Operation Manual

Edge® X Controller

for Benchmark® E Electric Boilers and Benchmark® NX Gas Fired Boilers

Other documents for this product include:

- **OMM-0173, Edge X Communications Manual**
- **OMM-0169 BMK E - Installation, Startup, Operation and Maintenance Manual**
- **OMM-0183 BMK NX - Installation, Startup, Operation and Maintenance Manual**



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IMPORTANT

Read this Manual BEFORE using this equipment. Failure to read and follow all safety and use information can result in death, serious personal injury, property damage, or damage to the equipment.

Keep this Manual for future reference.

⚠ WARNING!

WARNING: Installation, commissioning, electrical work, gas-train work, controller replacement, field wiring, and service must be performed only by qualified personnel who are trained for the applicable boiler and who comply with all applicable codes, site procedures, and AERCO instructions.

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SECTION 1: INTRODUCTION

This manual provides a guide to the **Edge X Controller** used on the **Benchmark E Electric Boiler, Benchmark NX Gas Fired Boiler,** and the external sensors and devices that can interface to the unit using the boiler's Input/Output (IO) Box.

Warranty Information: For warranty terms applicable to the Edge X Controller, refer to the Control Panel Warranty for Benchmark E and Control Panel Warranty for Benchmark NX.

1.1 Safety Precautions and Warnings

It is imperative that the initial startup of **Benchmark E** and **Benchmark NX** units be performed by factory trained personnel. Operation prior to initial startup by factory trained personnel will void the equipment warranty. In addition, the following **WARNINGS** and **CAUTIONS** must be observed at all times.

CAUTION!

All initial installation procedures must be completed before starting the unit.

⚡⚡ ELECTRICAL HAZARD WARNING ⚡⚡-

Electrical voltages in Benchmark E boilers may include **480 or 600 volts AC** and Benchmark NX boilers may include up to **120 VAC and 24 volts AC**. Therefore, these units must be serviced only by factory certified service technicians.

For Benchmark E, due to high electrical voltage the front door of the unit must always be closed during operation. Opening the front door shuts down unit operation but does **not** completely remove high voltage from the unit. Be sure the main power switch is de-activated and locked out before servicing the unit.

For Benchmark NX, the cover on the unit 's power panel (located behind the unit 's front panel) must be installed at all times, except during maintenance and servicing.

⚠ WARNING!

Never operate the boiler unless it is completely filled, properly vented, and water flow has been established and verified as required by the applicable boiler manual. Operating without adequate water or flow can cause overheating, pressure hazards, equipment rupture, death, serious personal injury, or property damage. Damage caused by dry firing may not be covered by the applicable written warranty.

⚠ WARNING!

Hazardous voltages may be present after the controller disables boiler operation or after a panel or door interlock opens. The Enable/Disable control and controller screen are not electrical disconnecting means. Before opening an enclosure, removing a panel, accessing wiring, or replacing the controller or a circuit:

- Shut down the boiler using the prescribed procedure.
- Disconnect and lock out/tag out electrical power in accordance with site procedures and law.
- Verify absence of voltage using appropriately rated test equipment.
- Discharge or allow stored energy to dissipate as specified in the applicable boiler manual.

Only qualified electrical service personnel may perform this work.

1.2 Downloading the Latest Firmware

As AERCO continuously implements improvements to the Controller firmware, it is possible the firmware on your boiler may be out of date. You must update the firmware to the latest version before using the Edge Controller for the first time (see Section 10.3).

SECTION 2: EDGE X CONTROLLER FRONT PANEL

The Edge X Controller's front panel consists of six LEDs, a 7-segment digital display, a touchscreen display, three soft keys, and an Enable/Disable button:



Figure 2-1: Edge X Controller Front Panel

2.1 LEDs

LED	Description
FAULT	Indicates a FAULT condition
DEMAND	Indicates a demand for heat
MANAGER	Indicates the Manager of a cascade of units
CASCADE COMM	Indicates active communication between the Manager unit and its Client units
BAS COMM	Indicates unit is communicating with Building Automation System (BAS)
PREDICTIVE MAINTENANCE	*This feature will be available in a future release*

2.2 7-Segment Display Messages

Message	Description
Out	Outlet
###	Temperature Value
°F or **°C**	Degrees Fahrenheit or degrees Celsius based on user selection

2.3 Button Functionality

Name	Description
CLEAR	Clears a fault, causing the red FAULT indicator to tun off
TEST	Initiates Low Water test
RESET	Resets unit after Low Water test
ENABLE/DISABLE	Enables or disables the unit functioning

SECTION 3: EDGE X MENU STRUCTURE

Edge X controller has an intuitive user interface. The menu navigation map for BMK E and BMK NX can be found in Appendix K and Appendix L, respectively.

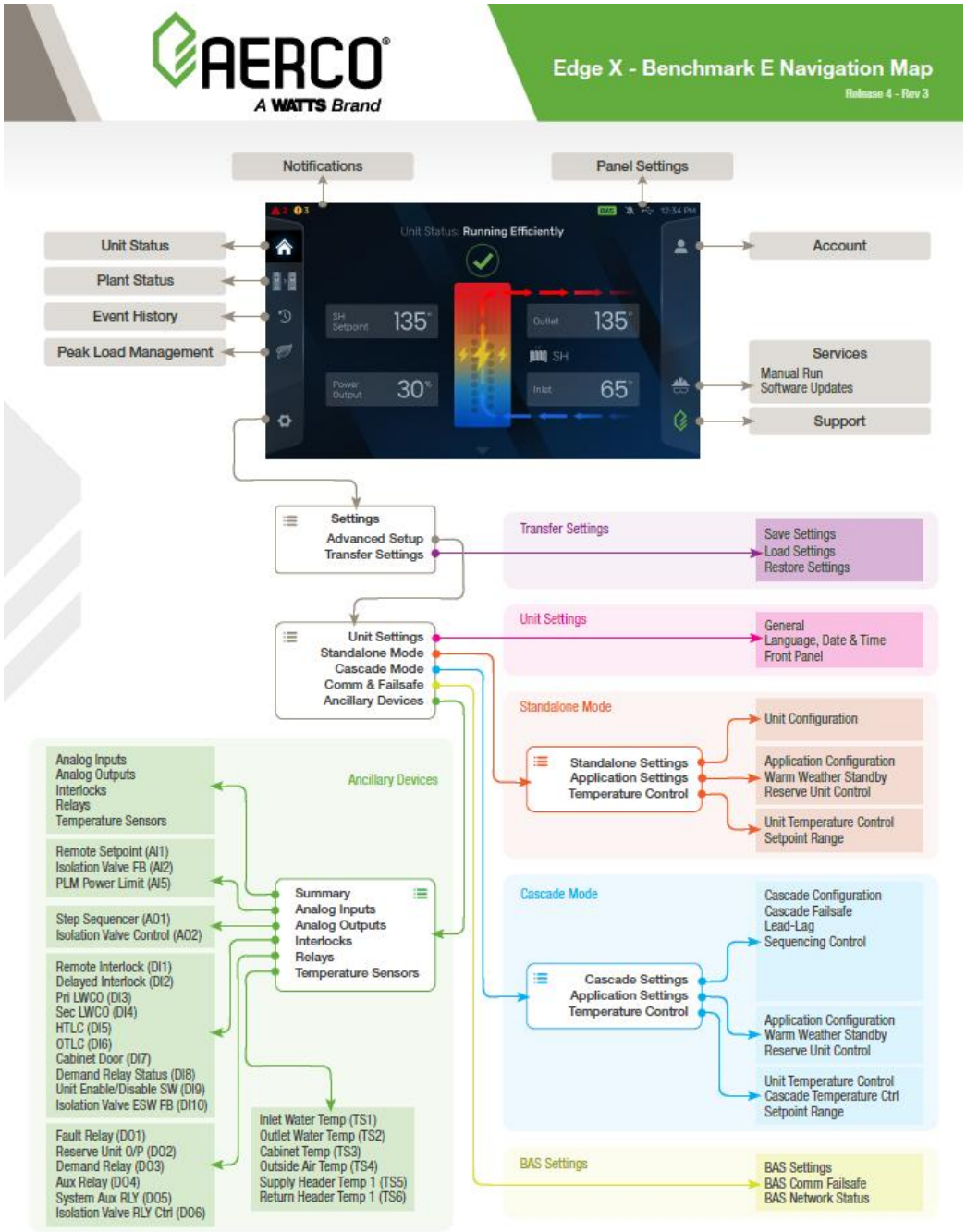


Figure 3-1: Menu Navigation Map for Benchmark E

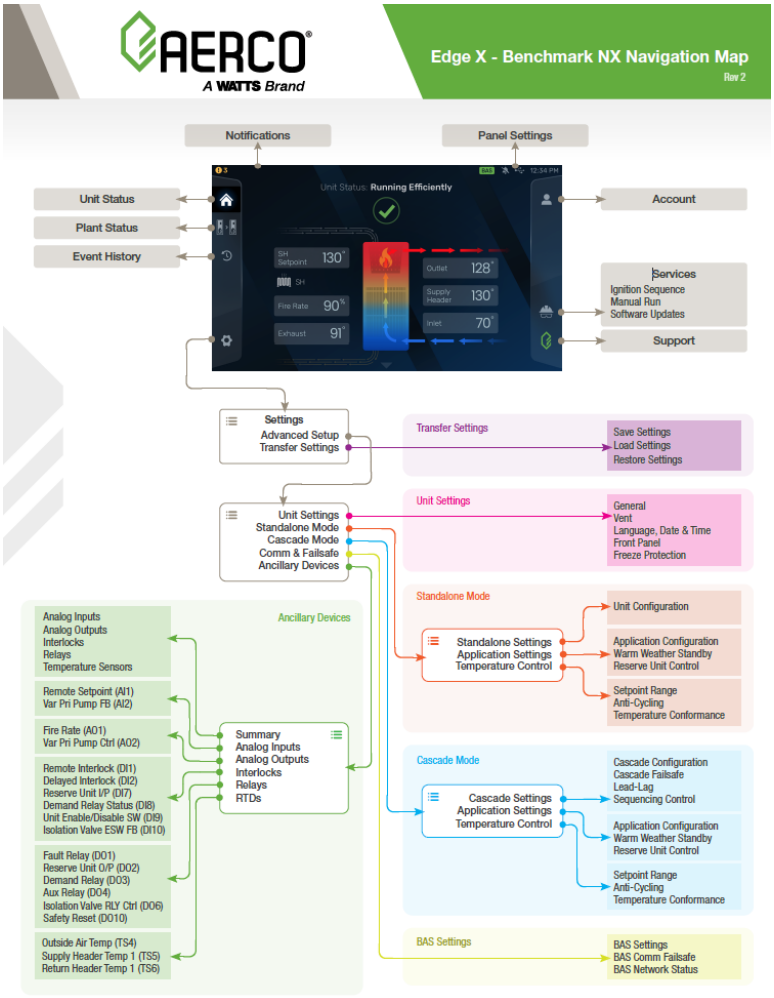


Figure 3-2: Menu Navigation Map for Benchmark NX



Figure 3-3: Notifications & Panel Settings

The menu icons on the left and right side of the controller screen are accessible from any screen. A downward-pointing arrow icon (▼) at the bottom of the page indicates the page is continued below. An upward-pointing arrow icon (▲) at the bottom of the page indicates there is a page above. Touch the arrows to access the pages.

SECTION 4: UNIT DASHBOARD

The **Unit Dashboard** screen provides a variety of parameters showing the status of the unit. It is the default screen for Standalone and Client units. The following fields are displayed on the first screen: **Unit Status, SH Setpoint, Power Output**[1], **Fire Rate**[2], **Exhaust**Error! Bookmark not defined., **Outlet** temperature, **Supply Header** Temperature**Error! Bookmark not defined.**, and **Inlet** temperature. Secondary screens accessed via the down arrow repeat some of the information from the primary screen and add other pertinent information about the unit.

Benchmark E Unit Dashboard:



Figure 4-1: Benchmark E Unit Dashboard: Screen 1

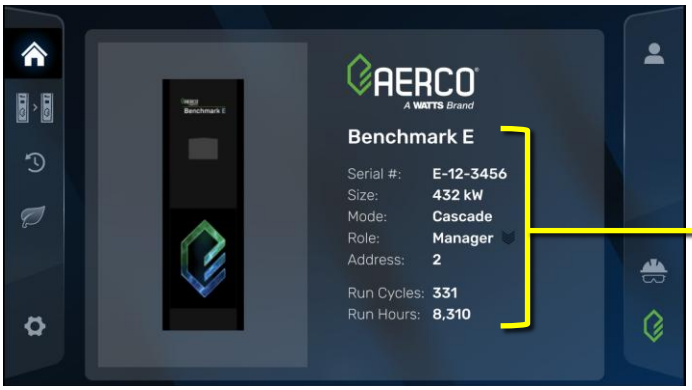
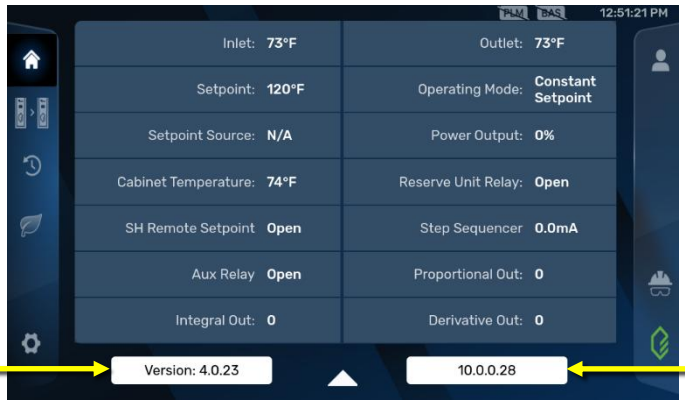


Figure 4-2: Benchmark E Unit Dashboard: Screen 2



[1] Applies to BMK E only
[2] Applies to BMK NX only

Figure 4-3: Benchmark E Unit Dashboard: Screen 3

Benchmark NX Unit Dashboard:



Figure 4-4: Benchmark NX Unit Dashboard: Screen 1

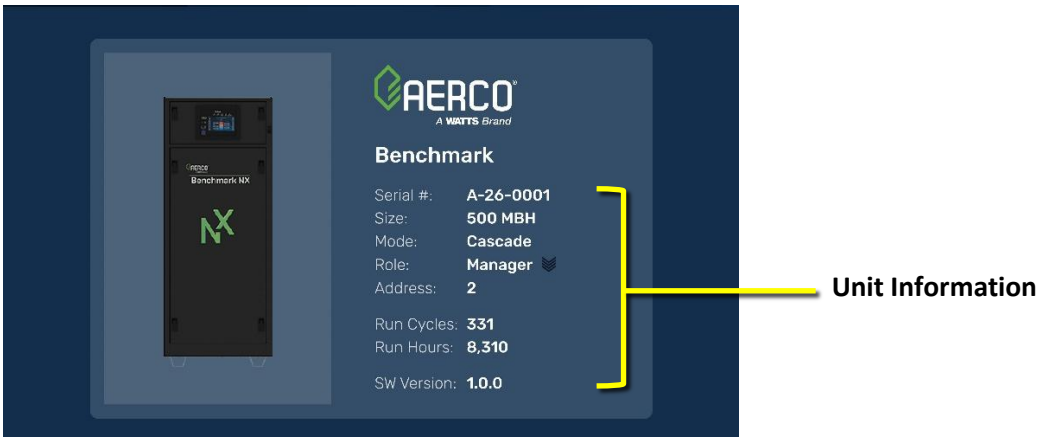


Figure 4-5: Benchmark NX Unit Dashboard: Screen 2

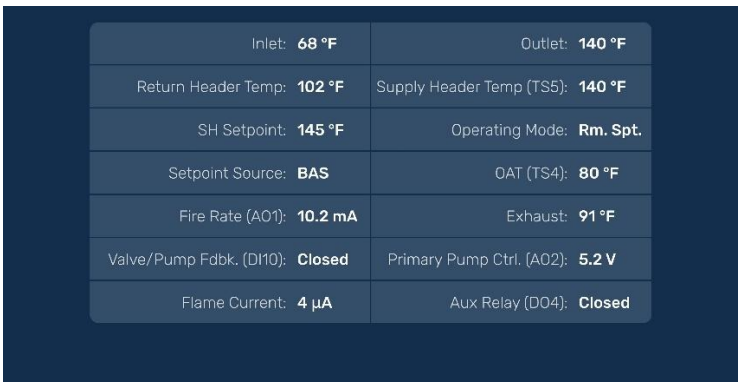


Figure 4-6: Benchmark NX Unit Dashboard: Screen 3

The unit's operating status is displayed at the top of the Unit Status screen. In the event of an operating error, the error is displayed along with either a **Warning** or **Fault** indicator.



Figure 4-7: Unit Dashboard Screen – Running Efficiently



Figure 4-8: Unit Dashboard Screen – Warning Indicator



Figure 4-9: Unit Dashboard Screen – Fault Indicator

SECTION 5: PLANT DASHBOARD

The **Plant Dashboard** screen for Benchmark E and Benchmark NX boilers provides a variety of parameters showing the general status of the plant along with some status information about each unit. It is the default screen on the Benchmark E and Benchmark NX Manager unit. The following fields are displayed on the first screen: **Plant Status, Average Inlet Temperature, Average Outlet Temperature, Plant Application, Plant SH Setpoint, Plant Average Output**, and **Manager and Client Status**. The secondary screen accessed via the down arrow repeats some of the information on the primary screen and adds other pertinent information about the plant.

Benchmark E – Plant Dashboard:



Figure 5-1: Plant Dashboard: Screen 1

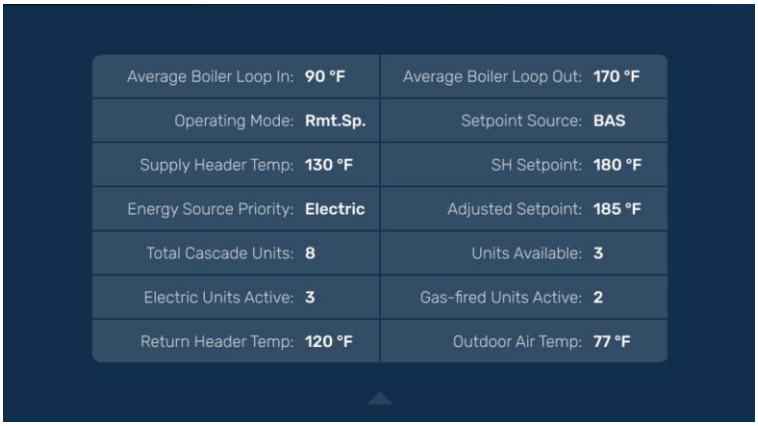


Figure 5-2: Plant Dashboard: Screen 2

Benchmark NX – Plant Dashboard:

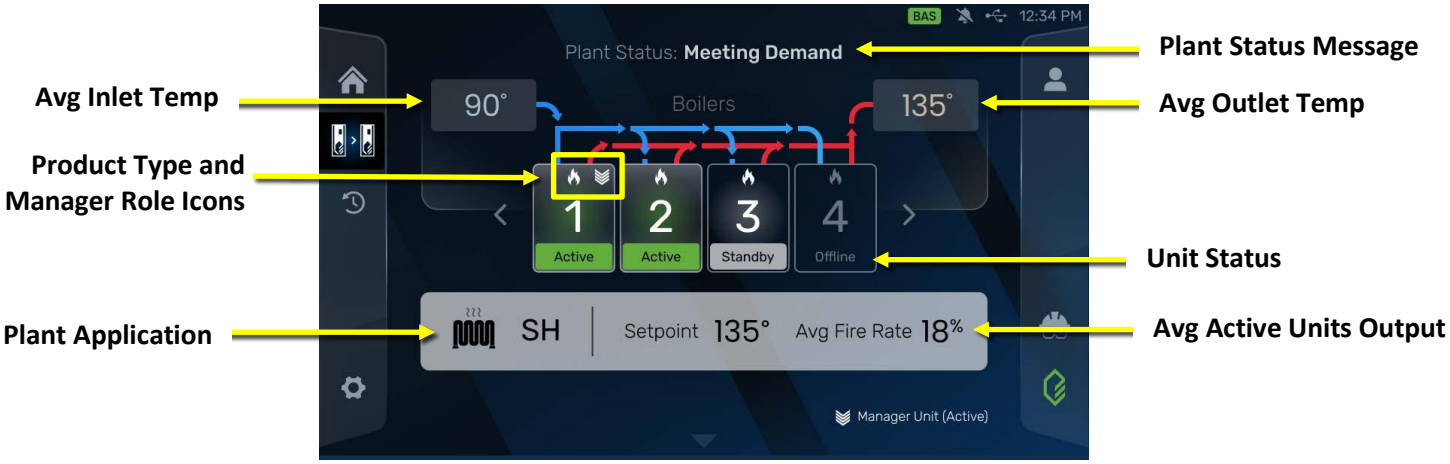


Figure 5-3: Plant Dashboard: Screen 1



Figure 5-4: Plant Dashboard: Screen 2

The plant's operating status is displayed at the top of the Plant Status screen. When the overall plant is operating to meet the setpoint or is meeting setpoint, the Plant Status message "Meeting Demand" is displayed. The status of each unit (Manager and Client) is shown within the boxes in the middle of the display along with its Unit Address. Active (running) units will show the white lightning symbol for electric boilers or flame symbol for gas fired boilers inside the top of its box. Inactive units (standby, faulted, and offline) will have this symbol greyed out. The manager unit will have the colonel symbol on it.

The Plant Status screen will indicate other operating information about the plant such as when a unit is being activated in the cascade. Though the plant may be meeting demand, individual units may be Disabled, Faulted, on Standby, or have a Warning message. This will be shown within the unit's box in the middle of the display along with the number of open warnings and faults on each unit. You can go to the "Unit Status" screen of the unit for further details.

SECTION 6: PEAK LOAD MANAGEMENT – BMK E[1]

Peak Load Management (PLM) provides a means of reducing the electrical power used by a Benchmark E electric boiler or cascade plant during peak periods when electrical usage needs to be limited. When PLM is active, the Edge X Controller can either limit the power output of the electric boiler or place the electric boiler in Standby, depending on the selected PLM Limit Type. When PLM is inactive or disabled, the boiler operates normally based on heating demand.

PLM can be used with electric units operating in **Standalone**, **Cascade**, or **Hybrid Cascade** applications. In a Hybrid Cascade, PLM applies to the electric Benchmark E units and does not apply to gas-fired units.

CAUTION!

Peak Load Management can reduce or stop electric boiler output. Before enabling, the system designer and operator must verify adequate alternate heat to protect occupants, piping, equipment, and processes under all expected outdoor and load conditions.

Do not use where reduced heat could cause freezing, unsafe indoor conditions, safety-critical process interruption, or code violations without an independently verified backup system. During commissioning, test transitions, communications loss, reserve-unit operation, and failsafe behavior.

PLM settings do not replace independent high-limit, low-water, freeze-protection, building-safety, or emergency controls.

6.1 PLM LIMIT TYPE

The PLM Limit Type determines how the electrical load is reduced when PLM becomes active. The available options are Power Limit and Standby. The default is Power Limit.

6.1.1 Power Limit

When **Power Limit** is selected, the Controller limits the electrical power output of the unit after the **PLM Transition Delay** expires. In Cascade and Hybrid Cascade configurations, Lead-Lag priority takes precedence over PLM; the units operate according to Lead-Lag priority while PLM limits the electrical power output.

The **PLM Power Limit** is expressed as a percentage from 0 to 100%, with a default of 60%.

6.1.2 Standby

When **Standby** is selected, PLM places the available electric unit(s) in Standby after the **PLM Transition Delay** expires.

For PLM to use the Reserve Unit Relay, Reserve Unit Control must be enabled under Application Settings. PLM takes priority over other functions using the Reserve Unit Relay while PLM is active. When PLM is deactivated, control of the relay is released for use by other functions.

In Standalone operation, the Controller enables the Reserve Unit Output (DO2) before placing the electric unit in Standby. In an all-electric Benchmark E Cascade, the Manager enables the Reserve Unit Output before placing the plant in Standby.

In a Hybrid Cascade, the Manager enables available gas-fired units according to the configured Lead-Lag priority and places the electric units in Standby after the transition delay. If gas-fired units are not available, the Manager enables the Reserve Unit Output.

6.2 PLM TRANSITION DELAY

The PLM Transition Delay provides a delay before the configured PLM Limit Type is fully applied. The default is 5 minutes, with an allowable range of 3 to 20 minutes.

The transition delay allows gas-fired or reserve equipment time to become available to support the heating demand before the electric units transition to their configured PLM condition. The delay allows time for the ignition process, auxiliary delays, and gas-fired unit warm-up.

6.3 PLM PRIORITIES

The source of the Power Limit depends on the active PLM Priority:

A. Time Schedule Priority: User-configured Power Limit for the local Peak Time Window

B. BAS Priority: PLM Power Limit received from the BAS

C. Analog Input Priority: PLM Power Limit received through AI5 on the Edge X IO board

6.3.2 Time Schedule Priority

Time Schedule Priority controls PLM operation according to locally configured Peak Time Windows over a 24-hour period. One or two Peak Time Windows can be configured, and the two windows cannot overlap.

When Time Schedule Priority is the highest priority, the Controller operates according to the configured PLM Limit Type when the configured Peak Time Window begins, after the PLM Transition Delay expires. Outside the configured Peak Time Window, PLM is inactive and the unit operates normally based on heating demand.

> **NOTE**: Configure the local **Time Zone** and **Time** under **Setting > Advanced Setup > Unit Settings > Language, Date & Time** before configuring PLM Time Schedule Priority.

6.3.3 BAS Priority

BAS Priority allows the Building Automation System (BAS) to control PLM. When BAS Priority is the highest priority and BAS communication is available, the Controller reads the PLM state from the BAS. When PLM is enabled by the BAS, the Controller uses the BAS PLM Power Limit and applies PLM operation after the PLM Transition Delay expires. If BAS communication is lost, the Controller checks for the next available enabled PLM Priority.

6.3.4 Analog Input Priority

Analog Input Priority uses an external analog signal connected to AI5 on the Edge X IO board to provide the PLM Power Limit. For Cascade operation, the PLM Power Limit signal is connected to AI5 on the Manager.

When Analog Input Priority is the highest priority, the Controller reads the PLM Power Limit from AI5 and applies PLM operation after the PLM Transition Delay expires. If AI5 is unassigned or cannot be read, the Controller checks for the next available enabled PLM Priority.

6.4 PLM FAILSAFE

PLM Failsafe determines how an electric unit operates when PLM is enabled, the source for the active PLM Priority becomes unavailable, and another enabled priority is not available.

PLM Failsafe provides two selectable options:

- **PLM Setpoint:** Operates using the configured PLM Failsafe Setpoint.
- **PLM Standby:** Places the applicable electric unit in Standby.

6.5 PLM OPERATION

PLM operation depends on the unit role. On a Standalone unit, PLM is configured and controlled locally. In a Cascade or Hybrid Cascade, PLM is configured on the Manager, which controls PLM operation for the plant and sends PLM parameters to the electric Clients. A Client follows PLM operation from the Manager; if communication with the Manager is lost while PLM is enabled, the Client enters PLM Failsafe. If PLM is disabled when Manager communication is lost, the Client uses Communication Failsafe.

NOTE: When a unit is operating in **Manual Run**, automatic PLM operation is temporarily disabled. Automatic PLM operation resumes when Manual Run is exited.

SECTION 7: EVENT HISTORY

This screen displays up to 200 of the most recent **Faults** and **Warnings**, providing a concise history of unit and plant operations. Event History under Standalone and Client units displays events related to the individual units, while Manager unit displays events related to the Manager as well as its Client unit(s). Each event has a unique **Event ID**; the **State** of the event (open or closed); a brief **Event Description**; and the event's **Date** and **Time** of occurrence. Event displayed on Manager Event History has **Unit Address** to inform on which unit that event occurred. See Appendix H for a list of fault codes.

Events are categorized into two types of alerts: **Warnings** and **Latching/Non-Latching Faults.**



Warnings

An abnormal condition has occurred. The unit may continue to operate, but the condition must be reviewed promptly. Follow the applicable troubleshooting instructions and contact qualified service personnel if the cause is unknown, the warning recurs, or continued operation could create a safety or equipment risk.



Faults

Non-Latching Fault: An abnormal event or condition occurred that caused the unit to shut down. The unit will restart automatically once the cause of the fault is resolved.

Latching Fault: An abnormal event or condition occurred that caused the unit to shut down. Corrective action may be required. Once the cause of the fault is resolved, the CLEAR button on the Controller front panel must be pressed manually to restart the unit.

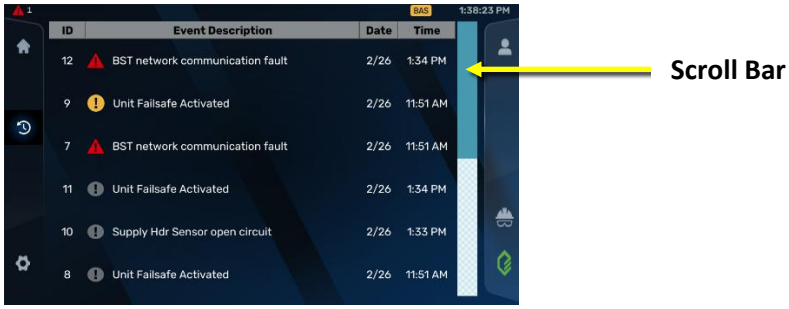


Figure 7-1: Unit Event History Screen

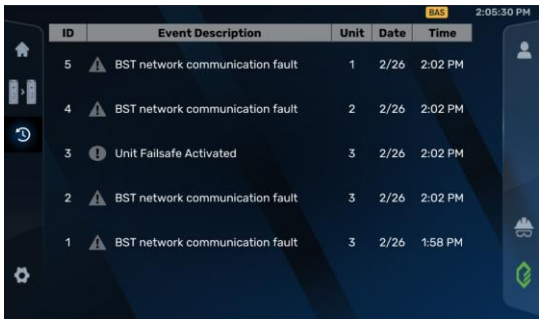


Figure 7-2: Manager Event History Screen

To clear an event, select it and press the CLEAR softkey. To clear all events, navigate to **Settings > Advanced Settings > Unit Settings > General > Clear Event History.**

SECTION 8: SETTINGS MENU

Settings menu includes Advanced Setup and Transfer Settings.

⚠ WARNING!

Incorrect settings can cause loss of heat, overheating, excessive cycling, failure of connected equipment, improper cascade operation, or defeat of intended protective functions. Only qualified personnel familiar with the boiler, hydronic system, connected equipment, and control sequence should change Advanced Setup parameters.

8.1 Advanced Setup

The Advanced Setup menu includes options for configuring **Unit Settings**, **Standalone Mode**, **Cascade Mode, Communication & Failsafe**, and **Ancillary Devices**.

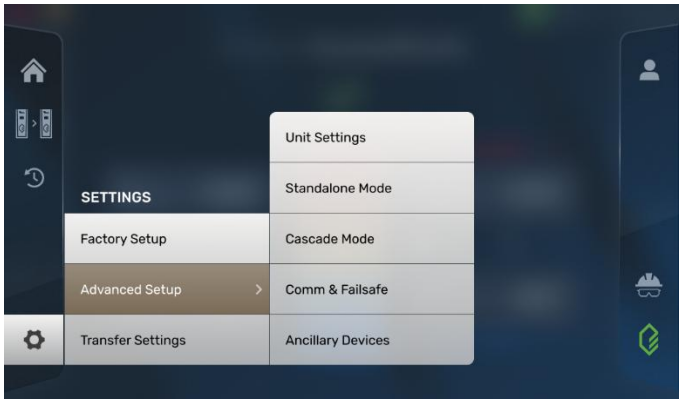


Figure 8-1: Advanced Setup Menu

8.1.1 Unit Settings

8.1.1.1 General

This page displays basic unit information and allows Clear Event History and Reset All Settings actions.

NOTE: Settings should be saved to a USB after the unit is turned on for the first time, or after the boiler has been reconfigured. This backup can be used to easily restore factory settings or a previous configuration in the event a **Reset All Settings** is performed on the unit.

8.1.1.2 **Vent**Error! Bookmark not defined.

The Vent screen allows users to select the vent material type and adjust the temperature differential (Vent Diff) and modulation percentage (Vent Hold) settings. Vent Diff and Vent Hold are available when Vent Type is not set to OFF.

8.1.1.3 Language, Date & Time

This page allows setting and adjusting language, units of measurement, date, and time parameters.

NOTE: Make sure to configure **Country** and country-specific **Time Zone** parameters before configuring **Date** and **Time**. Disable **Automatic Date & Time** to edit the date and time manually.

8.1.1.4 Front Panel

This page allows adjusting and testing the unit's display settings.

8.1.1.5 Freeze Protection[2]

The Freeze Protection feature can be activated or deactivated from this screen. When activated, you can set temperatures that control the operation of the unit to prevent damage due to freezing conditions.

8.1.2 Standalone Mode

The settings available under **Advance Setup > Standalone Mode** menu need to be configured to run the unit in Standalone Mode.

8.1.2.1 Standalone Settings

Unit Configuration displays the current **Application** of the unit.

8.1.2.2 Application Settings

The following menu options are available under Application Settings:

A. **Application Configuration:** This page allows configuring the **Constant Setpoint, Remote Setpoint**, and **Outdoor Air Reset** operating modes.

> **NOTE 1:** Analog Input (AI1) must be set to **Remote Setpoint** under **Ancillary Devices** to get setpoint for the **Remote Setpoint > Analog Input** operating mode.

> **NOTE 2:** When **Setpoint Source** is set to **Analog Input**, the **Signal Type** must match the DIP switch setting on MCB.

> **NOTE 3**: **Spare 1 (TS4)** must be configured for **Outdoor Air Temperature** function under **Advanced Setup > Ancillary Devices > Temperature Sensors** for the Outdoor Air Reset mode.

B. **Warm Weather Standby:** The **Warm Weather Standby or Warm Weather Shutdown**[2] **(WWS)** feature can be activated or deactivated from this screen. When activated, you can select the Outdoor Air Temperature (WWS Threshold) above which you want the unit to go into standby. You can also set a WWS Hysteresis - how many degrees below the WWS Threshold you want the unit to be active again.

> **NOTE:** The Outdoor Air Temp Sensor Source must be configured in **Settings > Advanced Setup > Ancillary Devices > Temperature Sensors > Spare 1 (TS4) > Function**.

C. **Reserve Unit Control:** It is used to enable a spare boiler or spare boiler plant to provide extra heat when the main plant is not able to meet system demand. It uses the Reserve Unit O/P Relay. This page allows to activate and configure thresholds for Reserve Unit Control feature.

> **CAUTION!**
> Reserve Unit Control is not a life-safety system and does not guarantee uninterrupted heat. Where loss of heat could threaten health, property, freeze protection, or a critical process, provide independently controlled and monitored backup protection appropriate to the application.

> **NOTE 1:** Reserve Unit O/P must be configured in **Ancillary Devices > Relays > Reserve Unit O/P.**

> **NOTE 2:** The Reserve Unit I/P allows the boiler to receive a reserve unit command from another boiler or plant and operates as a reserve unit[2]. Reserve Unit I/P must be configured in **Ancillary Devices > Interlocks > Reserve Unit I/P.**

8.1.2.3 Temperature Control

The **Temperature Control** menu items can be used to fine-tune the temperature responsiveness and limitations under which the unit operates.

A. Unit Temperature Control[1]: Includes options for Proportional Band, Integral Gain, and Temperature High Limit parameters.

B. Setpoint Range: The Setpoint Range and a daily Setback Schedule can be enabled on this screen. This allows one to set a Setback Setpoint temperature during certain times of the day or night. Outside of this time range, it will run based on the normal Operating Mode. This screen also allows users to read Range and Offset, which define the outlet temperatures below setpoint for maximum and minimum modulation, respectively, with the unit modulating between these thresholds[2].

C. Anti-Cycling[2]: This screen allows users to configure parameters that help reduce frequent cycling of the unit. On Delay sets the delay before restarting after demand is recognized, while Shutoff Delay Temp defines the allowable outlet temperature rise above setpoint before shutdown. Demand Offset applies a temperature offset to delay re-ignition.

D. Temperature Conformance[2]: This screen allows users to enable or disable Delta-T Limiting. When enabled, the Max Delta-T parameter can be configured to limit the temperature difference between the unit's inlet and outlet water during operation.

8.1.3 Cascade Mode

The settings available under **Settings > Advanced Setup > Cascade Mode** menu need to be configured for each unit in a boiler plant to run as a Cascade Manager or Cascade Client.

For **Cascade Mode** to be active, you must first access the **Settings > Advanced Setup > Standalone Mode > Standalone Setting**s menu and enable the **Cascade Mode** toggle. Hit the "X" at the top right corner to come out of the menu and then select **Settings > Advanced Setup > Cascade Mode**.

Hybrid Cascade[1] – A hybrid cascade plant contains a combination of Electric (BMK E) and Gas-Fired (BMK) boilers. The BMK E boiler (with Edge X controller) must be the Manager in a hybrid cascade plant. A BMK boiler (with an Edge[i] or Edge[ii] controller) cannot be used as the manager of a hybrid cascade. A typical hybrid cascade setup is shown in the diagram below.



Figure 8-2: Hybrid Cascade Plant with BMK E Manager and BMK E and BMK Clients

The **Lead-Lag** feature allows selecting the type of unit - Electric or Gas-Fired, that should take precedence to run. The **Sequencing Control** allows you to configure the Power Output % or Fire Rate % thresholds for each type of unit that needs to be considered when adding a new unit of that type to the cascade or removing one.

NOTE 1: A **system header temperature sensor** connected to the BMK E Manager is **required** for normal functioning of cascade and hybrid cascade when Cascade Control Method BST Supply (sBST) is selected. If it is unavailable, the cascade will go into failsafe.
NOTE 2: Refer to Edge Controller Operation Manual OMM-0139 to configure natural gas BMK client unit.

8.1.3.1 Cascade Settings

The following menu options are available under Cascade Settings:

A. Cascade Configuration: This page allows to configure a unit as a Manager or a Client. Only one Manager can be configured on a cascade of up to 16 units (including manager unit). The Manager will command the client units as needed to meet the demand.

Benchmark E Cascade Control Method allows choosing whether the plant should run based on the supply header temperature sensor or the average outlet temperature[1]. Benchmark NX plan runs based on the supply header temperature sensor only[2].

BST Supply (sBST) needs a supply header sensor wired to the Manager and compares supply header temperature with the plant setpoint to determine if the demand is met. BST Internal Setpoint[1] (iBST) compares the average outlet temperature of the active units with the plant setpoint to determine if the demand is met.

The Manager Address may default to 0 but should be adjusted to between Unit Start Address and Unit End Address. The range of units can only be set by the Manager.

Select **Minimum Valves Open** (default = 1) to match desired number of valves to stay open when demand is low to avoid exceeding maximum allowable flow through individual boiler(s).

When configuring a cascade client, select **Client** under Unit Role and then input a unique Address within the range set on the cascade Manager screen

NOTE 1: BMK E needs to be the Manager in the hybrid cascade of BMK E and BMK units.
NOTE 2: The Manager unit is also a Client unit.
NOTE 3: Ensure Cascade is set up for correct number of units and every unit is addressed uniquely.
NOTE 4: Baud Rate on all units in the plant must be same.

B. Cascade Failsafe (Manager only): A failsafe operation must be selected on the Manager unit, in case it loses any external signal or communication with the external setpoint source. That signal loss may be a Remote Setpoint, an Outdoor Air Temperature (OAT) sensor, or BAS.

C. Lead-Lag (Manager only): The Lead-Lag sequencing of the units in the plant must be set on this page. The default selection is **Run Hours** which will select the unit with the minimum Run Hours when a standby unit is asked to run. When the lead unit has exceeded another by the hours set, it will shut down and allow that unit to take the lead.

For a Hybrid Cascade, when Energy Source is chosen, the unit types of the particular energy source selected – Electric or Gas – will have precedence and run first while still following the run hours logic within the energy source selected[1].

D. Sequencing Control (Manager only):

- **Next On Threshold:** The Electric Next On Threshold[1] (Power Output % for Electric client) or Gas Next On Threshold (Fire Rate % for Gas-Fired client) above which the Manager will call for another unit to start will be set on this screen.

- **Next Off Threshold:** The Electric Next Off Threshold or Gas Next Off Threshold at which Manager will call for a running unit to shut down will be set on this screen.

> **NOTE:** For a Hybrid Cascade, be sure to set thresholds for both client unit types.

- **Next Off Delay:** The Next Off Delay is the time to wait for the plant to settle after shutting down a unit, before the manager can shut down another. If the Outlet temperature of the unit reaches the Temperature High Limit, this will take precedence and shut the unit down[1].
- **Cascade On Timeout:** This is the maximum time to allow a unit to start up before calling for the next unit in the startup sequence to run.

8.1.3.2 Application Settings (Manager Only)

Allows the user to configure the **Operating Mode** and the following available system applications:

A. Application Configuration: This page allows **Operating Mode** selection and configuration for the plant on the Manager. The three current modes of operation are **Constant Setpoint, Remote Setpoin**t, and **Outdoor Air Reset (OAR).**

> **NOTE 1: Analog Input (AI1)** must be set to **Remote Setpoint** under **Ancillary Devices** to get setpoint for the **Remote Setpoint > Analog Input** operating mode.
>
> **NOTE 2:** When **Setpoint Source** is set to **Analog Input**, the **Signal Type** must match the DIP switch setting on MCB.
>
> **NOTE 3**: **Spare 1 (TS4)** must be configured for **Outdoor Air Temperature** under **Settings > Advanced Setup > Ancillary Devices > Temperature Sensors** for Outdoor Air Reset mode.

B. Warm Weather Standby: The **Warm Weather Standby or Warm Weather Shutdown**[2] (WWS) can be activated or deactivated from this screen. When activated, users can select the Outdoor Air Temperature (WWS Threshold) above which the plant should go to standby. May set a WWS Hysteresis - how many degrees below the WWS Threshold the plant should be active again.

> **NOTE:** The Outdoor Air Temperature sensor source must be configured in **Settings > Advanced Setup > Ancillary Devices > Temperature Sensors > Spare 1 (TS4) > Function**.

D. Reserve Unit Control: It is used to enable a spare boiler or spare boiler plant to provide extra heat when the main plant is not able to meet system demand. It uses the Reserve Unit O/P Relay. This page allows to activate and configure thresholds for Reserve Unit Control feature.

> **CAUTION!**
> Reserve Unit Control is not a life-safety system and does not guarantee uninterrupted heat. Where loss of heat could threaten health, property, freeze protection, or a critical process, provide independently controlled and monitored backup protection appropriate to the application.

> **NOTE 1:** Reserve Unit O/P must be configured in **Ancillary Devices > Relays > Reserve Unit O/P.**

> **NOTE 2:** The Reserve Unit I/P allows the boiler to receive a reserve unit command from another boiler or plant and operates as a reserve unit[2]. Reserve Unit I/P must be configured in **Ancillary Devices > Interlocks > Reserve Unit I/P**.

8.1.3.3 Temperature Control

A. **Unit Temp Control and Cascade Temp Control[1]:** The basic temperature control operation of a unit (as a Manager or Client) uses PI (Proportional Band and Integral Gain). Considering Manager is also a Client, the PI used for the Manager when it has to control itself as a Client is programmed on the Unit Temp Control screen. The Temperature High Limit is the temperature above which a unit must go to standby. It will recycle after it cools down at least 5 degrees below this temperature.

B. **Cascade Temperature Control[1]:** The PI used by the Manager to control the cascade of boilers is programmed under Cascade Temp Control.

C. **Setpoint Range**: The Setpoint Range and a daily Setback Schedule can be enabled on this screen. This allows one to set a Setback Setpoint temperature during certain times of the day or night. Outside of this time range, it will run based on the normal Operating Mode. This screen also allows users to read Range and Offset, which define the outlet temperatures below setpoint for maximum and minimum modulation, respectively, with the unit modulating between these thresholds[2].

D. **Anti-Cycling[2]:** This screen allows users to configure parameters that help reduce frequent cycling of the unit. On Delay sets the delay before restarting after demand is recognized, while Shutoff Delay Temp defines the allowable outlet temperature rise above setpoint before shutdown. Demand Offset applies a temperature offset to delay re-ignition.

E. **Temperature Conformance[2]:** This screen allows users to enable or disable Delta-T Limiting. When enabled, the Max Delta-T parameter can be configured to limit the temperature difference between the unit's inlet and outlet water during operation.

8.1.4 Communication & Failsafe

8.1.4.1 BAS Settings

Refer to OMM-0173 on how to commission BACnet IP and MSTP protocols.

8.1.4.2 BAS Comm Failsafe

The **BAS Comm Failsafe** option specifies how the unit will operate when a Remote Signal is lost, and the unit has to operate independently. If **Constant Setpoint** is selected, the unit will fall back into a constant setpoint mode of operation with the setpoint defined in **Failsafe Setpoint** setting. If **Standby/Shutdown** is selected, the unit will fall back into a standby state until communication is reestablished. Select the failsafe mode and setpoint only after evaluating the consequences of communication loss for freeze protection, occupant safety, process loads, and connected equipment. Test the selected response during commissioning. Do not assume that BAS communication or controller software constitutes an independent safety control.

8.1.5 Ancillary Devices

This menu allows input and output configurations of supplementary equipment connected to the unit, including Analog IOs, Digital IOs, and Temperature sensors. See Appendix E for a list of IOs.

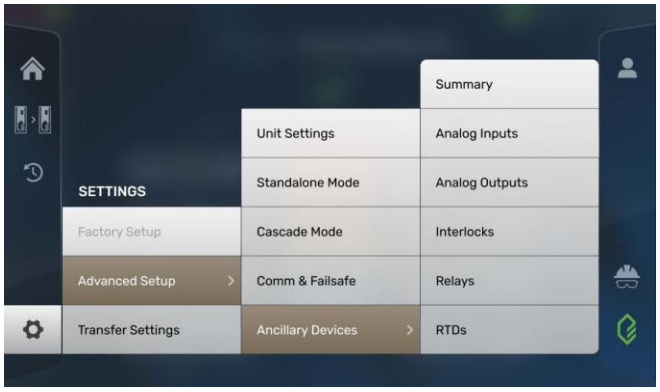


Figure 8-3: Ancillary Devices

NOTE: Some analog inputs and outputs on the controller must be configured for proper performance.

8.1.5.1 Summary

This page displays a list of all ancillary devices with their current values and statuses.

8.1.5.2 Analog Inputs

Each analog input can be set to a Voltage or Current **Signal Type.** Each signal type has its own customizable mapping of minimum to maximum signal/threshold. The "Name" of all analog inputs can be customized. See Appendix E for a list of Analog Inputs.

NOTE 1: Signal Type (Voltage or Current) must match DIP switch setting on MCB.
NOTE 2[1]: AI2 should be configured per isolation valve or primary pump in use. For the Belimo isolation valve provided by AERCO for BMK E (PN: 92084-12), feedback should be configured for 0.5-5V.
NOTE 3: If reliable feedback or external instrumentation indicates the reading is inaccurate, you can adjust its reading via the signal level parameter.

8.1.5.3 Analog Outputs

Each analog output can be set to a Voltage or Current **Signal Type.** Each signal type has its own customizable mapping of minimum to maximum signal/threshold. The "Name" of all analog outputs can be customized. See Appendix E for a list of Analog Outputs.

NOTE 1: The Signal Type (Voltage or Current) must match DIP switch setting on MCB.
NOTE 2[1]: AO2 should be configured according to the isolation valve or primary pump in use. For the Belimo isolation valve provided by AERCO for Benchmark-E (PN: 92084-12), control signal should be configured for 0.5-10V.

8.1.5.4 Interlocks

The Interlocks page displays the status and configuration of digital inputs used for unit operating and safety interlocks. The "Name" of all interlocks can be customized. See Appendix E for a list of Interlocks.

NOTE 1[1]: DI1-DI9 must be in the closed position for the unit to operate.
NOTE 2: For Individual Boiler Remote Interlock, wire **J9 Pins 1 and 2** with a separate dry contact from a multi-pole switch or relay only. Use a separate contact for each boiler.
NOTE 3: When the unit is in cascade, the Auxiliary Delay for Delayed Interlock (DI2) must be configured to be at least 90 seconds.

8.1.5.5 Relays

The Relays page displays the status and configuration of digital outputs used to control external devices or indicate unit operating conditions. The "Name" of all interlocks can be customized. See Appendix E for a list of Interlocks.

8.1.5.6 Temperature Sensors

The Temperature Sensors page displays the status and configuration of temperature sensor inputs used by the Controller. The "Name" of all Temperature Sensors can be customized. See Appendix E for a list of Temperature Sensors.

NOTE 1[1]: TS1, TS2, and TS3 should be left in their default factory settings.

NOTE 2: OAT, System Header Temp, and Return Header Temp sensors must be wired to the Edge X IO board before configuring Outdoor Air Temperature, System Header Temp, and Return Header Temp functions for Spare 1 (TS4), Spare 2 (TS5), and Spare (TS6) under Ancillary Devices.

8.2 Transfer Settings

The Edge X Controller includes functionality for saving and loading a backup of majority of the user-configurable parameters via a USB device plugged into the side of the Controller.

8.2.1 Save Settings

AERCO recommends using this option periodically to avoid needing to reconfigure the original setup.

NOTE: Each unit produces a setup file with a unique name based on the unit's serial number. If that setup file has already been saved, this step will overwrite it!

8.2.2 Load Settings

Once saved, the complete setup can be easily recovered by loading settings from the USB if the settings on the unit are lost or corrupted, through hardware malfunction or operator error.

CAUTION!

Load a saved configuration only after verifying that the serial number on the file matches the intended boiler serial number. Loading incompatible configurations can cause improper operation or loss of protective functions. Review and validate all safety-related and application-specific settings after every restore, controller replacement, or software update.

8.2.3 Restore Settings

This feature will be available in a future release.

SECTION 9: ACCOUNT

The Edge X Controller has multiple access levels to prevent unwanted configuration changes.

Level	Access Code	Description
Basic User	None	The default, read-only level that allows basic access. No password is required.
Trained Technicians (TTs)	Received upon TT training completion	Includes all Basic User permissions as well as unit configuration capabilities.
Master Trained Technicians (MTTs)	Received upon MTT training completion	Includes all TT permissions as well as advanced features.

To enter an access code, go to **Account > Access**. Type in the code then press **Enter**. If correct, the user is given the corresponding access level which is displayed under Access.

Selecting **Logout** will remove the current access level and revert to **Basic User** access. When the unit enters sleep mode, the access permission reverts to **Basic User** access.

SECTION 10: SERVICES

The Services menu is used to service the individual unit, such as testing or checking unit operation, updating software on the unit and performing routine maintenance.

10.1 Ignition SequenceError! Bookmark not defined.

The **Ignition Sequence** screen provides a visual indication of the unit's progress through each stage of the ignition cycle. The display updates as the sequence progresses, allowing personnel to monitor status. If the unit faults, the highlight returns to Standby with a fault icon displayed.

10.2 Manual Run

Manual Run allows the unit's power output[1] or fire rate**Error! Bookmark not defined.** to be controlled manually when testing or checking unit operation. When enabled, a yellow "Manual Run" banner will appear at the top of **Unit Dashboard, Plant Dashboard,** and **Event List** pages.

Raising or lowering the Analog Output value will raise or lower the power output[1] or fire rate**Error! Bookmark not defined.** of the unit.

⚠ WARNING!

Manual Run overrides normal automatic demand and modulation control. Use Manual Run only for supervised testing by qualified service personnel. Before enabling Manual Run, verify adequate water level and flow, open required valves, operating pumps, applicable interlocks, and safe heat dissipation.

Remain at the equipment while Manual Run is active. Continuously monitor outlet temperature, flow, pressure, and connected equipment. Immediately exit Manual Run if readings become abnormal. Never use Manual Run to bypass, defeat, or test around a safety device. Return the unit to automatic operation and verify normal operation before leaving the site.

If the unit is left in manual run and the controller screen is not touched for an extended period (30 minutes[1] or 60 minutes**Error! Bookmark not defined.**), the controller will automatically exit manual operation and return to automatic (normal) operation.

10.3 Software Update

To update the Application Firmware or Operating System (OS) Software, the latest software package must first be downloaded from the Watts LMS to an external computer and then saved to a USB (Version 2.0 or higher[1]) flash drive. Follow the steps below to update the software:

1. Disable the Unit by using the Enable/Disable switch.
2. Insert USB with latest software into the J3 connector on the MCB of the Controller (see Appendix B).
3. Go to **Service > Software Updates > Application & OS Update;** follow the on-screen prompts.
4. The unit will auto-restart after an Application Firmware update. A manual restart (power cycle) is required to complete the OS software update.

NOTE 1: Do not power cycle the unit until after restart.

NOTE 2: The "Update" button will be greyed out until a USB drive with a valid Application Firmware or OS Software file is detected.

NOTE 3: Refer to Appendix J for updating different versions of BMK E Edge X Application Firmware or OS Software.

SECTION 11: EDGE REPLACEMENT

⚡⚡ ELECTRICAL HAZARD WARNING ⚡⚡-

Electrical voltages in Benchmark E boilers may include **480 or 600 volts AC** and Benchmark NX boilers may include up to **120 VAC and 24 volts AC**. Therefore, these units must be serviced only by factory certified service technicians.

For Benchmark E, due to high electrical voltage the front door of the unit must always be closed during operation. Opening the front door shuts down unit operation but does **not** completely remove high voltage from the unit. Be sure the main power switch is de-activated and locked out before servicing the unit.

For Benchmark NX, the cover on the unit 's power panel (located behind the unit 's front panel) must be installed at all times, except during maintenance and servicing.

1. Download the latest OS Software and Application Firmware to a USB Flash Drive (see Section 10.3).
2. Make sure all power to the boiler is disabled and the Edge X controller is off.
3. Open the front door[1] or top panel**Error! Bookmark not defined.** of the boiler and insert the USB Flash Drive into the controller.
4. Close the front door[1] or top panel**Error! Bookmark not defined.** and restore power to the boiler.
5. Enable the boiler using the Enable/Disable switch on the front panel of the Edge X controller.
6. Go to **Account > Access.** Log in with a TT or MTT access code, then press **Enter** (see Section 9).
7. Save current unit settings to the USB (see Section 8.2.1). This step is required before loading all or common settings to the new or repurposed controller.
8. Disable the boiler using Enable/Disable switch on the front panel of the Edge X controller.
9. Turn off all power to the boiler.
10. Make sure all power to the boiler is disabled and the Edge X controller is off.
11. Open the front door[1] or top panel**Error! Bookmark not defined.** of the boiler and replace the Edge X controller or board(s), as needed.
12. Insert the USB Flash Drive into the controller.
13. Close the front door[1] or top panel**Error! Bookmark not defined.** and restore power to the boiler.
14. Enable the boiler using the Enable/Disable switch on the Edge X controller, if needed.
15. Go to **Account > Access.** Log in with a TT or MTT access code then press **Enter**.
16. To update software, go to **Services > Software Updates** and select **Update** under **Unit Operating System Software**. After updating, re-enter the TT or MTT access code in **Account > Access.**
17. If a firmware update is necessary, select **Update** under **Unit Application Firmware.** Once the update is complete, re-enter the TT or MTT access code in **Account > Access.**
18. If the Edge controller is being repurposed from an existing unit, make sure to reset all settings by going to **Settings > Advanced Settings > Unit Settings > General.**
19. Go to **Settings > Transfer Settings > Load Settings > USB**, to load settings, if desired. For previously saved settings file or if a controller is being replaced, select **Load Settings.**

20. To update settings, go to **Settings > Advanced Settings > Unit Settings.** If the Edge controller is being repurposed from an existing unit, select **Clear Event History.** Review and update other Unit Settings, if applicable.
21. To update Standalone Mode settings, go to **Settings > Advanced Settings > Standalone Mode.**
22. To update Cascade Mode settings, go to **Settings > Advanced Settings > Cascade Mode.**
23. To update Communication & Failsafe settings, go to **Advanced Settings > Comm & Failsafe.**
24. To review and update Ancillary Device settings go to **Advanced Settings > Ancillary Devices.**
25. Run boiler to test the unit operation and configuration.
26. After successful test run, clear faults by pressing the CLEAR Softkey on the controller front panel.

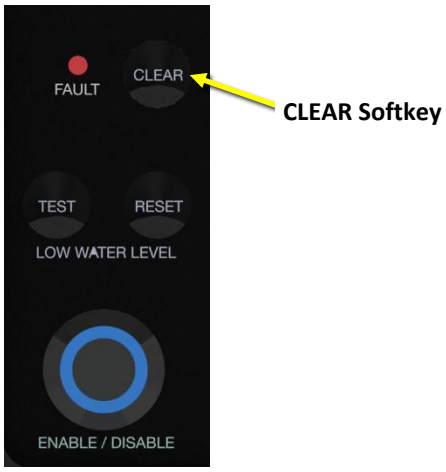


Figure 11-1: Clear Softkey

27. Make sure to logout by going to **Account > Logout** to log out of TT/MTT access.

APPENDIX A – ABBREVIATIONS & MENU ITEM DESCRIPTIONS

Common Abbreviations

Abbreviation	Term	Description
BAS	Building Automation System	A system that monitors and controls systems such as lighting, air conditioning, heating, ventilation, and air conditioning.
EMS	Energy Management System	A system that connects a building's systems (lighting, HVAC, etc.) to create a single, central platform to manage energy consumption.
LWCO	Low Water Cutoff	A device that prevents a burner from firing in low- or no-water.
OAR	Outdoor Air Reset	An operating mode in which the Setpoint value is defined by OAT
OAT	Outdoor Air Temperature	The temperature of the air surrounding (outside of) the building.
RTD	Resistance Temperature Detector	A sensor used to measure temperature whose resistance changes when its temperature changes.
SSR	Solid State Relay	Electronic switching device used to modulate a 36kW element group.
MCB	Microcontroller Board	Edge Controller Microcontroller Board
IOB	Input/Output Board	Edge Controller Input/Output Board
OS	Operating System	Essential software managing Edge Controller hardware and software resources. It controls processors, memory, and storage, while enabling applications to run.
OTS	Off-the-Shelf	Off-the-shelf (OTS) products are pre-made, ready-to-use software or hardware components available for purchase by the general public, designed to meet standard needs without custom development.
sBST	Boiler Sequencing Technology Supply	Cascade control method that utilizes supply header temperature sensor.
iBST	Boiler Sequencing Technology Internal Setpoint	Cascade control method that utilizes average outlet temperature of units with flow through them.

Menu Item Descriptions

Menu Item	Description
Automatic Date & Time	Disable to edit the date and time manually
AUX Relay	Displays the state of the AUX relay
Auxiliary Delay	Specifies the amount of time to wait between activating the Aux Relay (due to a demand) and checking the pre-purge string to start the unit
Cabinet Temperature	Displays the temperature value inside the cabinet
Clear Event History	Clears all events on Event History screen. Do NOT clear except when replacing the controller
Comm Address	For RS-485 communications (0-127). RS232 should have its own password
Constant Setpoint	Used when a fixed header temperature is desired, i.e. for water source heat pump loops and indirect heat exchangers for potable hot water systems or processes
Controller Model	Displays current controller model
Country	Select unit location; selected option dictates available time zones
Date and Time	Allows user to set the date and time manually
Derivative Time	This value responds to the rate of change of the setpoint error. This is the time that this action advances the PID temperature output. If the value is increased, the PID acts slower. If this value is decreased, the PID acts faster.
Energy Source	Specifies source of energy for unit. For BMK E, it is Electric by default
Mode (Failsafe Mode)	This setting is applicable when the operating mode is set to **Remote Setpoint** in the **Application Settings** menu. If there is a loss of communication the unit will revert to the selected failsafe mode until communication is reestablished.
Failsafe Setpoint	If the selected failsafe Mode is constant setpoint, this is the active setpoint if there is a loss of communication in the Remote Setpoint signal
Inlet	Displays the temperature of the water entering the unit
Integral Gain	This sets the fraction of the PID temperature output, due to setpoint error, to add or subtract from the output each minute to move towards the setpoint. If the value is increased, the integral portion of the PID acts faster. If the value is decreased, the integral acts more slowly.
Language	The language option currently available is English
Network Timeout	Specifies the timeout value before a Modbus Fault is declared

OAR Max Outside Temp	Maximum outside temperature that will change the setpoint of the outdoor reset function
OAR Max Setpoint	The maximum allowable setpoint when in OAR operating mode
OAR Min Outside Temp	Specifies minimum air temp unit will read; interacts with OAR Max Setpoint
OAR Min Setpoint	The minimum allowable setpoint when in OAR operating mode
Operating Mode	Displays current mode (Constant Setpoint, Remote Setpoint, or Outdoor Air Reset).
Outdoor Air Reset (OAR)	As the outside air temperature decreases, the supply header temperature will increase and vice versa. For this mode, it is necessary to install an outside air sensor.
Outdoor Air Temperature	Displays the current outdoor air temperature reading
Outlet	Displays the temperature of the water exiting the unit
Product Type	Displays AERCO products, BMK E
Proportional Band	Adjustment of the PID temperature output control based on error between setpoint temperature and actual outlet temperature. If value is increased, the proportional portion of the PID acts more slowly; if decreased, the proportional acts faster.
Remote Setpoint	The unit's setpoint can be remotely controlled by an Energy Management System (EMS) utilizing either a current or voltage signal level
Reserve Unit Enable and Disable Threshold	The Power Output level above which the Reserve Unit engages and below which the Reserve Unit deactivates.
Reserve Unit Relay	Displays the current state of the Reserve Unit relay (see Section 8.1.5.5)
Reset All Settings	Resets all settings and restores default values. Do NOT use except when replacing Controller.
Run Cycles	Displays number of run cycles since last system reset. Can be reset to 0 (or any other number)
Run Hours	Displays number of run hours since last system reset. Can be reset to 0 (or any other number)
Serial Number	Displays unit's factory-set serial number in a unique format of Z-YY-XXXX. Do NOT change except when replacing Controller. Z = a letter specific to Benchmark E boilers; YY = two-digit year; XXXX = 4-digit serial number.
Setback Schedule	This feature can be used to reduce the setpoint during periods of low use. This can help lower energy consumption when a building has a regular period of low demand. For example, an office building may have no occupancy from the hours of 0000 to 0500. For best comfort, it is recommended that the Setback Setpoint is no more than 5 to 10°F below normal setpoint, and to end the Setback period at least one hour before the demand returns to normal levels.
Setback Setpoint	The setpoint temperature the unit maintains within the setback schedule
Setback Start Time	The time that the Setback Schedule begins
Setback Stop Time	The time that the Setback Schedule ends
Setpoint Hi Limit	Used to set the maximum allowable setpoint (Setpoint Lo Limit up to 240°F)
Setpoint High Limit	If the operating mode is constant setpoint, this option allows the user to limit how high the unit's setpoint can be set in the Application Settings menu
Setpoint Lo Limit	Used to set the minimum allowable setpoint (40°F up to Setpoint Hi Limit)
Setpoint Low Limit	If the operating mode is constant setpoint, this option allows the user to limit how low the unit's setpoint can be set in the Application Settings menu
Setpoint Source	Used to set type of external signal used when operating in the Remote Setpoint
SH Setpoint	The target temperature value that the unit or plant aims to reach and maintain. To adjust setpoint see Application Settings.
SSR	Allows configuration with or without SSR. Change ONLY if updated by factory
Temperature High Limit	The temperature limit feature that will shut down the unit and generate an event if the actual outlet temperature exceeds this setting
Temperature Sensor	Specifies the sensor type (PT1000 = default) on the current units
Time Format	Select 12- or 24-hour format
Time Zone	Based on the Country selected, specific time zones will be available
Unit of Measurement	Choose English (°F, gpm, in. W.C., psi) or Metric (°C, lps, Pa). The LED indicator displays either °F or °C accordingly
Unit Size	Displays available sizes for given Product Type. Do NOT change except when replacing the Controller. Options are 216kW, 360kW, 432kW, 576kW, and 684kW.
Unit Voltage	480V or 600V
Warm Weather Shutdown	The outside temperature threshold above which the unit goes into standby

APPENDIX B – EDGE X BOARDS

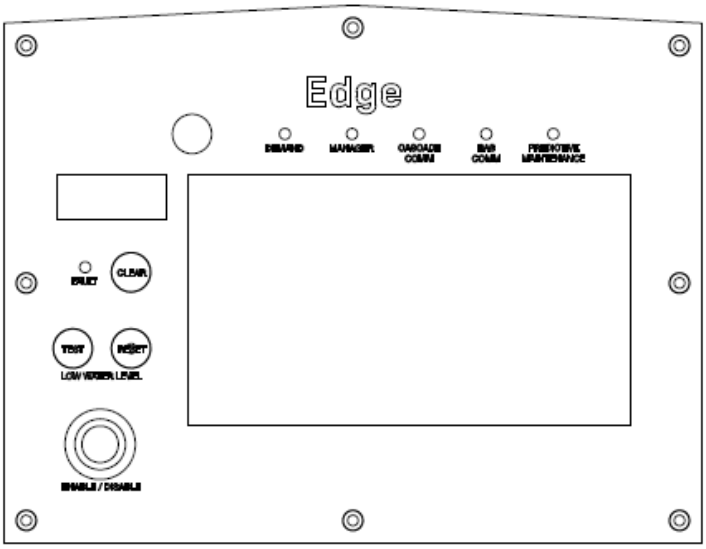


Figure B-1: Edge X Front Panel

B.1 BMK E Edge X (AERCO PN 69376-103)

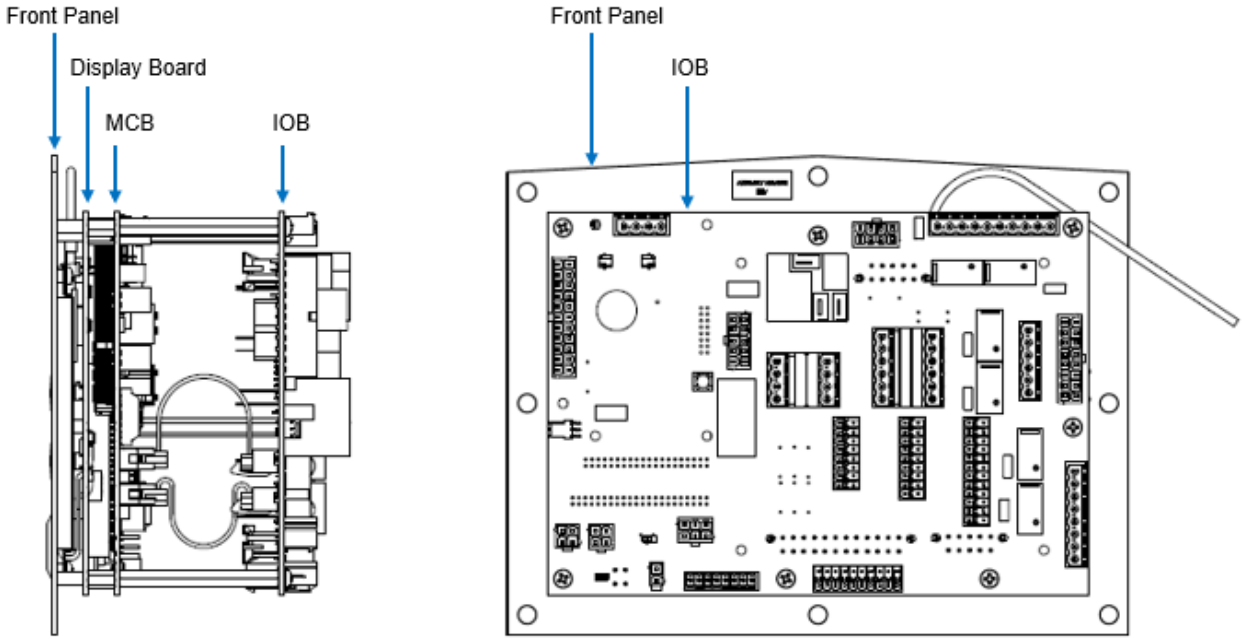


Figure B-2: Edge X 69376-103; Side View and Back View

B.2 BMK NX Expanded Edge X (AERCO PN 69376-104 & 64220-1)

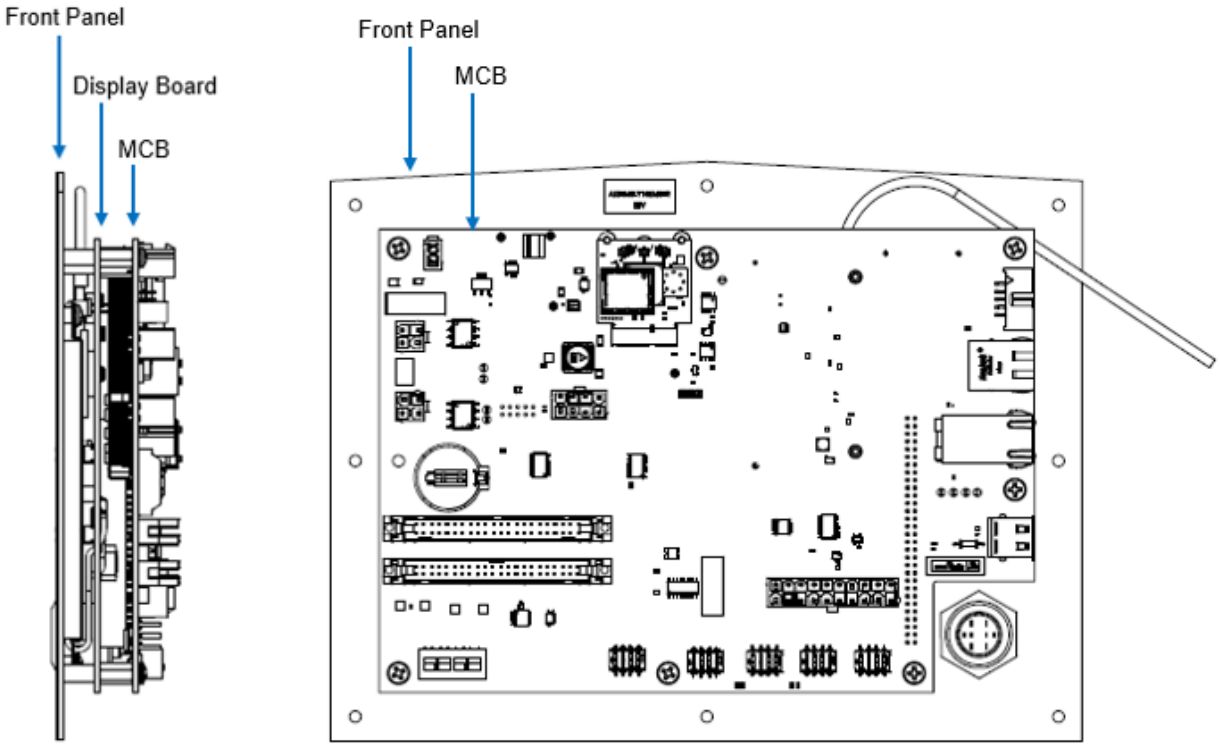


Figure B-3: Expanded Edge X 69376-104; Side View and Back View

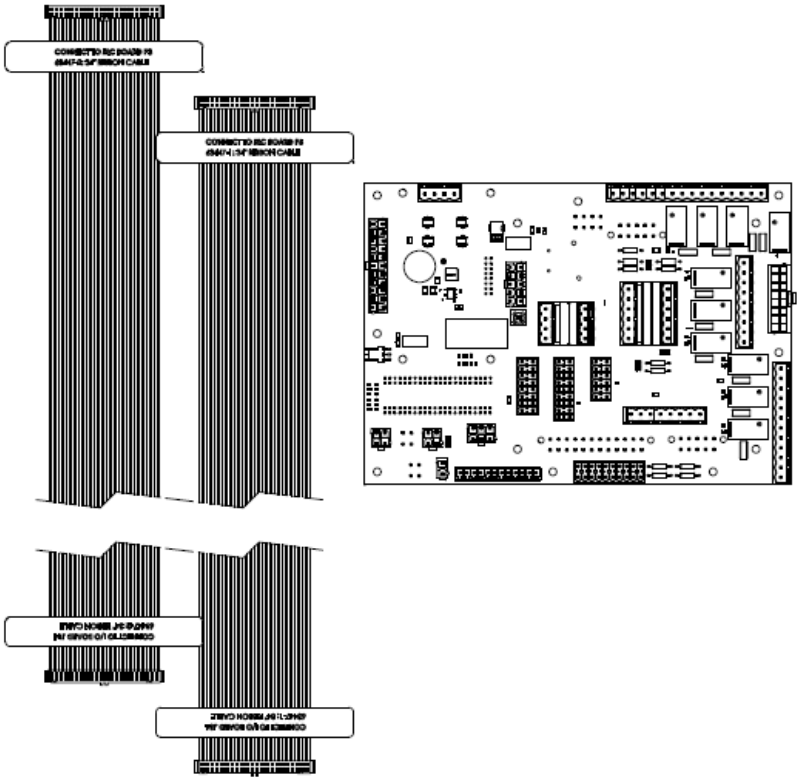


Figure B-4: Expanded Edge X IO Board 64220-1; Front View and Ribbon Cables

APPENDIX C - MICROCONTROLLER BOARD (MCB; 64180 REV C)

The Main Control Board (MCB) contains circuitry and connections for executing the central controlling functions of the Edge X controller. For field connection purposes, as seen below in Figure C-1 & C-2, the MCB contains:

- A USB port for firmware upgrades, save and load settings
- An ethernet port for network/BACnet IP communication,
- Configuration switches for analog input and analog output, and the MODBUS biasing and termination dip switches for the Cascade and BAS communication chains

NOTE: Identify the **MCB** part number and version using the **Part Number** and **Assembly Revision** printed on the board's white label, then refer to the appropriate diagram in **Section C.1 or Section C.2**.

C.1 MCB 64180 Rev C Settings

(A): Analog Output configuration switches K2/K1
(B): Analog Input configuration switches SW1/SW5
(C): MODBUS1/2 dip switch banks SW4/SW2 for BAS/Cascade termination respectively
(D): Back view of Edge X controller showing location of IO board on back of the controller
(E): Location of J5 gigabit ethernet jack for BACnet IP connection.
(F): Location of Digital Input terminal strip J11.
(G): Location of the USB port J3

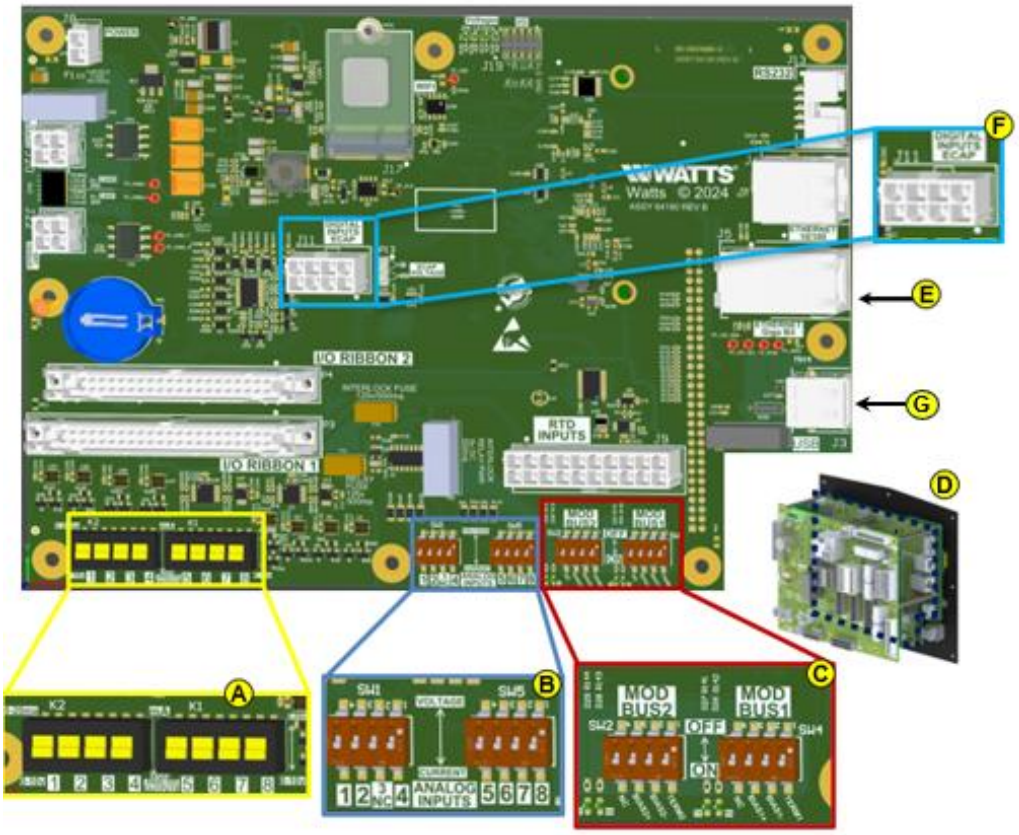


Figure C-1: Edge X MCB (64180 Rev C)

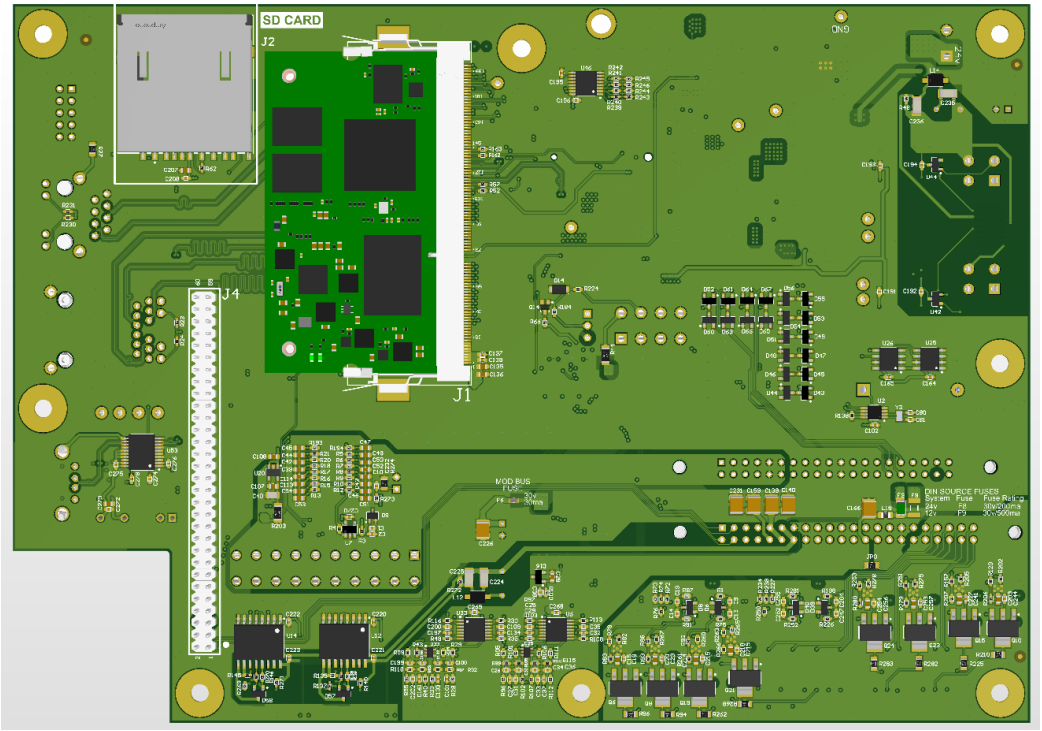


Figure C-2: Edge X MCB (64180 Rev C); Front View

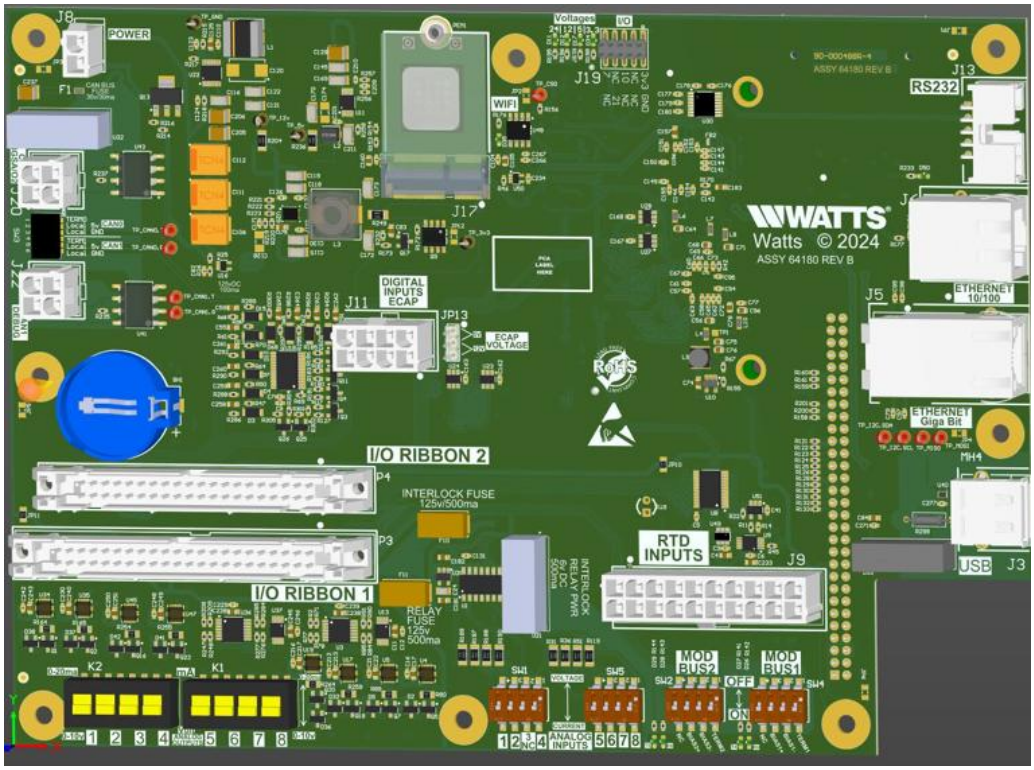


Figure C-3: Edge X MCB (64180 Rev C); Back View

C.2 Expanded MCB 64180-1 Rev E Settings

(A): Analog Output configuration switches SW8
(B): Analog Input configuration switches SW1/SW5
(C): MODBUS1 & MODBUS2 dip switch banks SW2 & SW4 for BAS/Cascade termination, respectively
(D): Location of the USB port J3
(E): Location of J5 gigabit ethernet jack for BACnet IP connection
(F): Location of Digital Input terminal strip J11

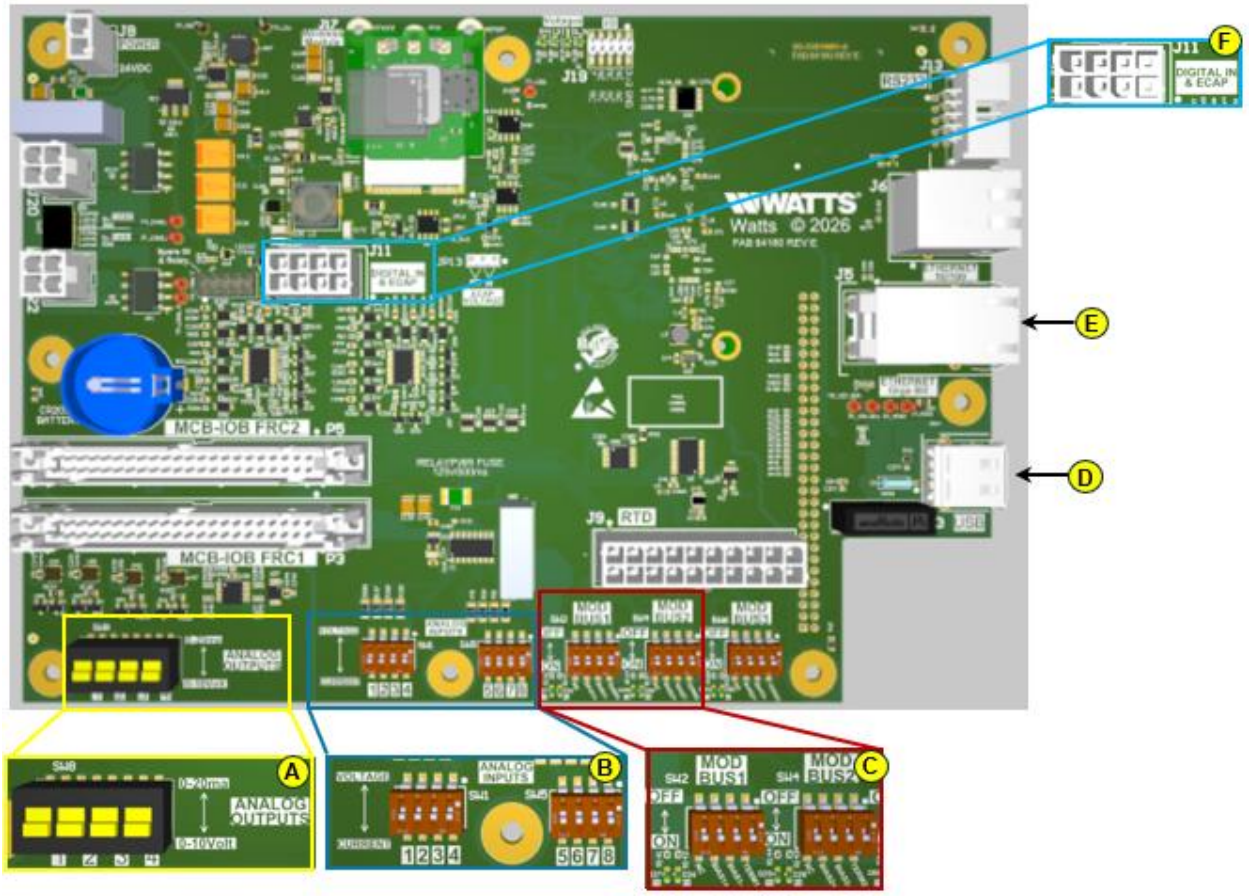


Figure C-4: Expanded MCB (64180-1 Rev E)

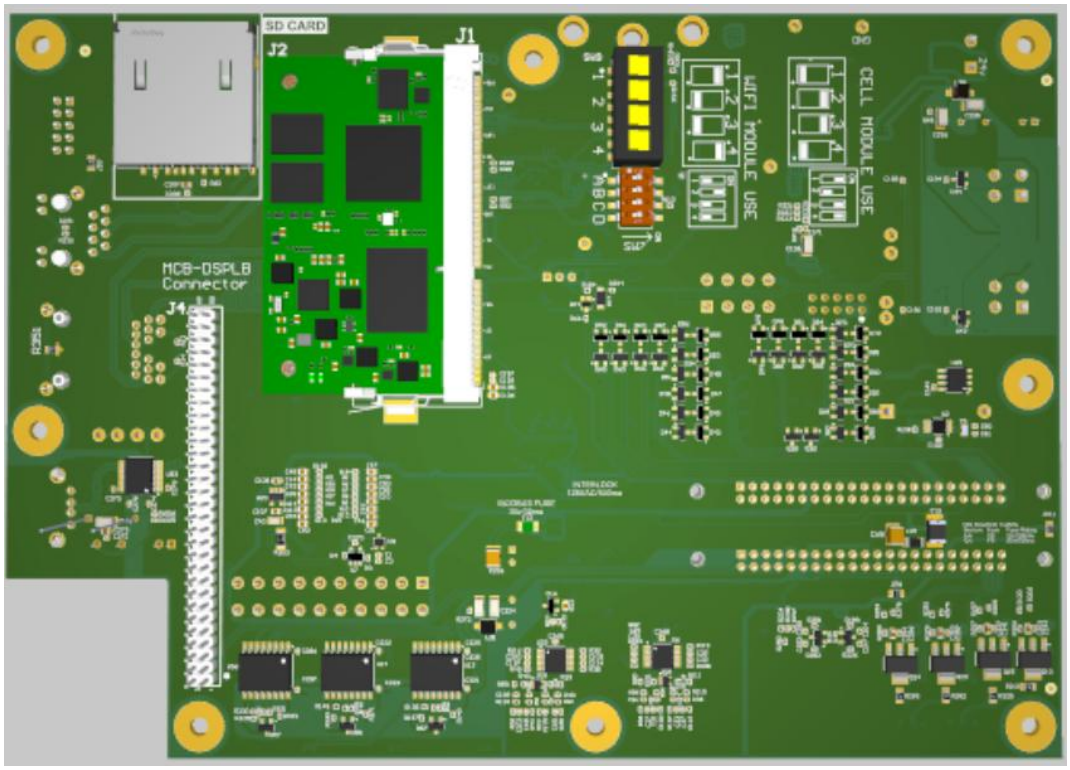


Figure C-5: Expanded MCB (64180-1 Rev E); Front View

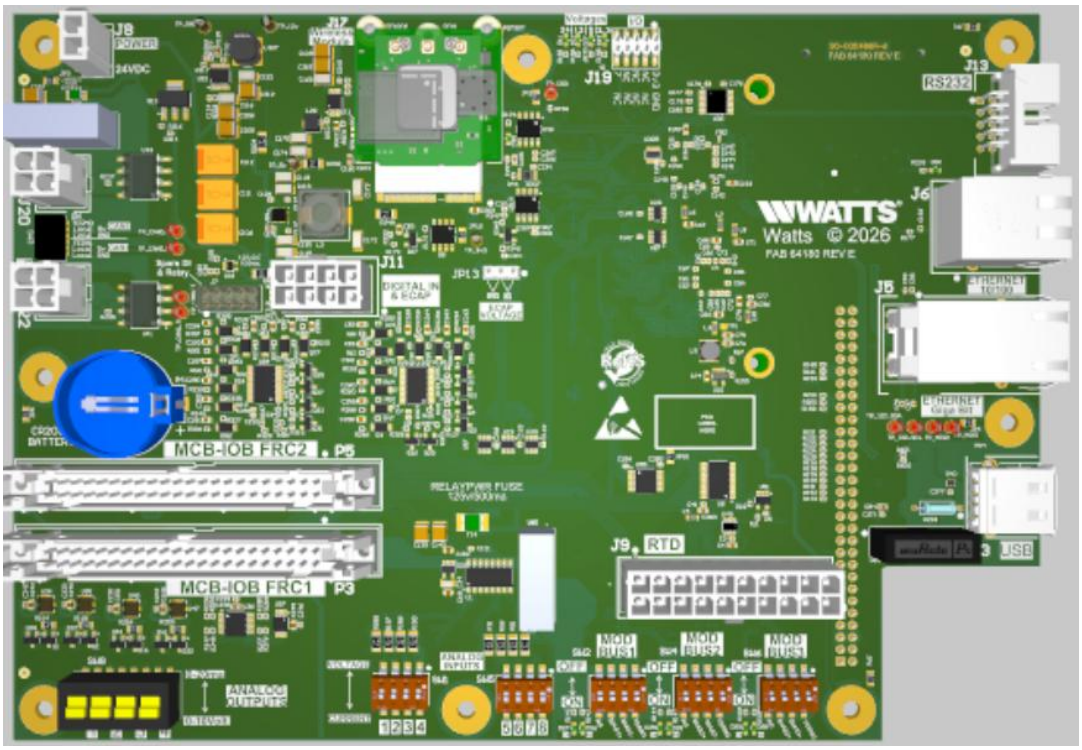


Figure C-6: Expanded MCB (64180-1 Rev E); Back View

C.3 Analog Outputs Configuration – BMK E

When programming analog outputs the corresponding dip switches must be configured in the Edge X controller as per Section 8.1.5.3. The figure below shows dip switch banks which are programmable to 0-10V or 0-20mA analog output.

1. Switch K2-1 is dedicated and factory configured for Analog Output 1 (IO Board J13-P14,15) for the proportional sequencer.
2. Switch **K2-2** is dedicated for Analog Output 2 (**IO Board J13-P4,16**), which is for the **Isolation Valve Control** or **Variable Primary Pump Control** and requires configuration in accordance with the isolation valve and primary pump in use.

   Note: **For the Belimo isolation valve provided by AERCO for Benchmark-E (PN: 92084-12), dip switch K2-2 should be set to "voltage."**
3. The other dip switches can be left in their default position.



Figure C-7: Analog Output Configuration Switches K2/K1

C.4 Analog Outputs Configuration – BMK NX

When programming analog outputs the corresponding dip switches must be configured in the Edge X controller as per Section 8.1.5.3. The figure below shows dip switch banks which are programmable to 0-10V or 0-20mA analog output.

1. Switch **SW8-1** is dedicated for Analog Output 1 (**IO Board J33-P8,9**), which is for the **Fire Rate**.
2. Switch **SW8-2** is dedicated for Analog Output 2 (**IO Board J33-P2,10**), which is for the **Variable Primary Pump Control** and requires configuration in accordance with the primary pump used.
3. The other dip switches can be left in their default position.

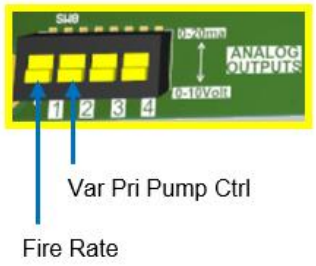


Figure C-8: Analog Output Configuration Switches SW8

C.5 Analog Inputs Configuration – BMK E

When programming analog inputs the corresponding dip switches must be configured per the site application. For example: a site BAS sending a remote setpoint as a current should have SW1-1 set to "Current." Similarly, dip switch SW1-2 must be configured for isolation valve feedback in accordance with the isolation valve feedback signal type. The figure below shows dip switch banks SW1/SW5.

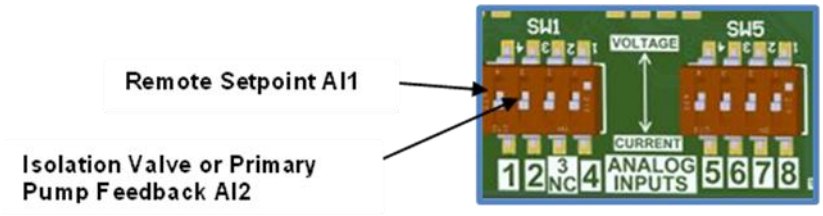


Figure C-9: Analog Input Configuration Switches SW1/SW5

On Switch SW1:

1. Switch **SW1-1** is dedicated to analog input 1 (**IO Board J18-P1,9**), which is for the **Remote Setpoint**.
2. Switch **SW1-2** is dedicated to analog input 2 (**IO Board J18-P3,11**), which is for the Isolation Valve Feedback or Variable Primary Pump Feedback.
   For the Belimo isolation valve provided by AERCO for Benchmark-E (PN: 92084-12), dip switch SW1-2 should be set to "voltage."

C.6 Analog Inputs Configuration – BMK NX

When programming analog inputs the corresponding dip switches must be configured per the specific site application. For example: a site whose BAS is sending a remote setpoint as a current should have SW1-1 set to "Current." Similarly, dip switch SW1-2 must be configured for variable primary pump feedback in accordance with the variable primary pump feedback signal type. The figure below shows dip switch banks SW1/SW5.

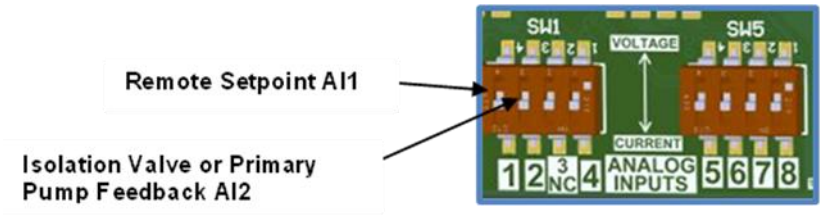


Figure C-10: Analog Input Configuration Switches SW1/SW5

On Switch SW1:

1. Switch **SW1-1** is dedicated to analog input 1 (**IO Board J18-P1,9**), which is for the **Remote Setpoint**.
2. Switch **SW1-2** is dedicated to analog input 2 (**IO Board J18-P3,11**), which is for the **Variable Primary Pump Feedback**.

APPENDIX D - INPUT/OUTPUT BOARD (AERCO PN 64188 and 64220)

The field-wiring of relays, interlocks, communication (RS485), analog inputs, and analog outputs are wired to this board.

> **NOTE:** Identify the **IOB** part number and version using the **Part Number** and **Assembly Revision** printed on the board's label, then refer to the appropriate diagram in **Section D.1** or **Section D.2**.

D.1 IO Board 64188 Rev A

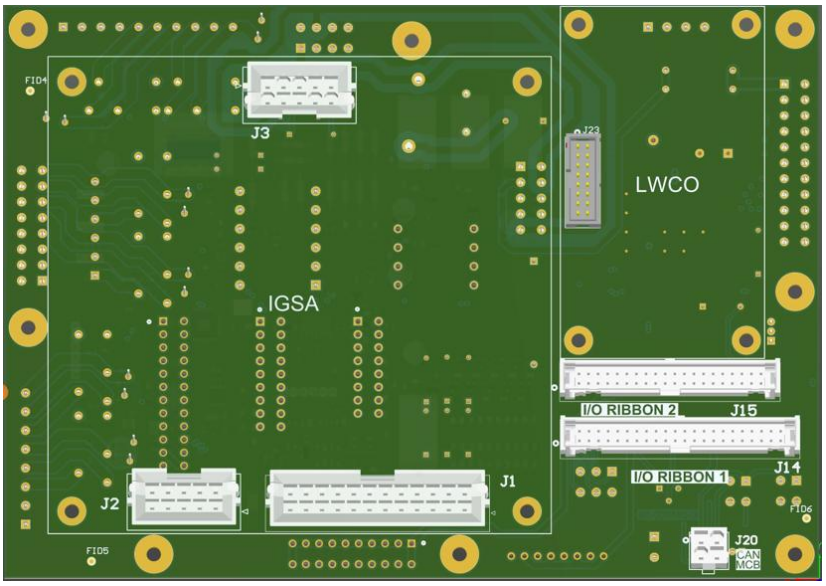


Figure D-1: IO Board 64188 Rev A; Front View

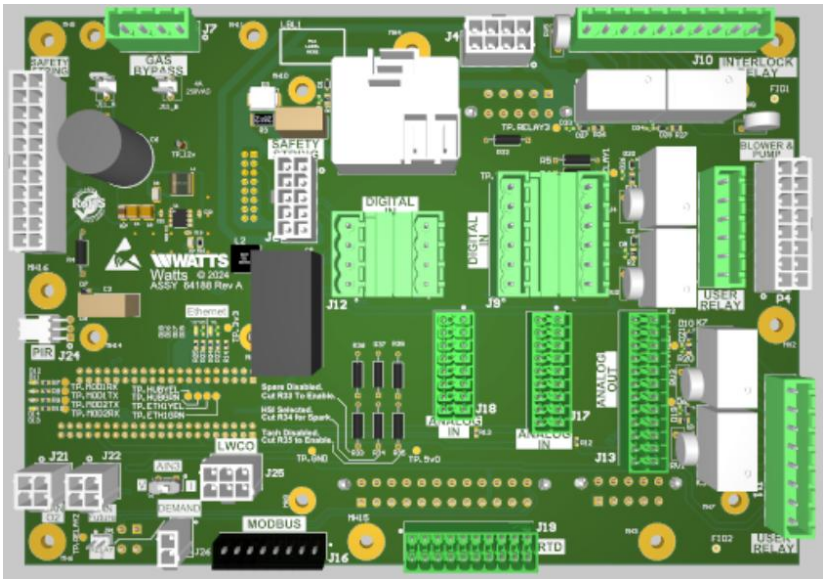


Figure D-2: IO Board 64188 Rev A; Back View

D.2 IO Board 64220 Rev B2

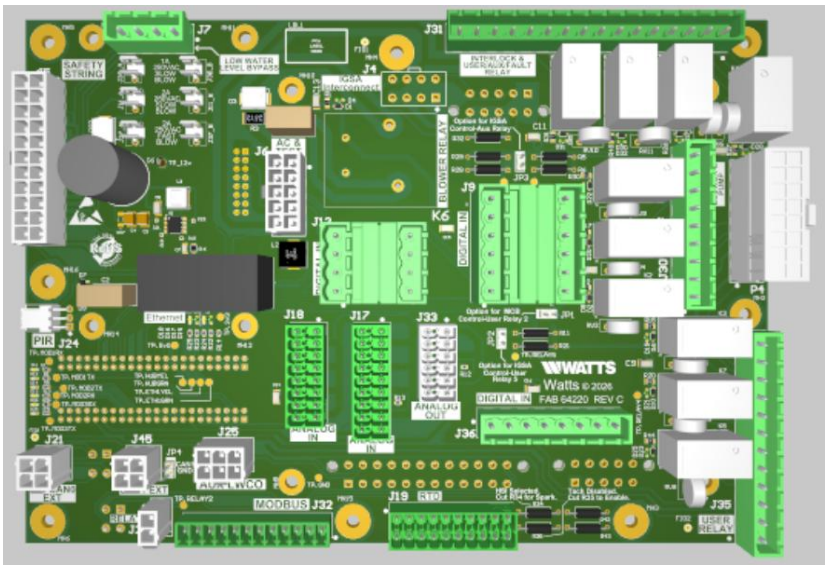


Figure D-3: IO Board 64220 Rev B2; Front View

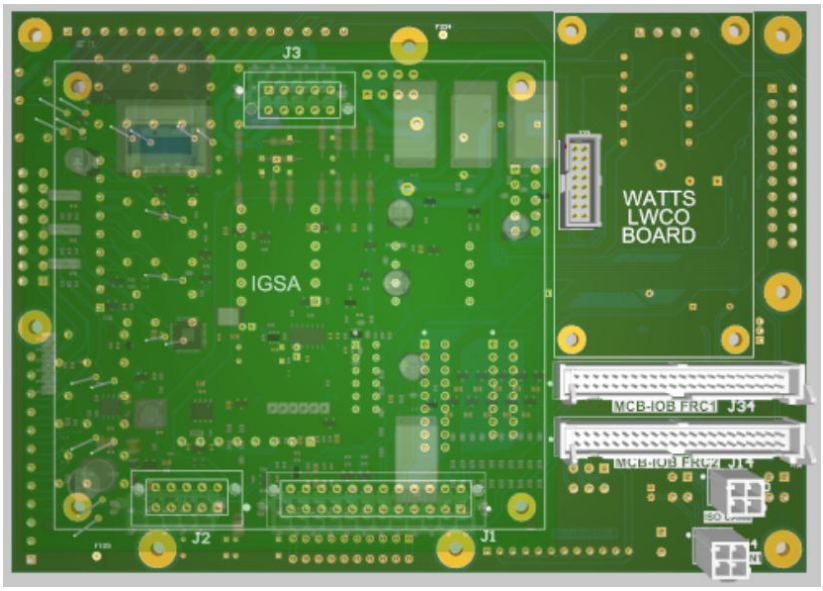


Figure D-4: IO Board 64220 Rev B2; Back View

APPENDIX E – FIELD INPUT/OUTPUT WIRING AND LIST

On the Edge X IO Board connectors, pin 1 (P1) is designated by a white dot.

NOTE: Identify the **IOB** part number and version using the **Part Number** and **Assembly Revision** printed on the board's white label, then refer to the appropriate diagram in **Section E.1** or **E.2**.

E.1 IO Board 64188 Rev A – BMK E

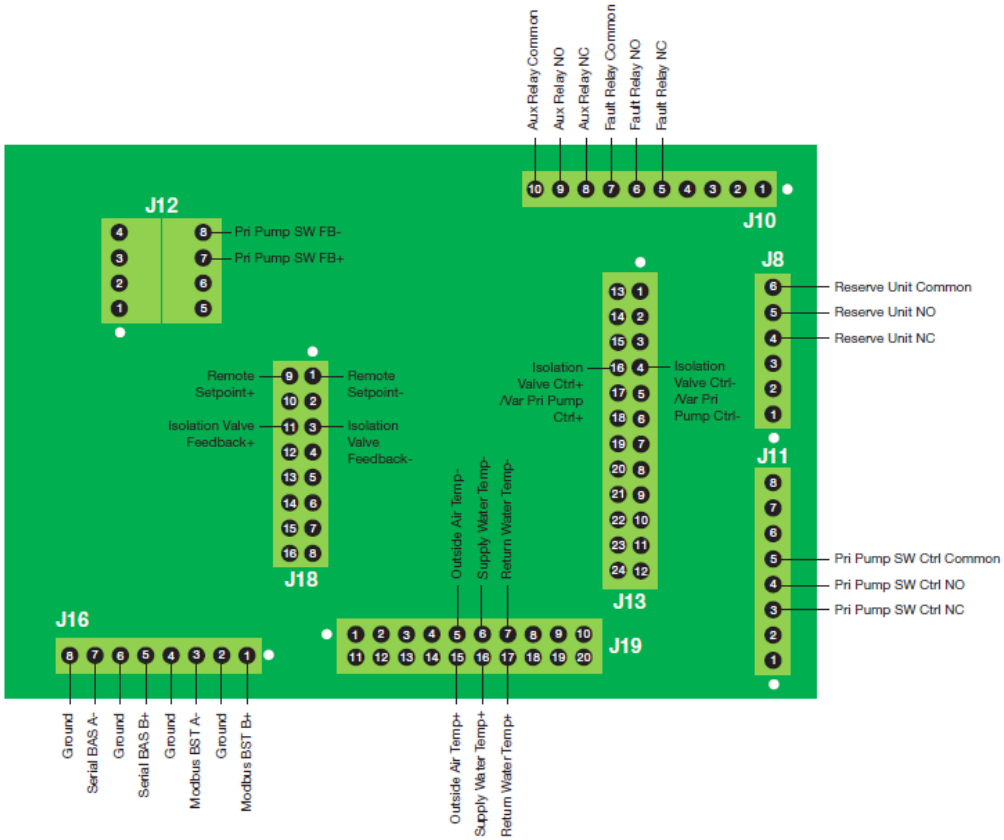


Figure E-1: IO Board 64188 Rev A showing only field-wiring terminal connections

Field Wiring Terminals	Terminal Pin Assignments
Terminal strips **J8, J10, and J11** contain relay connections	• **J8-P4,5,6** are available for Reserve Unit Output signal on Manager unit only. • **J10-P5,6,7** are available for Fault Relay output signal. • **J10-P8,9,10** are available for Aux Relay output signal. • **J11-P6,7,8** are available for System Aux Relay output signal on Manager unit only. • **J11-P3,4,5** are available for Isolation Valve Relay Ctrl and Primary Pump Switch Control signals.
Terminal strip **J12** contains digital input connections	• **J12-P7,8** are available for Isolation Valve E-Switch Feedback and Primary Pump Switch Feedback signals. NOTE: For Edge X IO board 64188 Rev A and MC board 64180 Rev C, jump a 18-20 AWG wire between IO board J12-P7 and MC Board J11-P3 before wiring Isolation Valve Switch Feedback or Primary Pump Switch Feedback signals on to the IO board J12-P7,8. Refer to Appendix I for detailed instructions.

Terminal strip **J13** contains analog output connections	• **J13-P4,16** are available for Isolation Valve Control or Variable Primary Pump Control signals as current or voltage. **NOTE that Analog Output must be configured (see** Section 8.1.5.3**)**
Terminal strip **J17 and J18** has analog input connections	• **J18-P1,9** are available for Remote Setpoint signal as current or voltage. • **J18-P3,11** are available for Isolation Valve Feedback or Variable Primary Pump Feedback signals as current or voltage. • **J17-P1,10** are available for Peak Load Management Power Limit signal as current or voltage on Manager unit only. **NOTE that Analog Input must be configured (see** Section 8.1.5.2**)**
Terminal strip **J19** has temperature sensor connections	• **J19-P5,15** are available for Outdoor Air Temperature sensor (for outdoor air reset) on Manager unit only. • **J19-P6,16** are available for System Header Temperature sensor on Manager unit only. • **J19-P7,17** are available for Return Header Temperature sensor on Manager unit only.

IOs	Functions	Signal Type	Board	Connector-Pin#
AI1	Remote Setpoint Default: Unassigned; configurable	0-10Vdc @ 1mA min or 0-20mA	IOB	J18-P9: AIN 1 J18-P1: Ain_GND
AI2	Isolation Valve FB / Var Pri Pump FB Default: Unassigned; configurable	0-10Vdc @ 1mA min or 0-20mA	IOB	J18-P11: AIN 2 J18-P3: Ain_GND
AI5	PLM Power Limit Default: Unassigned; configurable	0-10Vdc @ 1mA min or 0-20mA	IOB	J17-P10: AIN 5 J17-P1: Ain_GND
AO1	Step Sequencer Default: Step Sequencer; read-only	0-20mA max / 0-10Vdc @ 50mA max	IOB	J13-P15: AOUT 1 J13-P14: Aout_GND
AO2	Isolation Valve Ctrl / Var Pri Pump Ctrl Default: Unassigned; configurable	0-20mA max / 0-10Vdc @ 50mA max	IOB	J13-P16: AOUT 2 J13-P4: Aout_GND
DI1	Remote Interlock Default: Remote Interlock; read-only	0-24VAC / VDC @ 1mA per min	IOB	J9-P1: DIGITAL_IN_1 J9-P2: AIN_12/24v
DI2	Delayed Interlock Default: Delayed Interlock; read-only	0-24VAC / VDC @ 1mA per min	IOB	J9-P3: DIGITAL_IN_2 J9-P4: AIN_12/24v
DI3	Primary Low Water Cut-off SW Default: Pri LWCO; read-only	0-24VAC / VDC @ 1mA per min	IOB	J9-P5: DIGITAL_IN_3 J9-P6: AIN_12/24v
DI4	Secondary Low Water Cut-off [Field Install] Default: Sec LWCO; read-only	0-24VAC / VDC @ 1mA per min	IOB	J9-P7: DIGITAL_IN_4 J9-P8: AIN_12/24v
DI5	High-Temperature Limit Control [Manual Clear] Default: HTLC; read-only	0-24VAC / VDC @ 1mA per min	IOB	J9-9: DIGITAL_IN_5 J9-10: AIN_12/24v
DI6	Operating Temperature Limit Control [Auto Clear] Default: OTLC; read-only	0-24VAC / VDC @ 1mA per min	IOB	J9-P11: DIGITAL_IN_6 J9-P12: AIN_12/24v
DI7	Cabinet Door Switch Default: Cabinet Door SW; read-only	0-24VAC / VDC @ 1mA per min	IOB	J12-P1: DIGITAL_IN_7 J12-P2: AIN_12/24v
DI8	Demand Relay Status Default: Demand Relay Status; read-only	0-24VAC / VDC @ 1mA per min	IOB	J12-P3: DIGITAL_IN_8 J12-P4: AIN_12/24v
DI9	Unit Enable/Disabled SW [On Edge Front Panel] Default: Unit Enable/Disabled SW; read-only	0-24VAC / VDC @ 1mA per min	MCB	J11-P1: DIGITAL_IN_9
DI10	Isolation Valve ESW FB / Pri Pump FB [Remote Interlock type] Default: Unassigned; configurable	0-24VAC / VDC @ 1mA per min	IOB + MCB	J12-P7: OVERTEMP_IN J12-P8: AIN_12/24v J11-P3: OVERTEMP_IN J11-P4: GND

IOs	Functions	Signal Type	Board	Connector-Pin#
DO1	Fault Relay Default: Unassigned; configurable	NO: 50,000 cycles, 120Vac @ 6A GP NO/NC: 100,000 cycles, 120Vac @3A GP	IOB	J10-P7: IGSA_FAULT_RELAY_COM J10-P6: IGSA_FAULT_RELAY_NO J10-P5: IGSA_FAULT_RELAY_NC
DO2	Reserve Unit O/P Default: Unassigned; configurable	NO: 50,000 cycles, 120Vac @ 6A GP NO/NC: 100,000 cycles, 120Vac @3A GP	IOB	J8-P6: USER_RELAY1_COM J8-P5: USER_RELAY1_NO J8-P4: USER_RELAY1_NC
DO3	Demand Relay Default: Demand Relay; read-only	NO: 50,000 cycles, 120Vac @ 6A GP NO/NC: 100,000 cycles, 120Vac @3A GP	IOB	J8-P3: USER_RELAY2_COM J8-P2: USER_RELAY2_NO J8-P1: USER_RELAY2_NC
DO4	Aux Relay Default: Unassigned; configurable	NO: 50,000 cycles, 120Vac @ 6A GP NO/NC: 100,000 cycles, 120Vac @3A GP	IOB	J10-P10: AUX_RELAY_COM J10-P9: AUX_RELAY_NO J10-P8: AUX_RELAY_NC
DO5	System Aux RLY Default: Unassigned; configurable	NO: 50,000 cycles, 120Vac @ 6A GP NO/NC: 100,000 cycles, 120Vac @3A GP	IOB	J11-P8: USER_RELAY4_COM J11-P7: USER_RELAY4_NO J11-P6: USER_RELAY4_NC
DO6	Isolation Valve RLY Ctrl / Pri Pump Ctrl Default: Unassigned; configurable	NO: 50,000 cycles, 120Vac @ 6A GP NO/NC: 100,000 cycles, 120Vac @3A GP	IOB	J11-P5: USER_RELAY5_COM J11-P4: USER_RELAY5_NO J11-P3: USER_RELAY5_NC
TS1	Inlet Water Temp Default: Inlet Water Temp; read-only	Voltage	IOB	J19-P12: RTD_IN8 J19-P2: RTD 8 RETURN
TS2	Outlet Water Temp Default: Outlet Water Temp; read-only	Voltage	IOB	J19-P13: RTD_IN9 J19-P3: RTD 9 RETURN
TS3	Cabinet Temp Default: Cabinet Temp; read-only	Voltage	IOB	J19-P14: RTD_IN10 J19-P4: RTD 10 RETURN
TS4	Outside Air Temp (OAT) Default: Unassigned; configurable	Voltage	IOB	J19-P15: RTD_IN11 J19-P5: RTD 11 RETURN
TS5	Supply Header Temp 1 Default: Unassigned; configurable	Voltage	IOB	J19-P16: RTD_IN12 J19-P6: RTD 12 RETURN
TS6	Return Header Temp 1 Default: Unassigned; configurable	Voltage	IOB	J19-P17: RTD_IN13 J19-P7: RTD 13 RETURN

E.2 IO Board 64220 Rev B2 – BMK NX

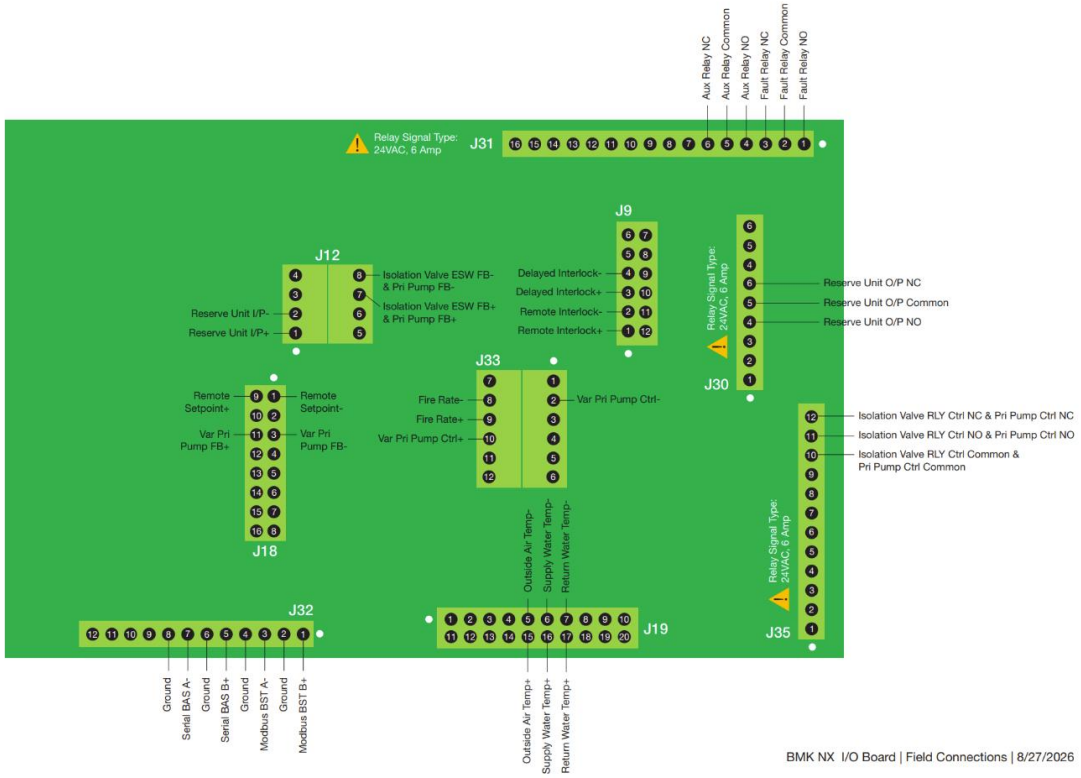


Figure E-2: IO Board 64220 Rev B2 showing only field-wiring terminal connections

Field Wiring Terminals	Terminal Pin Assignments
Terminal strips **J30, J31, and J35** contain relay connections	• **J30-P4,5,6** are available for Reserve Unit Output signal on Manager unit only. • **J31-P1,2,3** are available for Fault Relay output signal. • **J31-P4,5,6** are available for Aux Relay output signal. • **J35:P7,8,9** are available for System Aux Relay output signal on Manager unit only. • **J35:P10,11,12** are available for Isolation Valve Relay Ctrl and Primary Pump Switch Control signals.
Terminal strip **J12** contains digital input connections	• **J12-P1,2** are available for Reserve Unit Input signal on Manager unit only. • **J12-P7,8** are available for Isolation Valve E-Switch Feedback and Primary Pump Switch Feedback signals.
Terminal strip **J33** contains analog output connections	• **J33-P8,9** are available for Fire Rate signal as current or voltage. • **J33-P2,10** are available for Variable Primary Pump Control signals as current or voltage. **NOTE that Analog Output must be configured (see Section 8.1.5.3)**
Terminal strip **J18** has analog input connections	• **J18-P1,9** are available for Remote Setpoint signal as current or voltage. • **J18-P3,11** are available for Variable Primary Pump Feedback signal as current or voltage. **NOTE that Analog Input must be configured (see Section 8.1.5.2)**

Terminal strip **J19** has temperature sensor connections	• **J19-P5,15** are available for Outdoor Air Temperature sensor (for outdoor air reset) on Manager unit only. • **J19-P6,16** are available for System Header Temperature sensor on Manager unit only. • **J19-P7,17** are available for Return Header Temperature sensor on Manager unit only.

IOs	Functions	Signal Type	Board	Connector-Pin#
AI1	Remote Setpoint Default: Unassigned; configurable	0-10Vdc @ 1mA min or 0-20mA	IOB	J18-P9: AIN 1 J18-P1: Ain_GND
AI2	Isolation Valve FB / Var Pri Pump FB Default: Unassigned; configurable	0-10Vdc @ 1mA min or 0-20mA	IOB	J18-P11: AIN 2 J18-P3: Ain_GND
AO1	Fire Rate Default: Unassigned; configurable	0-20mA max / 0-10Vdc @ 50mA max	IOB	J33-P9: AOUT 1 J33-P8: Aout_GND
AO2	Var Pri Pump Ctrl Default: Unassigned; configurable	0-20mA max / 0-10Vdc @ 50mA max	IOB	J33-P10: AOUT 2 J33-P2: Aout_GND
DI1	Remote Interlock Default: Remote Interlock; read-only	0-24VAC / VDC @ 1mA per min	IOB	J9-P1: DIGITAL_IN_1 J9-P2: AIN_12/24v
DI2	Delayed Interlock Default: Delayed Interlock; read-only	0-24VAC / VDC @ 1mA per min	IOB	J9-P3: DIGITAL_IN_2 J9-P4: AIN_12/24v
DI7	Reserve Unit I/P Default: Unassigned; configurable	0-24VAC / VDC @ 1mA per min	IOB	J12-P1: DIGITAL_IN_7 J12-P2: AIN_12/24v
DI8	Demand Relay Status Default: Demand Relay Status; read-only	0-24VAC / VDC @ 1mA per min	IOB	J12-P3: DIGITAL_IN_8 J12-P4: AIN_12/24v
DI9	Unit Enable/Disabled SW [On Edge Front Panel] Default: Unit Enable/Disabled SW; read-only	0-24VAC / VDC @ 1mA per min	IOB	J5-13 to Enable/Disable switch J5-14 from Enable/Disable switch
DI10	Isolation Valve ESW FB / Pri Pump FB [Remote Interlock type] Default: Unassigned; configurable	0-24VAC / VDC @ 1mA per min	IOB	J12-P7: BST_VALVE J12-P8: 12vREF
DO1	Fault Relay Default: Unassigned; configurable	NO: 50,000 cycles, 120Vac @ 6A GP NO/NC: 100,000 cycles, 120Vac @3A GP	IOB	J31-P3: FAULT_RELAY_NC J31-P2: FAULT_RELAY_COM J31-P1: FAULT_RELAY_NO
DO2	Reserve Unit O/P Default: Unassigned; configurable	NO: 50,000 cycles, 120Vac @ 6A GP NO/NC: 100,000 cycles, 120Vac @3A GP	IOB	J30-P6: USER_RELAY1_NC J30-P5: USER_RELAY1_COM J30-P4: USER_RELAY1_NO
DO3	Demand Relay Default: Demand Relay; read-only	NO: 50,000 cycles, 120Vac @ 6A GP NO/NC: 100,000 cycles, 120Vac @3A GP	IOB	J30-P3: USER_RELAY2_NC J30-P2: USER_RELAY2_COM J30-P1: USER_RELAY2_NO
DO4	Aux Relay Default: Unassigned; configurable	NO: 50,000 cycles, 120Vac @ 6A GP NO/NC: 100,000 cycles, 120Vac @3A GP	IOB	J31-P6: AUX_RELAY_NC J31-P5: AUX_RELAY_COM J31-P4: AUX_RELAY_NO
DO5	System Aux RLY Default: Unassigned; configurable	NO: 50,000 cycles, 120Vac @ 6A GP NO/NC: 100,000 cycles, 120Vac @3A GP	IOB	J35-P9: USER_RELAY4_NC J35-P8: USER_RELAY4_NO J35-P7: USER_RELAY4_COM

IOs	Functions	Signal Type	Board	Connector-Pin#
DO6	Isolation Valve RLY Ctrl / Pri Pump Ctrl Default: Unassigned; configurable	NO: 50,000 cycles, 120Vac @ 6A GP NO/NC: 100,000 cycles, 120Vac @3A GP	IOB	J35-P12: USER_RELAY5_NC J35-P11: USER_RELAY5_NO J35-P10: USER_RELAY5_COM
DI10	Safety Reset Default: Safety Reset; read-only	NO: 50,000 cycles, 120Vac @ 6A GP NO/NC: 100,000 cycles, 120Vac @3A GP	IOB	J31-P9: USER_RELAY9_NC J31-P8: USER_RELAY9_COM J31-P7: USER_RELAY9_NO
TS4	Outside Air Temp (OAT) Default: Unassigned; configurable	Voltage	IOB	J19-P15: RTD_IN11 J19-P5: RTD 11 RETURN
TS5	Supply Header Temp 1 Default: Unassigned; configurable	Voltage	IOB	J19-P16: RTD_IN12 J19-P6: RTD 12 RETURN
TS6	Return Header Temp 1 Default: Unassigned; configurable	Voltage	IOB	J19-P17: RTD_IN13 J19-P7: RTD 13 RETURN

E.2.1 BTC II & PIM Field Connections for Troubleshooting

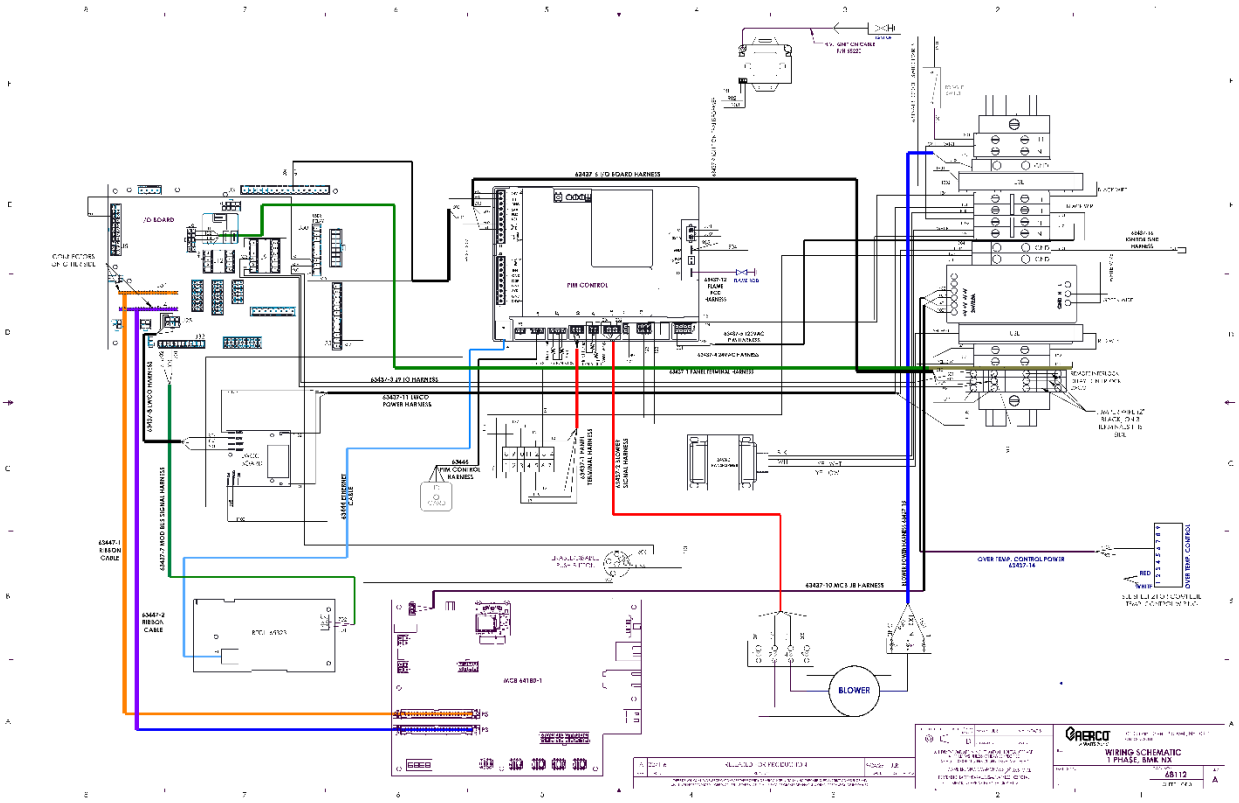


Figure E-3: Wiring schematic showing Edge X, BTC II and PIM connections

APPENDIX F – CASCADE WIRING & CONFIGURATION

On the Edge X IO Board connectors, pin 1 (P1) is designated by a white dot.

NOTE: Identify the **IOB** part number and version using the **Part Number** and **Assembly Revision** printed on the board's white label, then refer to the appropriate diagram in **Section F.1** or **Section F.2**.

F.1 IO Board 64188 Rev A Connection – BMK E

The white dot denotes pin #1 and numbers on the connector J16 increase from right to left. Pin numbers are added for clarity as they do not appear on the physical board.

On terminal strip J16 labelled "MODBUS", this pin is on the right-hand side. Pins J16 P1(+) and J16 P3(-) are dedicated for Cascade connections. A back view of the IO board showing the RS485 terminal for MODBUS protocol is shown below. Bottom right inset figure indicates the location of the IO board on the back of the controller. Refer to figure E-1 in Appendix E for pin number, location, and description.

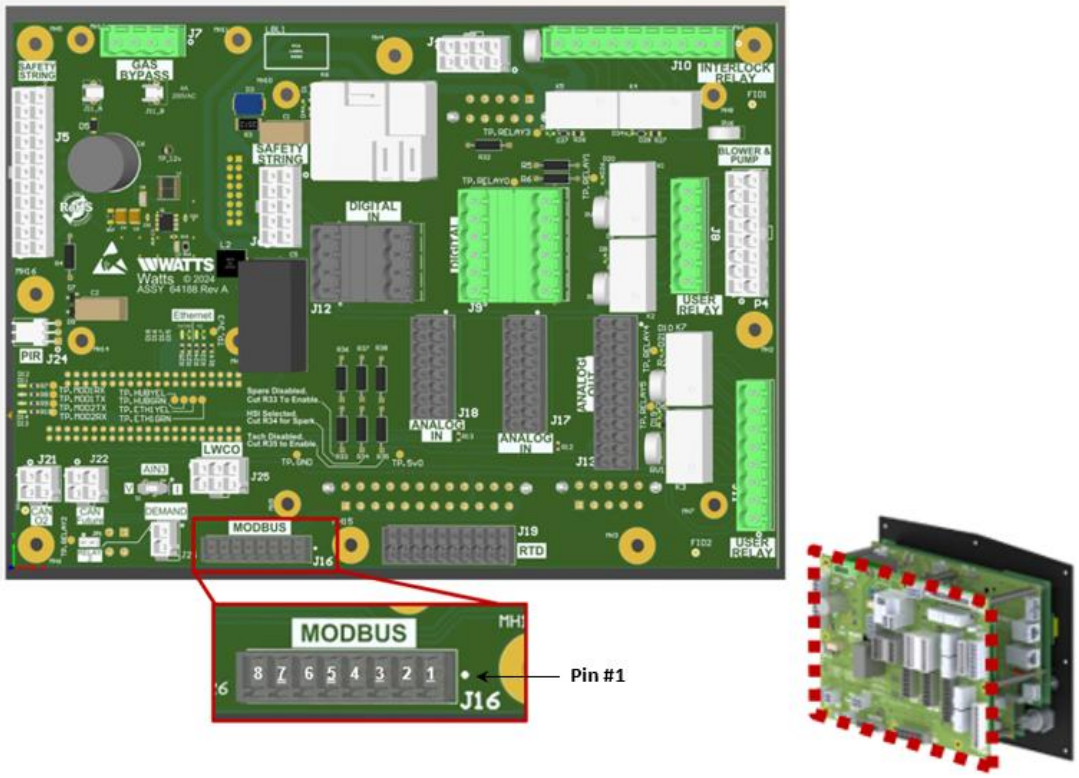


Figure F-1: IO Board (64188 Rev A) showing RS485 connection for MODBUS protocol

F.2 Cascade Communication Wiring – BMK E

Edge X controllers connected for Cascade should be daisy chained together per the RS485 standard. Specifically, communication wire should run from J16P1 on one controller to J16P1 on the next controller (+ to +), and likewise for J16P3 to J16P3 (- to -), and so on.

The wiring diagram in Figure F-2 below shows a 3-unit cascade with RS485 wiring. This wiring will carry MODBUS signals from unit to unit in the cascade. For RS485 connections, twisted pair, shielded, 18-24 AWG wire is recommended per the RS485 standard. In this cascade, units 1 and 3 should be terminated while unit 2 should be unterminated. NOTE that any of the units regardless of address can be assigned the cascade Manager role.

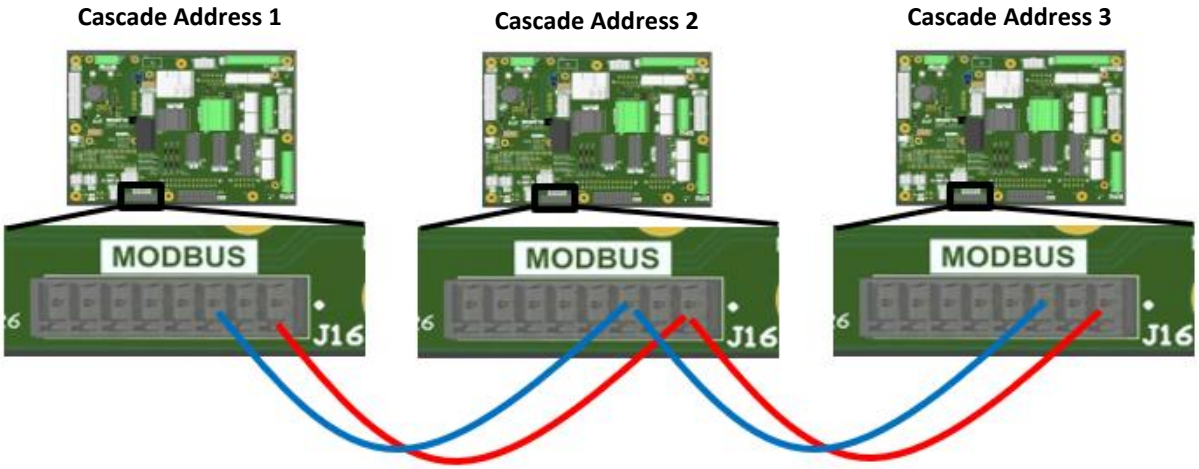


Figure F-2: RS485 daisy chain showing communication wire landings on IO board terminal strip J16P1 (red wire, +) and J16P3 (blue wire, -)

F.3 IO Board 64220 Rev B2 Connection – BMK NX

The white dot denotes pin #1 and numbers on the connector J32 increase from right to left. Pin numbers are added for clarity as they do not appear on the physical board.

On terminal strip J32 labelled "MODBUS", this pin is on the right-hand side. Pins J32 P1(+) and J32 P3(-) are dedicated for Cascade connections. A back view of the IO board showing the RS485 terminal for MODBUS protocol is shown below. Refer to figure E-2 in Appendix E for pin number, location, and description.

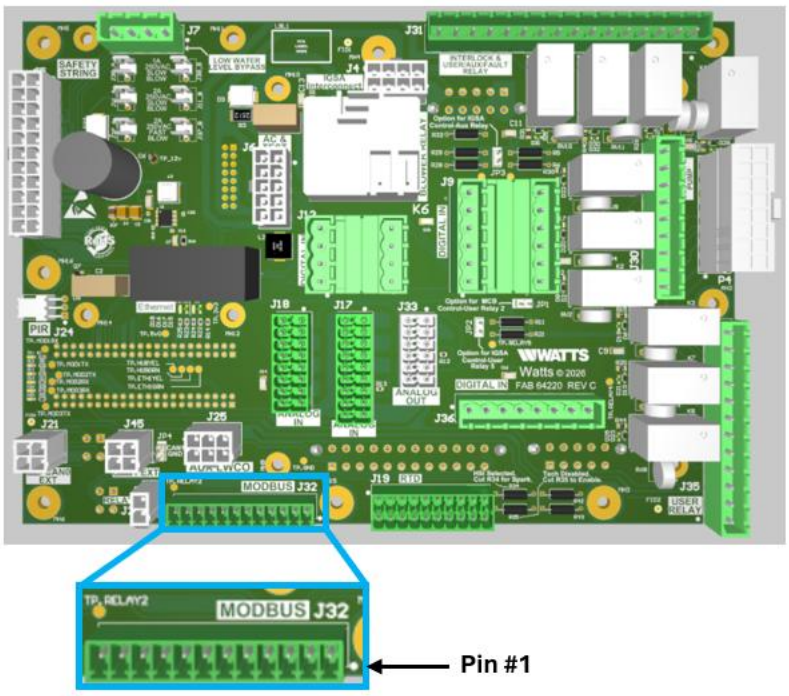


Figure F-3: IO Board (64220 Rev B2) showing RS485 connection for MODBUS protocol

F.4 Cascade Communication Wiring – BMK NX

Edge X controllers connected for Cascade should be daisy chained together per the RS485 standard. Specifically, communication wire should run from J32P1 on one controller to J32P1 on the next controller (+ to +), and likewise for J32P3 to J32P3 (- to -), and so on.

The wiring diagram in Figure F-4 below shows a 3-unit cascade with RS485 wiring. This wiring will carry MODBUS signals from unit to unit in the cascade. For RS485 connections, twisted pair, shielded, 18-24 AWG wire is recommended per the RS485 standard. In this cascade, units 1 and 3 should be terminated while unit 2 should be unterminated. NOTE that any of the units regardless of address can be assigned the cascade Manager role.

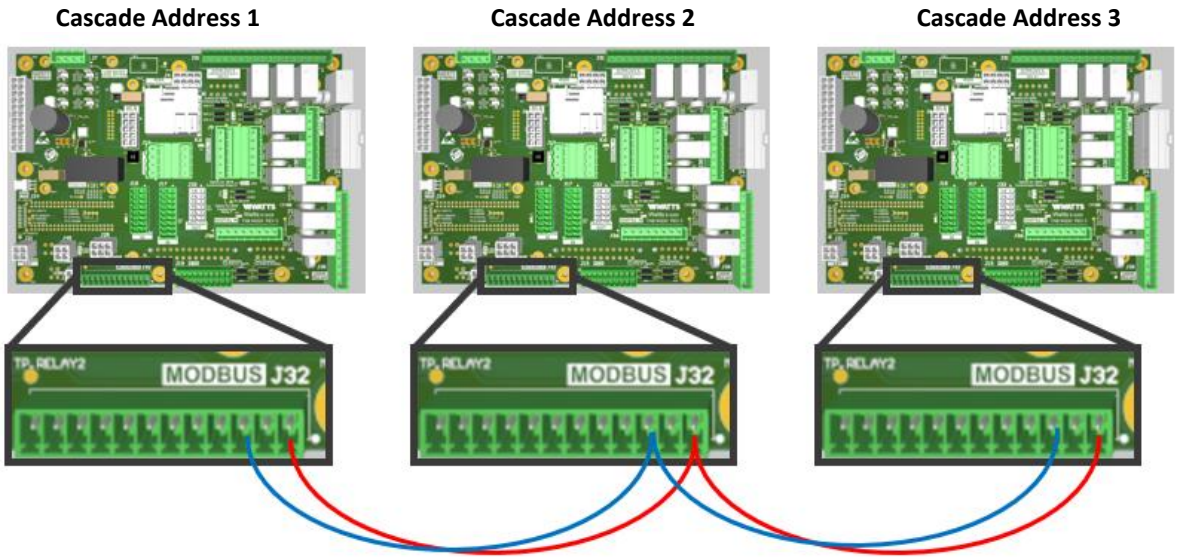


Figure F-4: RS485 daisy chain showing communication wire landings on IO Board terminal strip J32P1 (red wire, +) and J32P3 (blue wire, -)

F.5 Cascade Communication Termination

For field connection purposes, as seen below in Figure F-5, the MCB contains configuration switches for the MODBUS biasing and termination dip switches (SW2) for the Cascade chain
The figure below shows dip switch banks MODBUS2 (SW2) and MODBUS1 (SW4).

Cascade termination: For proper communication operation in a Cascade, the first and last unit in the chain should have MODBUS2 (SW2) TERM2 dip switch ON and the units internal to the chain should have TERM2 OFF. Only the first and last units should be terminated so that communication integrity is not compromised by signal reflection.

NOTE: Refer to Edge X Communication Manual OMM-0173 for BAS termination.

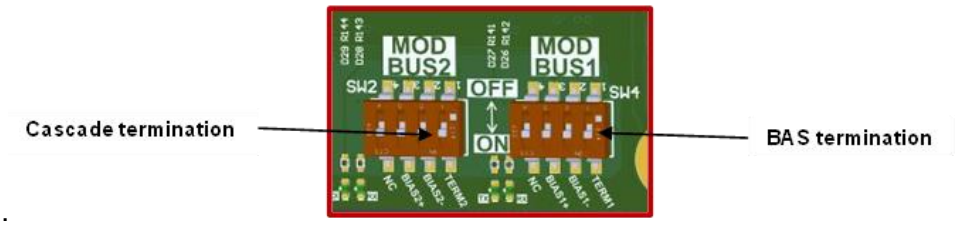


Figure F-5: Cascade and BAS Terminations

APPENDIX G – EDGE X STATE LIST

G.1 State List – BMK E

Applicable to	State	Description
BMK E & BMK	Unit Disabled	Edge controller **Enable/Disabled** switch is set to Disabled position.
BMK E & BMK	Standby	Displayed when: 1- Enable/Disable switch on Edge controller is in Enable position, but there is no demand for heat. 2- When unit is in failsafe 3- When Warm Weather Shutdown is enabled and Warm Weather Shutdown condition is satisfied
BMK E & BMK	Unit In Demand Delay	Demand delay timer is active. This timer represents the time allocated for isolation valve to open and make the remote interlock contact.
BMK	Purging	Displayed during the purge cycle during startup. The duration of the purge cycle counts up in seconds.
BMK	Ignition Trial	Displayed during ignition trial of startup sequence. The duration of cycle counts up in seconds.
BMK	Flame Proven	Displayed after flame has been detected for 2 seconds. Initially, the flame strength is shown in %. After 5 seconds has elapsed, the time and date are shown in place of flame strength.
BMK	Wait Ignition Retry	Retrial for ignition.
BMK	Wait Fault Purge	Fault while purging.
BMK	Wait Retry Pause	Pause before retrial for ignition.
BMK	Ignition Monitor	Waiting for proof of ignition.
BMK	Pre Ignition	Waiting for SSOV to prove open.
BMK	Cleaning Igniter	Ignition transformer is energized with SSOV closed.
BMK	Auto Diagnostic Mode ACTIVE	Informational message.
BMK	Auto Diagnostic Mode COMPLETED	Informational message.
BMK	Auto Diagnostic Mode ABORTED	Informational message.
BMK	O2 Cal Purge	O2 Purge in progress.
BMK	Auto Calibration In Progress	Auto Calibration in progress.
BMK	O2 Warning Service Required	O2 service is required.
BMK E & BMK	Fault	Unit has an active latching or non-latching fault
BMK E	Automatic Mode	Unit is running normally
BMK E	Manual Mode	Unit is being operated in Manual mode
BMK E & BMK	Starting	BMK E: Displayed during the initial power up only. BMK: Displayed for 2 minutes during the initial warm-up only for BMK.
BMK E	Meeting Demand	Displayed under Plant Dashboard when the plant is running towards meeting the demand
BMK E	Plant Failsafe Activated	Displayed when Manager loses contact with the external setpoint source.

G.2 State List – BMK NX

Applies to BMK NX standalone units and BMK NX-only cascades.

Applicable to	State	Description
BMK NX	Unit Disabled	Edge controller **Enable/Disabled** switch is set to Disabled position.
BMK NX	Standby	Displayed when: 1- Enable/Disable switch on Edge controller is in Enable position, but there is no demand for heat. 2- When unit is in failsafe 3- When Warm Weather Shutdown is enabled and Warm Weather Shutdown condition is satisfied
BMK NX	Unit In Demand Delay	Demand delay timer is active. This timer represents the time allocated for isolation valve to open and make the remote interlock contact.
BMK NX	Purging	Displayed during the purge cycle during startup. The duration of the purge cycle counts up in seconds.
BMK NX	Unit Post-Purging	Displayed during the post-purge cycle.
BMK NX	Ignition Trial	Displayed during ignition trial of startup sequence. The duration of cycle counts up in seconds.
BMK NX	Flame Proven	Displayed after flame has been detected for 2 seconds. Initially, the flame strength is shown in %. After 5 seconds has elapsed, the time and date are shown in place of flame strength.
BMK NX	Unit Fault	Unit has an active latching or non-latching fault
BMK NX	Manual Mode	Unit is being operated in Manual mode
BMK NX	Unit Starting	Displayed during the initial fire up only.
BMK NX	Meeting Demand	Displayed under Plant Dashboard when the plant is running towards meeting the demand
BMK NX	Plant Failsafe Activated	Displayed when Manager loses contact with the external setpoint source.

APPENDIX H – EDGE X ALERT LIST

The Edge X controller provides the following three types of alerts:

Warning – indicates a potential problem that requires attention or inspection by a trained technician to prevent further damage, major breakdowns, or safety hazards.

Fault Non-Latching – indicates a condition that causes the unit to standby and attempt a restart once the fault condition has cleared. Does not require a manual reset.

Fault Latching – This fault causes a standby and requires a manual reset even after the initial fault condition is cleared. Unlike a non-latching fault, a latched fault prevents unit operation to ensure the safety concern is addressed first.

These alert codes will be communicated from Edge X controller to BAS. For standalone unit, see BACnet Object ID 0. And for cascade unit, see BACnet Object IDs 302-1802.

NOTE 1: Table below shows mode (Standalone) and role (Manager & Client) that is able to publish the alert.
NOTE 2: All Manager and Client alerts are displayed on Manager Event History page (latest 200 records only).

H.1 Alert List – BMK E

CODE #	ALERT TYPE	ALERT MESSAGE	STANDALONE BMK E	MANAGER BMK E	CLIENT	
					BMK E	BMK
8	Fault Latching	High Temp Limit Control Open	Yes	Yes	Yes	Yes
9	Fault Latching	Primary Low Water Level	Yes	Yes	Yes	Yes
10	Fault Latching	Low Gas Pressure Fault	-	-	-	Yes
11	Fault Latching	High Gas Pressure Fault	-	-	-	Yes
12	Warning	Remote Interlock Open	Yes	Yes	Yes	Yes
13	Fault Latching	Delayed Interlock Open	Yes	Yes	Yes	Yes
14	Fault Latching	Airflow Fault During Purge	-	-	-	Yes
15	Fault Latching	SSOV Fault During Purge	-	-	-	Yes
16	Fault Latching	Prg Switch Open During Purge	-	-	-	Yes
17	Fault Latching	Ign Switch Open During Ignition	-	-	-	Yes
18	Fault Non-Latching	Airflow Fault During Ign	-	-	-	Yes
19	Fault Latching	Airflow Fault During Run	-	-	-	Yes
20	Fault Latching	SSOV Fault During Ignition	-	-	-	Yes
21	Fault Latching	SSOV Fault During Run	-	-	-	Yes
22	Fault Latching	Flame Loss During Ignition	-	-	-	Yes
23	Fault Latching	Flame Loss During Run	-	-	-	Yes
24	Fault Latching	High Exhaust Temp Switch	-	-	-	Yes
25	Fault Non-Latching	Loss of Power	-	-	-	Yes
28	Fault Non-Latching	High O2 Level	-	-	-	Yes
29	Fault Non-Latching	Low O2 Level	-	-	-	Yes
31	Fault Latching	SSOV Relay Failure	-	-	-	Yes
32	Fault Latching	Residual Flame	-	-	-	Yes
33	Fault Latching	Heat Demand Failure	-	-	-	Yes
34	Fault Latching	Ign Switch Closed During Purge	-	-	-	Yes
35	Fault Latching	Prg Switch Closed During Ign	-	-	-	Yes
36	Fault Latching	SSOV Switch Open	-	-	-	Yes
37	Fault Non-Latching	Ign Board Comm Fault	-	-	-	Yes
40	Fault Non-Latching	Remote Setpt Signal Fault	-	-	-	Yes
40	Warning	Remote Setpt Signal Warning	Yes	Yes	-	-
42	Fault Non-Latching	Outlet Temp Sensor Fault	-	-	-	Yes
43	Fault Non-Latching	FFWD Temp Sensor Fault	-	-	-	Yes
44	Fault Non-Latching	High Water Temp Fault	Yes	Yes	Yes	Yes

CODE #	ALERT TYPE	ALERT MESSAGE	STANDALONE BMK E	MANAGER BMK E	CLIENT	
					BMK E	BMK
45	Fault Latching	Line Voltage Out of Phase	-	-	-	Yes
46	Fault Latching	Stepper Motor Failure	-	-	-	Yes
47	Fault Non-Latching	Setpoint Limiting Active	-	-	-	Yes
48	Fault Non-Latching	Modbus Comm fault	-	-	-	Yes
48	Warning	BST Communication Loss	-	Yes	Yes	-
52	Warning	Exhaust Temp Sensor Short	-	-	-	Yes
53	Warning	Exhaust Temp Sensor Open	-	-	-	Yes
54	Warning	Warning Exhaust Temp High	-	-	-	Yes
55	Fault Latching	Exhaust Temp High	-	-	-	Yes
56	Warning	Inlet Temp Sensor Short	Yes	Yes	Yes	Yes
57	Warning	Inlet Temp Sensor Open	Yes	Yes	Yes	Yes
58	Warning	Inlet Temp High	Yes	Yes	Yes	Yes
59	Warning	Inlet Temp Low	Yes	Yes	Yes	Yes
60	Fault Non-Latching	Inlet Gas Press Sensor Open	-	-	-	Yes
61	Fault Non-Latching	Gas Plate Dp Sensor Open	-	-	-	Yes
62	Fault Non-Latching	O2 Percentage Low	-	-	-	Yes
63	Fault Non-Latching	O2 Sensor Malfunction	-	-	-	Yes
64	Warning	Warning O2 Level High	-	-	-	Yes
65	Fault Latching	Recirc Pump Failure	-	-	-	Yes
68	Fault Latching	Ignition Spark Fault	-	-	-	Yes
71	Fault Non-Latching	Too Many Cycles In 24 Hours	-	-	-	Yes
72	Fault Non-Latching	Too Many Ovrtemps In 24 Hours	-	-	-	Yes
73	Fault Non-Latching	Air Sensor Fault	-	-	-	Yes
88	Warning	Autocal Finished	-	-	-	Yes
89	Warning	O2 Sensor Out Of Range	-	-	-	Yes
91	Warning	Wait Sensor Warm-up	-	-	-	Yes
92	Fault Non-Latching	Air Pump Failed AERtrim Disabled	-	-	-	Yes
94	Warning	Isolation Valve Stuck Open	Yes	Yes	Yes	Yes
95	Fault Non-Latching	Isolation Valve Stuck Closed	Yes	Yes	Yes	Yes
99	Warning	Delta-T Activated	-	-	-	Yes
100	Warning	Delta-T Shutdown	-	-	-	Yes
102	Warning	IO Board Comm Failed	-	-	-	Yes
106	Warning	BST Warm Weather Shutdown	-	-	-	Yes
107	Warning	Warm Weather Shutdown	Yes	Yes	Yes	-
112	Warning	System Return Sensor Short Warning	-	Yes	-	-
113	Warning	System Return Sensor Open Warning	-	Yes	-	-
300	Warning	OAT Sensor Open Circuit	Yes	Yes	-	-
301	Warning	OAT Sensor Short Circuit	Yes	Yes	-	-
302	Warning	OAT Sensor Not Set	Yes	Yes	-	-
303	Fault Non-Latching	High Cabinet Temperature	Yes	Yes	Yes	-
304	Fault, Non-Latching	Cabinet Temp Sensor Open	Yes	Yes	Yes	-
305	Fault, Non-Latching	Cabinet Temp Sensor Short	Yes	Yes	Yes	-
306	Fault, Non-Latching	Outlet Temp Sensor Short	Yes	Yes	Yes	-
307	Fault, Non-Latching	Outlet Temp Sensor Open	Yes	Yes	Yes	-
308	Fault Latching	Demand Relay Open	Yes	Yes	Yes	-
309	Warning	Enable/Disable Switch Open	Yes	Yes	Yes	-
310	Fault Non-Latching	OTLC Open	Yes	Yes	Yes	-

CODE #	ALERT TYPE	ALERT MESSAGE	STANDALONE BMK E	MANAGER BMK E	CLIENT	
					BMK E	BMK
311	Warning	24VAC Safety String Invalid	Yes	Yes	Yes	-
312	Warning	Manual Run Enabled	Yes	Yes	Yes	-
313	Warning	Manual Run User Disabled	Yes	Yes	Yes	-
314	Warning	Manual Run Auto Disabled	Yes	Yes	Yes	-
315	Warning	Setback Schedule Enabled	Yes	Yes	-	-
318	Warning	Reserve Unit Enabled	Yes	Yes	-	-
319	Warning	Comm Failsafe Activated	Yes	-	Yes	Yes
320	Warning	SWT1 Sensor Short	-	Yes	-	-
321	Warning	SWT1 Sensor Not Set	-	Yes	-	-
322	Warning	SWT1 Sensor Open	-	Yes	-	-
323	Fault, Non-Latching	Valve/Pump Not Configured	-	Yes	Yes	-
324	Warning	Plant Failsafe Warning	-	Yes	-	-
325	Warning	Pri Pump FB Signal Lost	Yes	Yes	Yes	-
344	Warning	PLM Active via TS Priority	Yes	Yes	Yes	-
345	Warning	PLM Inactive via TS Priority	Yes	Yes	Yes	-
346	Warning	PLM Active via BAS Priority	Yes	Yes	Yes	-
347	Warning	PLM Inactive via BAS Priority	Yes	Yes	Yes	-
348	Warning	PLM Active via Analog Input Priority	Yes	Yes	Yes	-
349	Warning	PLM Inactive via Analog Input Priority	Yes	Yes	Yes	-
355	Warning	Remote Setpt AI Unassigned	Yes	Yes	-	-
900	Fault Latching	Secondary Low Water Level	Yes	Yes	Yes	-
901	Fault Latching	Cabinet Door Open	Yes	Yes	Yes	-

H.2 Alert List – BMK NX

CODE #	ALERT TYPE	ALERT MESSAGE	STANDALONE BMK NX	MANAGER BMK NX	CLIENT BMK NX
8	Fault Latching	High Temp Limit Control Open	Yes	Yes	Yes
9	Fault Latching	Primary Low Water Level	Yes	Yes	Yes
12	Warning	Remote Interlock Open	Yes	Yes	Yes
13	Fault Latching	Delayed Interlock Open	Yes	Yes	Yes
22	Fault Latching	Flame Loss During Ignition	Yes	Yes	Yes
23	Fault Latching	Flame Loss During Run	Yes	Yes	Yes
25	Fault Non-Latching	Loss of Power	Yes	Yes	Yes
32	Fault Latching	Residual Flame	Yes	Yes	Yes
40	Fault Non-Latching	Remote Setpt Signal Fault	Yes	Yes	-
42	Fault Non-Latching	Outlet Temp Sensor Fault	Yes	Yes	Yes
48	Fault Non-Latching	BST Comm Loss	-	Yes	Yes
52	Warning	Exhaust Temp Sensor Short	Yes	Yes	Yes
55	Fault Latching	Exhaust Temp High	Yes	Yes	Yes
56	Warning	Inlet Temp Sensor Short	Yes	Yes	Yes
94	Warning	Isolation Valve Stuck Open	Yes	Yes	Yes
95	Fault Non-Latching	Isolation Valve Stuck Closed	Yes	Yes	Yes
99	Warning	Delta-T Activated	Yes	Yes	Yes
105	Warning	No BAS Communication	Yes	Yes	Yes
107	Warning	Warm Weather Shutdown	Yes	Yes	-
112	Warning	RWT1 Sensor Short	Yes	Yes	-

CODE #	ALERT TYPE	ALERT MESSAGE	STANDALONE BMK NX	MANAGER BMK NX	CLIENT BMK NX
113	Warning	RWT1 Sensor Open	Yes	Yes	-
300	Warning	OAT Sensor Open	Yes	Yes	-
301	Warning	OAT Sensor Short	Yes	Yes	-
302	Warning	OAT Sensor Not Set	Yes	Yes	-
306	Fault, Non-Latching	Outlet Temp Sensor Short	Yes	Yes	Yes
307	Fault, Non-Latching	Outlet Temp Sensor Open	Yes	Yes	Yes
308	Fault Latching	Demand Relay Open	Yes	Yes	Yes
309	Warning	Enable/Disable Switch Open	Yes	Yes	Yes
312	Warning	Manual Run Enabled	Yes	Yes	Yes
313	Warning	Manual Run User Disabled	Yes	Yes	Yes
315	Warning	Setback Schedule Enabled	Yes	Yes	-
318	Warning	Reserve Unit Enabled	Yes	Yes	-
319	Warning	Comm Failsafe Activated	Yes	-	Yes
320	Warning	SWT1 Sensor Short	Yes	Yes	-
321	Warning	SWT1 Sensor Not Set	Yes	Yes	-
322	Warning	SWT1 Sensor Open	Yes	Yes	-
323	Fault, Non-Latching	Valve/Pump Not Set	Yes	Yes	Yes
324	Warning	Plant Failsafe Activated	-	Yes	-
325	Warning	Pri Pump FB Signal Lost	Yes	Yes	Yes
334	Fault, Non-Latching	Freeze Protection Emergency	Yes	Yes	Yes
335	Warning	Freeze Protection Auto Disabled	Yes	Yes	Yes
336	Warning	Freeze Protection Flow Enabled	Yes	Yes	Yes
337	Warning	Freeze Protection Unit On	Yes	Yes	Yes
338	Warning	Reserve Unit On	Yes	Yes	-
342	Warning	Adj Stpt Reached Stpt Hi Lmt	Yes	Yes	Yes
343	Warning	Adj Stpt Reached Stpt Low Lmt	Yes	Yes	Yes
379	Fault, Non-Latching	Blocked Condensate[3]	Yes	Yes	Yes
9988	Fault, Non-Latching	BTC II Communication Timeout	Yes	Yes	Yes
9990	Fault Latching	LGP/HGP/HIGH TEMP	Yes	Yes	Yes
9991	Fault, Non-Latching	EEROM	Yes	Yes	Yes
9992	Fault, Non-Latching	BLOWER SPEED BELOW MINIMUM	Yes	Yes	Yes
9993	Fault, Non-Latching	PIM INTERNAL FAILURE	Yes	Yes	Yes
9994	Fault, Non-Latching	AIR PRESSURE	Yes	Yes	Yes
9995	Fault, Non-Latching	BTC-PIM ID CARD ERROR	Yes	Yes	Yes
9996	Fault, Non-Latching	REMOTE PROOF	Yes	Yes	Yes
9997	Fault, Non-Latching	LOW HSI	Yes	Yes	Yes
9998	Fault, Non-Latching	FTBUS COMMUNICATION	Yes	Yes	Yes

[3] **Alert Code 379, Blocked Condensate (Non-Latching Fault):** This alert follows a timed retry sequence. During the initial 5 minute retry period, the alert remains active and cannot be manually cleared from the front panel. After three consecutive occurrences, the unit enters a 1-hour lockout. During the 1-hour lockout, the alert may be cleared using the front-panel CLEAR button once the blocked condensate condition has been corrected. If the condition remains when the lockout expires, another 1-hour lockout period begins.

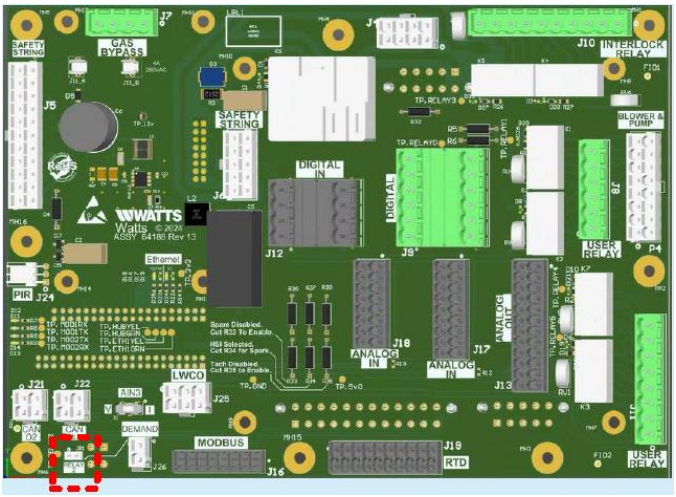
APPENDIX I – TROUBLESHOOTING – BMK E

⚠ WARNING!

Perform this procedure only if the unit model, controller, I/O-board part number, board revision, and wiring configuration exactly match those identified in this procedure and AERCO Technical Support has confirmed that the procedure applies. An incorrect jumper removal or connection can disable an indicator, compromise an interlock, damage a board, or cause unsafe operation.

1. **Issue: Enable/Disable button LED light stays active when unit is disabled.**

   Recommendation: Configure the IO board (AERCO PN 64188) to remove the jumper (SJ1) from the connector JP1 to disable the Enable/Disable button LED on the front panel for Benchmark E only.



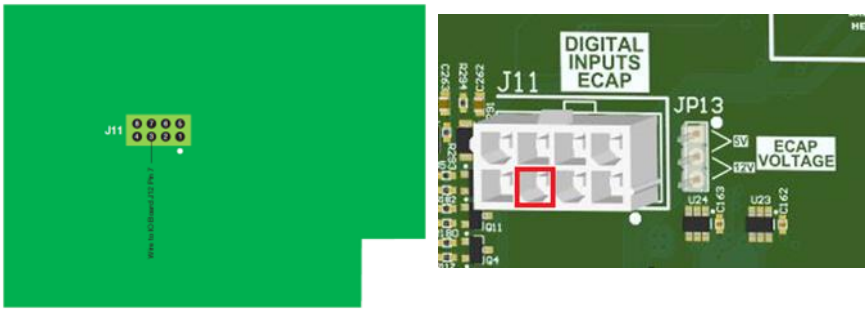
2. **Issue: Need to connect Isolation Valve RLY Ctrl or Pri Pump Ctrl digital output signal wiring.**

   Connection: From IO Board J12 Pin 7 to MC Board J11 Pin 3

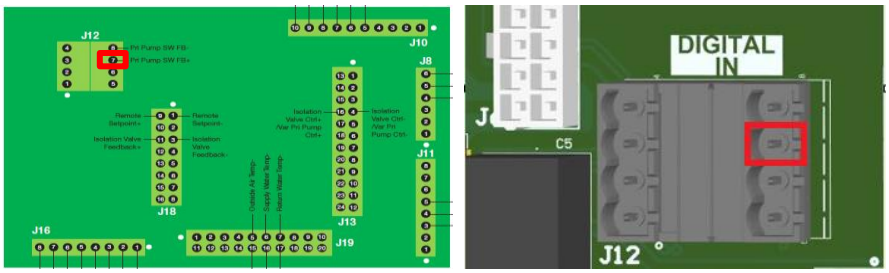
   Follow these instructions to wire J12 pin 7 TO MC Board J11 pin 3

   Step 1: Identify Connection Points

   1. Locate connector **J11 Pin 3** on the **Micro Control Board**. J11 Pin 3 is on the bottom row, second terminal from left.



   2. Locate connector J12 Pin 7 on the IO Board. J12 Pin 7 is on the right side, second terminal from top.



Step 2: Prepare the Wire

1. Cut 18-20 AWG wire to required length ensuring adequate slack.
2. Strip insulation from both ends (5–6 mm recommended).
3. Label each end:
    a. J11-3 → Primary Pump Feedback
    b. J12-7 → Primary Pump Feedback Input
4. Jump the wire across J11 Pin3 [MC Board] to J12 Pin7 [IO Board].

APPENDIX J – APPLICATION AND OPERATING SYSTEM UPDATE – BMK E

The Edge X Controller firmware v4.0.0 for Benchmark E boilers is available on Watts LMS. Select the update procedure based on the firmware version currently installed on the Controller.

Current Edge X Firmware Version	Update Media	Update Type	File Name
Below v1.2.13	SD card	Operating System and Application Software	AEX_6.12.0.tar.gz
v1.2.13 through v3.2.0	USB flash drive	Operating System and Application Software	AEX_6.12.0.tar.gz
Above v3.2.0	USB flash drive	Application Firmware	BMKE_4.0.0.tar.gz

NOTE: Verify the Edge X Controller date and time are correct before performing an update.

J.1 Firmware Below v1.2.13

For firmware below v1.2.13, update the Operating System (OS) Software using an SD card.

1. Contact your local representative to obtain an SD card containing **AEX_6.12.0.tar.gz**.
2. Verify the Edge X Controller date and time are correct.
3. Disable the BMK E unit using Enable/Disable switch.
4. Turn off power to the BMK E unit.
5. Insert the SD card. Make sure the pins are facing the user for correct SD card placement.
6. Restore power to the BMK E unit.
7. Check the 7-segment display at the upper left of the Front Panel.
8. Verify the 7-segment display progresses from 0 → 1 → 2, followed by a hyphen (-)..
9. When the hyphen (-) appears, turn off power to the BMK E unit.
10. Remove the SD card.
11. Restore power to the BMK E unit without the SD card installed.
12. Go to **Service > Software Update** and verify Software to confirm the update was successful.
13. Enable the unit using Enable/Disable switch.

CAUTION!
Do not interrupt power while the SD card update is in progress.

J.2 Firmware v1.2.13 Through v3.2.0

For firmware v1.2.13 through v3.2.0, update the OS Software using a USB flash drive.

1. Download **AEX_6.12.0.tar.gz** from Watts LMS and save it to a USB flash drive.
2. Verify the Edge X Controller date and time are correct.
3. Insert the USB flash drive into the Edge X Controller.
4. Go to **Settings > Transfer Settings > Save Settings** and save the unit configuration.
5. Disable the BMK E unit using Enable/Disable switch.
6. Go to **Service > Software Update > Unit Operating System Software** and follow the prompts.
7. Allow approximately 6 minutes for the OS update to complete.
8. Go to **Settings > Advanced Setup > Unit Settings > General** and select Reset All Settings.
9. Power cycle the Edge X Controller.
10. Go to **Settings > Transfer Settings > Load Settings**.
11. Verify the saved # number matches the unit serial #, then load the saved configuration.
12. Enable the unit using Enable/Disable switch.

NOTE: If OAR was enabled before the update, verify setting after the update and re-enable it if necessary.

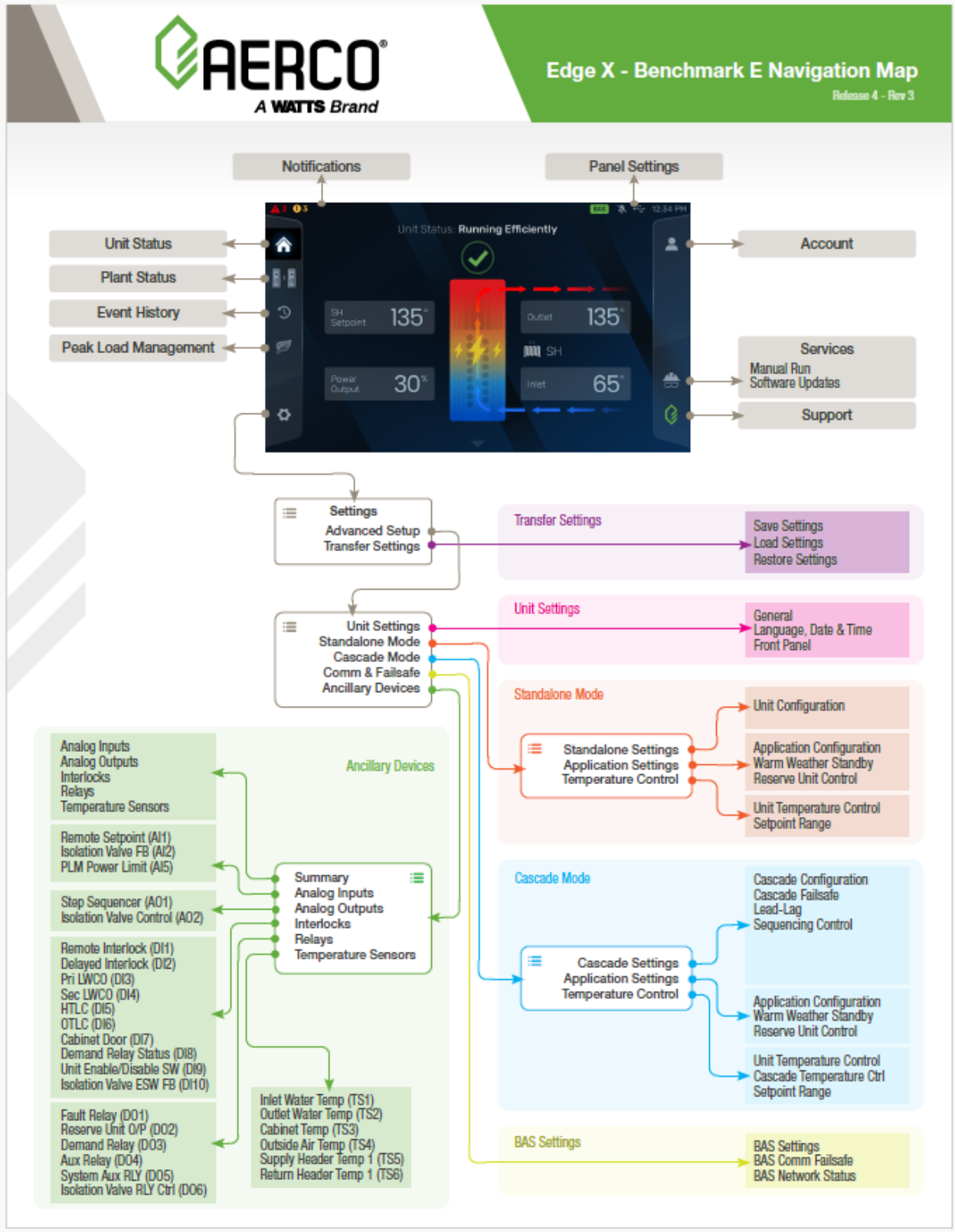
J.3 Firmware Above v3.2.0

For firmware above v3.2.0, update the Application Firmware using a USB flash drive.

1. Download the **BMKE_4.0.0.tar.gz** from Watts LMS and save it to a USB flash drive.
2. Verify the Edge X Controller date and time are correct.
3. Insert the USB flash drive into the Edge X Controller.
4. Go to **Settings > Transfer Settings > Save Settings** and save the unit configuration.
5. Disable the BMK E unit using Enable/Disable switch.
6. Go to **Service > Software Update > Unit Application Firmware**.
7. Follow the on-screen prompts to complete the Application Firmware update.
8. Go to **Settings > Advanced Setup > Unit Settings > General** and select Reset All Settings.
9. Power cycle the Edge X Controller.
10. Go to **Settings > Transfer Settings > Load Settings**.
11. Verify the serial number in the saved settings file matches the unit serial number, then load the saved configuration.
12. Enable the unit using Enable/Disable switch.

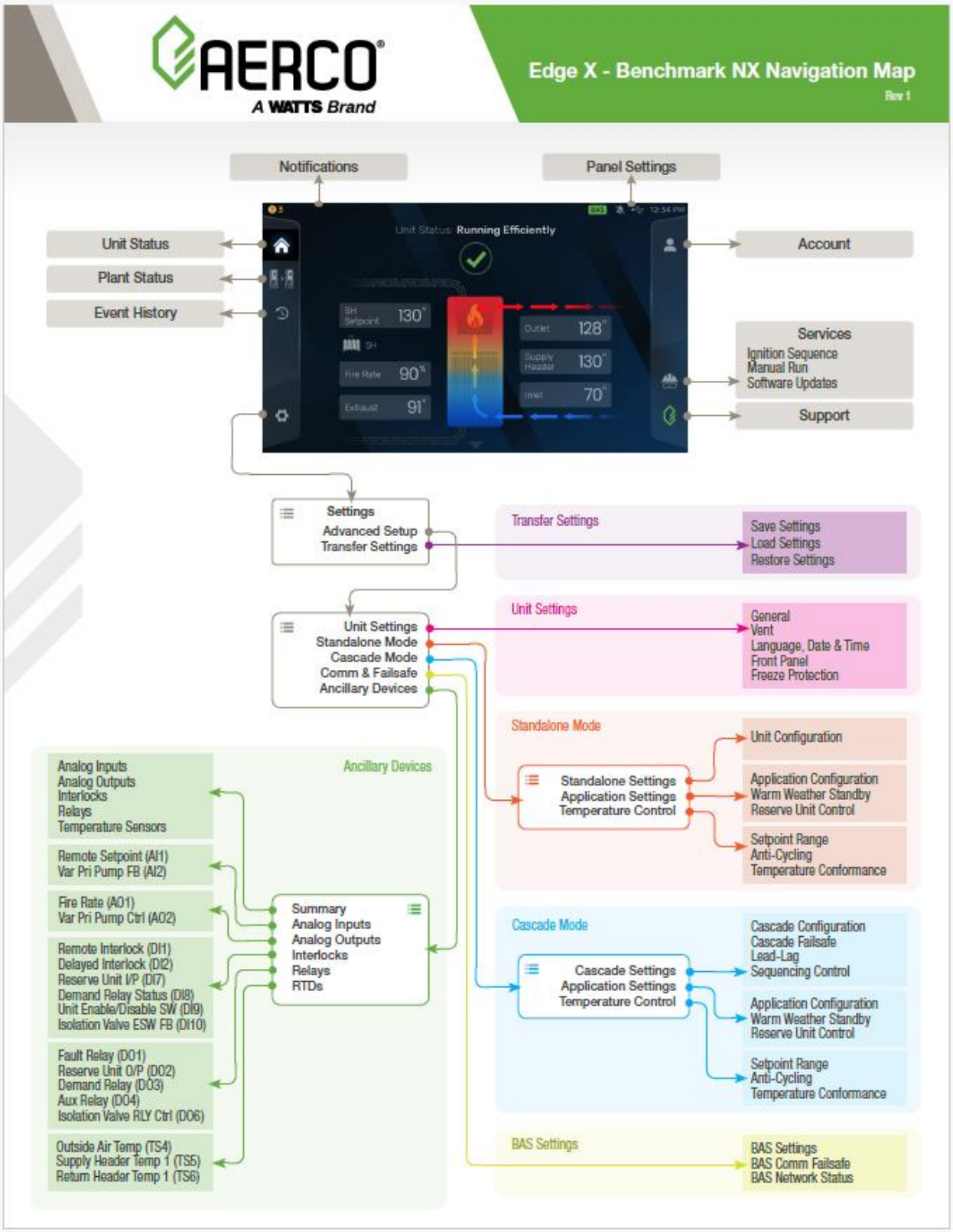
NOTE: If Outdoor Air Reset (OAR) was enabled before the update, verify the setting after the update and re-enable it if necessary.

APPENDIX K – EDGE X – BENCHMARK E NAVIGATION MAP



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APPENDIX L – EDGE X – BENCHMARK NX NAVIGATION MAP



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