header setpoint, plant firing rate, boiler quantity called to start, boiler selected as lead and all setup parameters shall be easily read and written.

7. **Quality Assurance**
The control system shall be manufactured and labeled in accordance with UL508 requirements (CSA C22.2 #14 for use in Canada). Inspection and labeling shall be supervised by UL or other OSHA approved Nationally Recognized Test Lab (NRTL). The control system shall be a Preferred Instruments, Danbury, CT, Model JC-FWC-NS.