HSC

Hydronic System Control

Installation and Operation

750-350
07/2012

TO: **Owners, Operators and/or Maintenance Personnel**

This operating manual presents information that will help to properly operate and care for the equipment. Study its contents carefully. The unit will provide good service and continued operation if proper operating and maintenance instructions are followed. No attempt should be made to operate the unit until the principles of operation and all of the components are thoroughly understood.

It is the responsibility of the owner to provide training and advice in all aspects of safety not only to his or her personnel, but to any contractors' personnel who will be servicing, repairing, or operating the equipment.

Cleaver-Brooks equipment is designed and engineered to give long life and excellent service on the job. The electrical and mechanical devices supplied as part of the unit were chosen because of their known ability to perform; however, proper operating techniques and maintenance procedures must be followed at all times.

Any "automatic" features included in the design do not relieve the attendant of any responsibility. Such features merely eliminate certain repetitive chores, allowing more time for the proper upkeep of equipment.

It is solely the operator's responsibility to properly operate and maintain the equipment. No amount of written instructions can replace intelligent thinking and reasoning and this manual is not intended to relieve the operating personnel of the responsibility for proper operation. On the other hand, a thorough understanding of this manual is required before attempting to operate, maintain, service, or repair this equipment.

Operating controls will normally function for long periods of time and we have found that some operators become lax in their daily or monthly testing, assuming that normal operation will continue indefinitely. Malfunctions of controls lead to uneconomical operation and damage and, in most cases, these conditions can be traced directly to carelessness and deficiencies in testing and maintenance.

The operation of this equipment by the owner and any operating personnel must comply with all requirements or regulations of the insurance company and/or other authority having jurisdiction. In the event of any conflict or inconsistency between such requirements and the warnings or instructions contained herein, please contact Cleaver-Brooks before proceeding.

Cleaver-Brooks

HSC

Hydronic System Control

Installation, Operation, Service and Parts Manual

Manual Part No. 750-350

Table of Contents

SECTION 1 - GENERAL DESCRIPTION AND PRINCIPLE OF OPERATION

Congratulations and thank you for choosing the Cleaver-Brooks Hydronic System Control. The Hydronic System Control (HSC) is designed to deliver optimum control of hydronic systems with multiple hot water boilers of all types, as well as connected pumps, valves, dampers, etc. The HSC can effectively manage condensing boiler or non-condensing boiler systems. The HSC is the ideal control for hot water systems with both condensing and non-condensing boilers, commonly referred to as a hybrid hydronic system.

The HSC is a highly flexible control system and has been designed with the user in mind. The HSC should provide many years of dependable, safe, and efficient operation for your hydronic system. To ensure optimum, trouble-free operation, please be sure to follow all instructions in this manual regarding proper installation, set-up, operation, and maintenance.

1.1 - System Description

The Cleaver-Brooks Hydronic System Control, or HSC, is a control system specifically designed to deliver heating water at a desired set point to a building heating system or similar process heating application. The HSC can effectively and efficiently control up to ten (10) condensing boilers and up to ten (10) non-condensing boilers sharing a common supply and return. The HSC can also sequence and modulate up to four (4) system pumps. In addition, the HSC can provide boiler start permissive interlock control for up to twenty-four (24) combustion air dampers, draft controls, gas boosters, etc., or any combination thereof.

The HSC performs PID set point control to maintain the system supply temperature. The HSC calculates the optimum set point based on an outdoor reset schedule configured for the particular site. Boilers, pumps, and valves are selected and controlled as needed to meet the system's requirements.

The system consists of an Administrator managing a network of one or more satellite control modules utilizing the CANbus network architecture. The Administrator is installed in a convenient and central location for user access and input connections. Up to four temperature transmitters and six discrete inputs can be connected to the Administrator. The Administrator has outputs to locally enable two system pumps and two DHW pumps/valves, as well as a bypass valve and general system alarm.

The Administrator accepts 4-20mA current inputs for the common header supply temperature, a condensing boiler header supply temperature (for hybrid systems), a header return temperature and outside air temperature. Digital inputs include system enable, domestic hot water (DHW) demand priority, cold building setpoint override, and local system pump proves. In lieu of the HSC's outdoor reset set point calculation, the Administrator can receive a remote set point from an energy management system via 4-20mA input or Modbus RTU.

A satellite control module - referred to as a Boiler Interface Module -- is installed at each boiler in the network and includes control of connected boiler pump and/or isolation valve. A Pump Interface Module is used to remotely enable, stage, and modulate up to four system pumps. A Damper Interface Module is also available for boiler start permissive interlock function such as applications utilizing combustion air dampers, draft controls, gas boosters, etc.

The HSC Administrator features a 6" color touch-screen interface and Modbus RTU interface. The Administrator provides visual indication of connected temperatures, calculated set point(s), individual boiler status and sequence, and any alarms. Basic system setup and commissioning are performed at the Administrator panel, including boiler assignments and staging methods, outdoor reset

schedule, night setback schedule, and PID tuning. A trend analysis screen can be utilized for system tuning. The Administrator includes active alarm status and alarm history.

The Boiler Interface Module (BIM) includes a 3.5" monochrome touch-screen display and two RTD temperature inputs used for boiler modulation, boiler outlet temperature limiting and boiler pump modulation. Boiler monitoring and control connections are made between the boiler controls and BIM. Boiler specific parameterization is done at the BIM including, low fire hold time, outlet temperature limit, boiler pump/valve configuration and damper interlock assignment.

The Pump Interface Module (PIM) also features a 3.5" monochrome touch-screen display and one pressure transmitter input for system pump modulation. System pump monitoring and control connections are made between the pump controls and PIM. Pump specific parameter configuration is done at the PIM, including pump staging, analog input scaling, pump modulation set point, and PID tuning.

The Damper Interface Module (DIM) has a monochrome LCD display with keypad interface. The DIM is used for boiler start permissive interlock functions and has the necessary outputs and inputs for enabling and proving connected devices. The boiler interlock function ensures the necessary damper(s), draft control(s), gas booster, etc. are enabled and functioning prior to allowing assigned boilers to start.

1.2 - Principle of Operation

The Hydronic System Control monitors the temperature in the main heating supply header and selects boilers and controls their firing rates to maintain the ideal system set point temperature.The HSC determines the optimum setpoint by way of an outdoor temperature reset schedule which is user-defined. The HSC utilizes the firing rate threshold method to add and drop boilers as required while performing PID modulation setpoint control to maintain the optimum system temperature.

The HSC uses a central Administrator to coordinate satellite modules via a control area network (CANbus). Each boiler in the network will have a Boiler Interface Module (BIM) that monitors the boiler's local conditions and communicates this information to the Administrator. Each BIM has the ability to enable and modulate a connected boiler pump and/or isolation valve. The Administrator uses the information gathered over the network to monitor and control the function of each boiler.

The Administrator can enable one or two connected system pumps via local discrete connections. In addition, the HSC has the ability to control up to four system pumps via a Pump Interface Module (PIM) on the network. With the PIM, the HSC can perform system pump sequencing, modulation, and lead rotation.

The HSC can provide boiler start permissive interlock function with the Damper Interface Module (DIM). The DIM can be connected to combustion air damper(s), draft control, gas booster, etc. to be used as an interlock for individual boiler start. Up to 24 "dampers" can be enabled with each DIM having up to 6 enable outputs and 6 prove inputs (Maximum of four DIM's on a HSC network).

When the HSC Administrator is first enabled, connected system pumps are enabled to ensure flow through the hydronic system before calling any boilers. Based on the boiler system configuration and outdoor temperature, the HSC determines the appropriate heating mode and system setpoint.

When the main supply header temperature drops below the setpoint, the first boiler (Lead) is called. Upon successful ignition and completion of low fire hold, the HSC Administrator provides a modulating firing rate signal to the Lead boiler. Following the add stage delay time - while the system temperature remains below set point -- and when the Lead boiler reaches the firing rate threshold to add

another boiler, the Lag1 boiler will be called. Upon successful ignition and completion of the Lag1 boiler low fire hold, both boilers will modulate in unison to meet set point. If another boiler is available and both boilers have reached the add stage firing threshold, the Lag2 boiler will be called with a repeat of the Lag1 boiler start and modulation sequence. Boilers are added in this fashion as required until all available boilers are firing in unison.

When the system temperature exceeds the system set point, the modulation rate of the firing boilers is decreased in unison. When the modulation rate for a boiler group reaches the drop stage firing threshold, a drop stage will be initiated and one boiler will be dropped from the group. Lag boilers will continue to be dropped until only the Lead boiler is firing. The Lead boiler will shut down when its modulation rate reaches the minimum firing rate and the main supply temperature has exceeded the system high limit above set point. If configured for a primary flow pumping arrangement, the Lead boiler's isolation valve or pump will remain open (or enabled) to ensure flow through the system is not interrupted. The system pump(s) continue to operate as long the system is enabled and the outdoor temperature remains below the warm weather shutdown set point.

As the modulation rate approaches the add/drop thresholds and if the header temperature deviates outside of the narrow deadband limits around set point, boilers will be added or dropped to help achieve the setpoint. This control method optimizes boiler operational efficiency while minimizing unnecessary boiler cycling.

The boilers are controlled with a sequenced Lead-Lag basis in either a First On-First Off or a Last On-First Off mode (user selectable). With First On-First Off mode, the Lead boiler is automatically rotated when a drop stage is initiated.

In Last On-First Off mode, the Lead boiler may be automatically rotated on a timed basis. The operator may also manually select the Lead-Lag sequence for the boilers.

In a hybrid system, the boilers are controlled within their condensing or non-condensing boiler groups. The "lead" group is determined according to outside air temperature (OAT). When the OAT is above a user selectable outdoor temperature switchover setpoint, the system is in 'Condensing' mode and will run the condensing boilers as the lead group. When the OAT is below the outdoor switchover temperature setpoint, the system is in 'Non-Condensing' mode and will run the non-condensing boilers as the lead group. When all the boilers of a group are running at capacity and more heating is required, the system will begin running boilers in the "non-lead" group. This mode is called Non-Condensing assist mode.

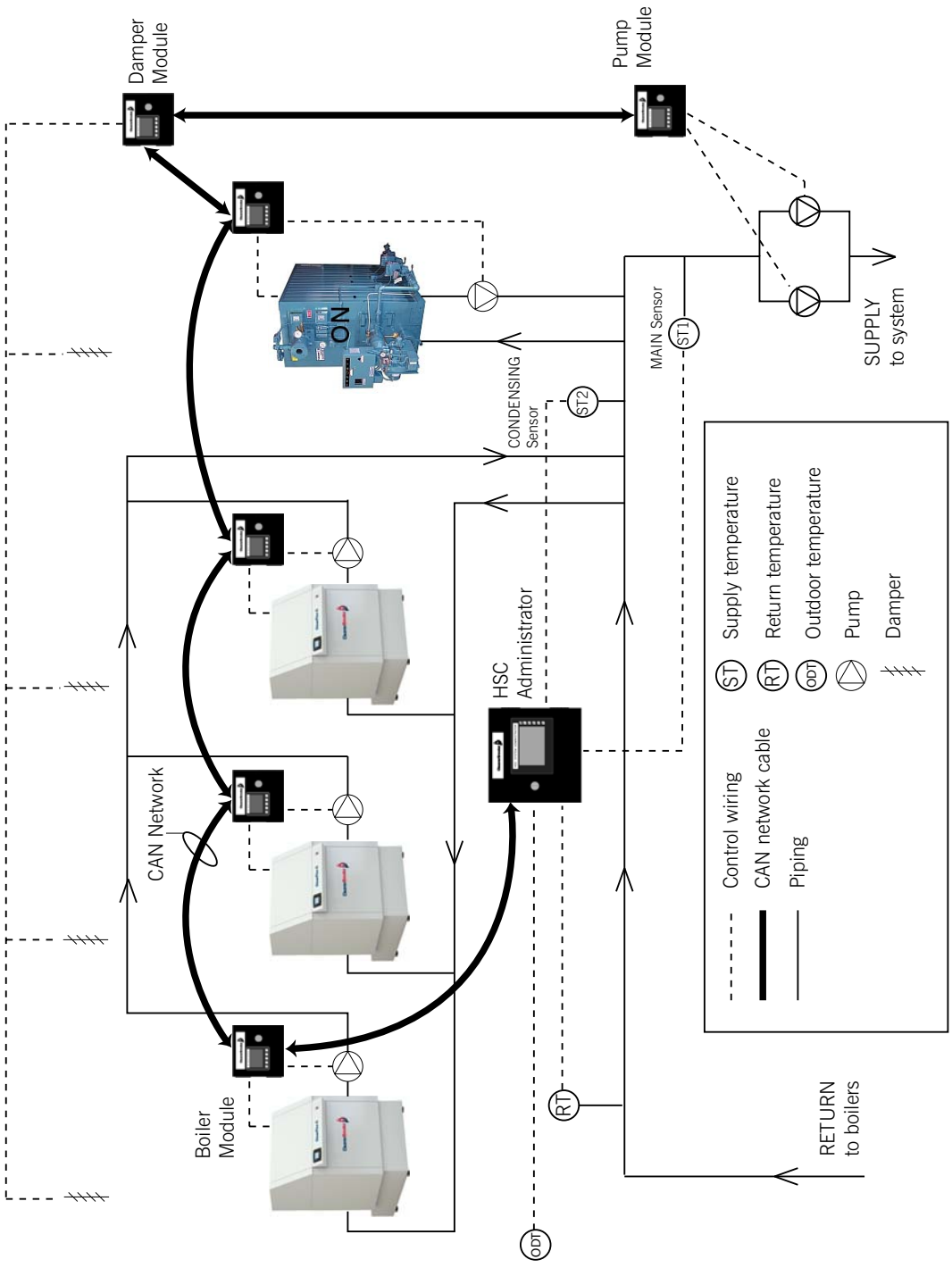
An additional feature of the HSC is that it ensures operation above the minimum inlet temperature for non-condensing boilers.

When running in condensing mode, the condensing boilers are controlled according to the main supply header temperature transmitter. When running in non-condensing mode, or non-condensing assist mode, the condensing boilers are controlled according to the condensing header temperature transmitter.

1.3 - Example System Schematic

The example below shows a typical ‘hybrid’ HSC system using both condensing and non-condensing boilers in a primary/secondary piping configuration. The control system components are daisy-chained over the CANbus network. The example shows the Administrator connected to four Boiler Interface Modules, a Damper Interface Module, and a Pump Interface Module.

For additional example systems see **SECTION 6** in this manual.



In condensing mode the condensing boilers are controlled according to **ST1**, the main supply temperature transmitter.

In non-condensing mode or non-condensing assist mode, the condensing boilers are controlled according to **ST2,** the condensing header transmitter. Non-condensing assist mode allows the condensing boilers to essentially preheat water for the non-condensing boilers.

Non-condensing boilers are always controlled to meet the setpoint at **ST1.** In this way the HSC is able to simultaneously take advantage of the unique performance characteristics of each type of boiler.

SECTION 2 - INSTALLATION

HSC Technical Specifications

POWER

Input Voltage: 110-120V/1/50-60Hz
Power Consumption (each module): 1 amp

ENVIRONMENTAL

Operating Temperature: 0 C to 50 C (32 F to 122 F)
Storage Temperature: minus 20 C to 50 C (minus 40 F to 122 F)
Relative Humidity: 5 to 95% Non-condensing

GENERAL

Display Interface, Administrator: LED Backlit 6" TFT LCD aspect (4x3) pixels (320/240) Interface for navigation, configuration, and data entry.
Power Center: 2A circuit breaker at each module.

ENCLOSURE

Rating: NEMA type 1
Construction: ABS Plastic in steel enclosure

CONNECTIVITY

CANbus (communication to remote modules)
Serial ports (factory programming and Modbus RTU for bldg communication interface)
Removable media (2GB micro SD for backup/restore & data logging)
USB (for factory programming only)

INPUTS

Digital: Up to 150 power supplied field dry contacts
Analog Signal: System Temperatures - main supply header, condensing supply header, main return header, and outdoor air or remote set point - (4) 4-20mA transmitters, scalable
System Pump - Pressure or Temperature
(2) 4-20mA transmitters, scalable
Up to (40) PT100 RTD sensor inputs; (2) temperature sensors per boiler

OUTPUTS

Contacts:
Up to (110) SPDT 5A resistive, 1/6 HP
Up to 30 SPST 1A resistive

Analog Signal:
Up to (48) 4 - 20 mA standard

SELECTION GUIDE

1 - 20 Boilers

1 - 20 boiler primary pumps

1 - 8 system pumps

1 - 24 combustion air damper or draft inducer controls.

STANDARD PERIPHERALS

(3) Temperature Sensors with wells: Main System Supply, Condensing Header, Return Header
Main System Temperature
Outdoor Air (1) Temperature Sensor w/weather enclosure
Boiler Temperature (2) temperature sensors per boiler

2.1 - Cables and Wiring

The interconnecting signal cables between the Administrator and field devices should be located as far as possible from high voltage wiring and large electrical equipment. Items like the ignition cable and combustion air fan motor can introduce voltage spikes which could upset the operation of the Administrator. The signal cables should be run at right angles to any power wiring and must not be routed with any boiler wiring.

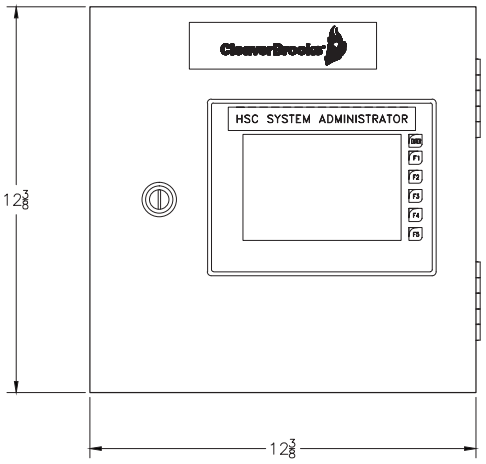
Each control panel requires 115 VAC, 2 amp. All wiring must conform to the National Electrical Code (NEC), and all applicable local codes.

See illustrations/tables in this section and wiring diagrams in **SECTION 5**.

2.2 - HSC System Administrator

The Administrator Panel may be mounted on a pedestal, a wall, or a convenient post. To avoid excessive heat or vibration, it should not be mounted on a boiler. Also, it must be located away from large or high voltage equipment such as power distribution panels, motors, ignition transformers, etc. If pedestal mounted, the base must be securely anchored.

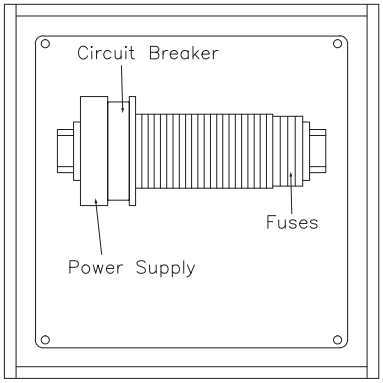
HMI Display - The Administrator has a built-in color touch screen display. It shows all the information pertaining to the HSC system and is the means for operator interface to the system. All operating parameters are entered and/or adjusted via this touchscreen interface.



Power Supply - The 24 VDC power supply mounted on the back panel provides power to the Administrator.

Relays - The relays provide dry contacts for use by the customer as well as an interface with the pump motor starters.

Circuit Breaker/Fuse Blocks - These provide protection from electrical shorts caused by improper wiring or damaged electrical equipment.

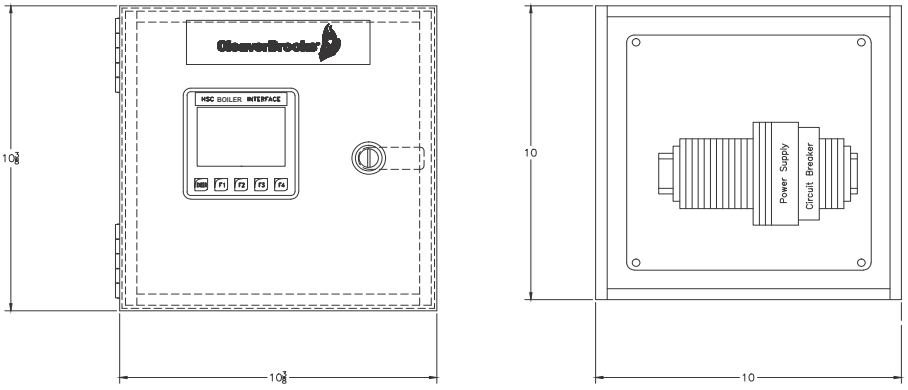


2.3 - Remote Interface Modules

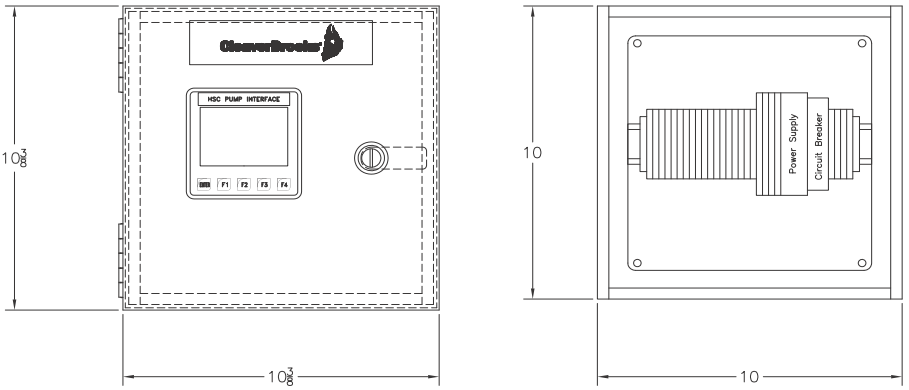
Remaining components should be located with a view toward ease of use, while minimizing interconnecting wiring. Each Boiler Interface Module (BIM) should be located near its respective boiler. The Pump Interface Module (PIM) should be close to any associated pump starters or VSDs. The Damper Interface Module (DIM) should be located near its associated device(s) (combustion air dampers, etc.).

Terminating resistors (121 Ω) are required on the System Administrator and the last device in the CANbus network. See wiring diagrams.

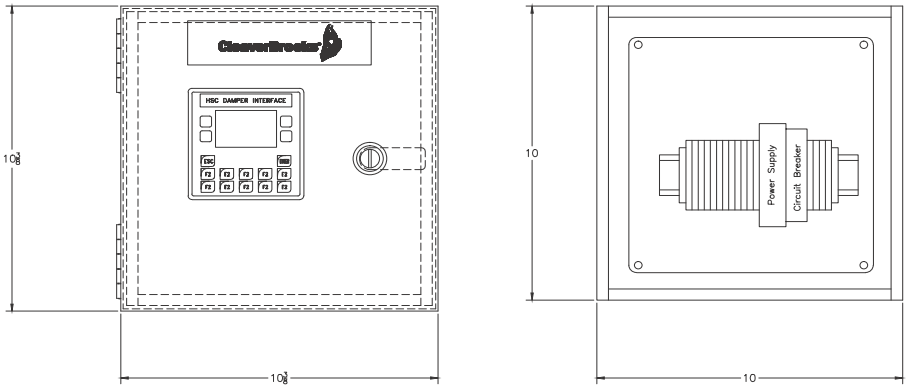
BOILER INTERFACE MODULE



PUMP INTERFACE MODULE



DAMPER INTERFACE MODULE



2.4 - Parts List

System Admin Kit 880-04266		
Qty	P/N	Description
1	283-03646	System Administrator Panel, w/ UL Listed cct brkr & pwr supply, NEMA 1
3	834-00488	Water Temp transmitter 4-20 mA, w/ thermowell, 1/2"NPT x 4" L
1	834-00489	Outdoor Temperature Transmitter
200’	826-00100	Cable, 2C shielded, for temperature sensors
200’	826-00104	Cable, 4C shielded, for CANbus network

Boiler Kit (CF) 880-04267		
Qty	P/N	Description
1	283-03647	Boiler Interface (BIM), w/ UL Listed cct brkr & pwr supply, NEMA 1
2	834-00490	Water Temp sensor, PT100 RTD, w/ thermowell, 1/2"NPT x 4" L
1	836-01136	Contact block, NO (for demand switch - "boiler ready")
50	826-00100	Cable, 2C shielded, for temperature sensors

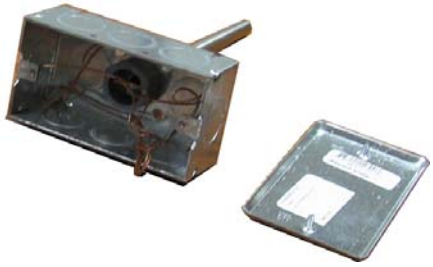
Boiler Kit (non CF) 880-04268		
Qty	P/N	Description
1	283-03647	Boiler Interface (BIM), w/ UL Listed cct brkr & pwr supply, NEMA 1
2	834-00490	Water Temp sensor, PT100 RTD, w/ thermowell, 1/2"NPT x 4" L
50	826-00100	Cable, sensors
1	880-00238	Resistor kit, convert 4-20mA for M954/M955 mod motors

Auxiliary Pump Kit 880-04269		
Qty	P/N	Description
1	283-03648	Aux. Pump Interface Module (PIM), w/ UL Listed cct brkr & pwr supply, NEMA 1
4	832-02204	Resistor, 500 ohm, 3 watt

Auxiliary Damper Kit 880-04270		
Qty	P/N	Description
1	283-03649	Aux. Damper Interface Module (DIM), w/ UL Listed cct brkr & pwr supply

Options	
826-00100	Cable, shielded, 2C, 22 AWG
834-00491	Water Temp Transmitter, strap-on, 0-300F range, 4-20mA, matched cal - pipe mount
826-00104	Cable, shielded, 4C, 18 AWG - CANbus network
834-00492	Water Temp Sensor, PT100 RTD, strap-on - pipe mount
833-03501	Relay, SPDT, 24V coil, 6A, TB style
833-09920	Signal Splitter, 4-20mA, 1 input/2 output
	Transmitter, Differential Pressure, 3-valve manifold, scalable, 4-20mA output

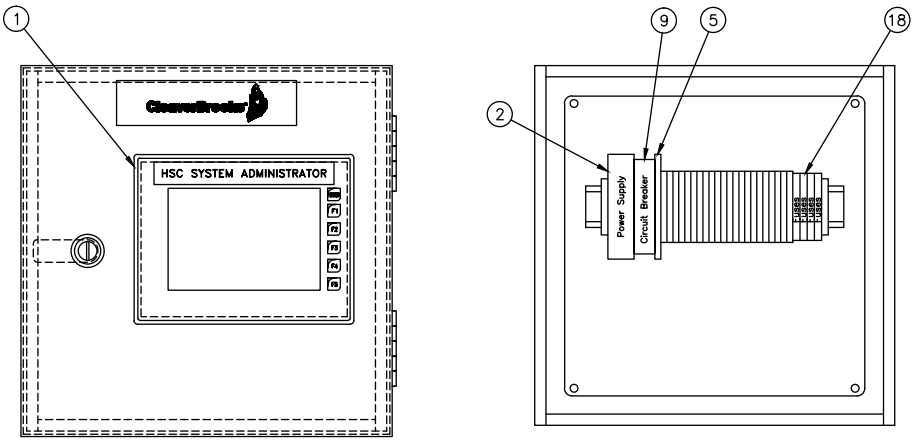
34-00488 Water Temp. Transmiter



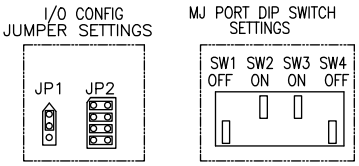
34-00490 Water Temp. Sensor

834-00489 Outdoor Temp. Transmitter

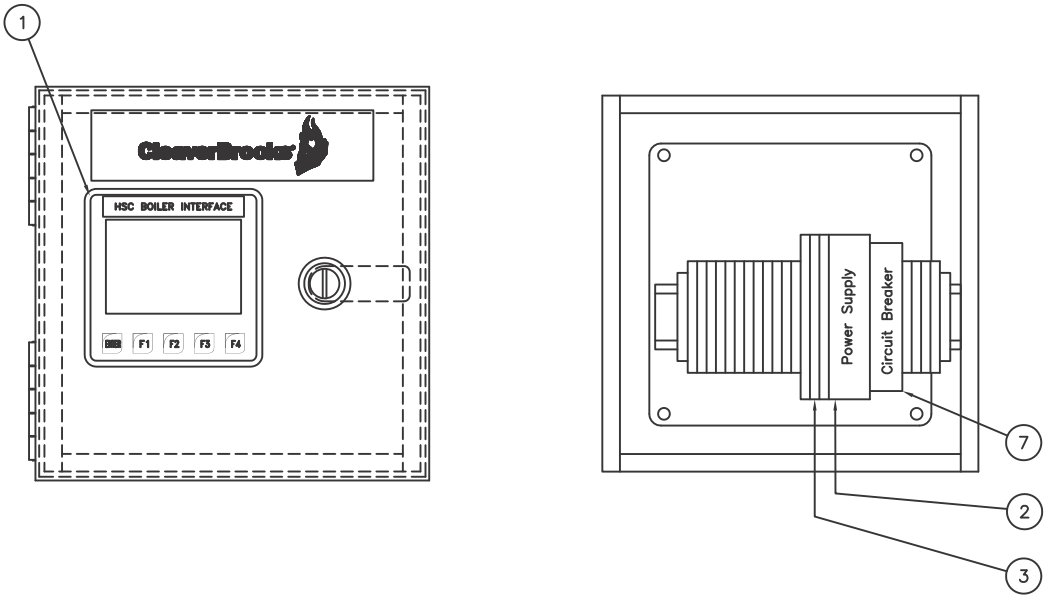
System Administrator Module 283-03646



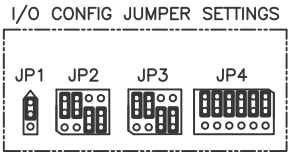
ITEM	QTY.	CB PART#	DESCRIPTION
1	1	833-03812-000	PLC,HMI,5.7" COLOR,4AI,6DO,12DI
2	1	832-02575-000	POWER SUPPLY 24 VDC, 30 W
5	1	833-09942-000	RV RELAY & SV SOCKET, 6mm, 24V AC/DC
9	1	983-00085-000	CIRCUIT BREAKER
17	1	985-00488-000	PROGRAM, HSC, ADMIN
18	4	832-02435-000	FUSE, 1/8 A, 5 x20mm, FAST ACTING

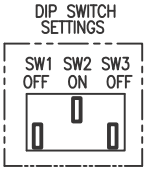


Boiler Interface Module 283-03647

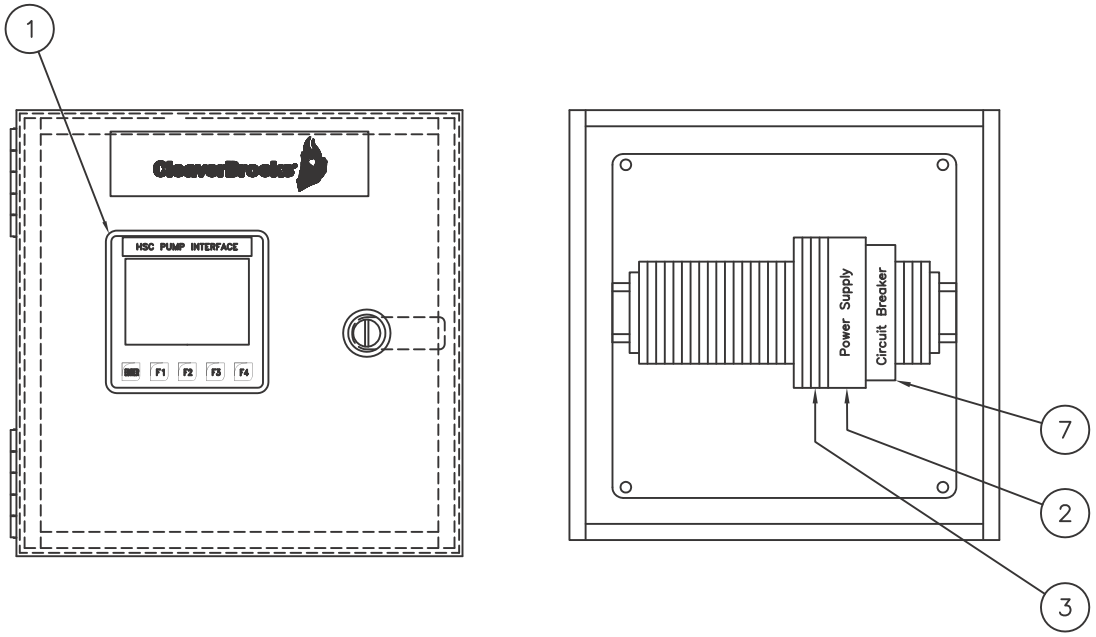


ITEM	QTY.	CB PART#	DESCRIPTION
1	1	833-04072-000	PLC/HMI, LCD DISPLAY, 2AI, 2AO, 12DI, 12DO
2	1	832-02575-000	POWER SUPPLY 24 VDC, 30 W
3	3	833-09942-000	RV RELAY & SV SOCKET, 6mm, 24V AC/DC
7	1	983-00085-000	CIRCUIT BREAKER
14	1	985-00489-000	PROGRAM, HSC, BOILER



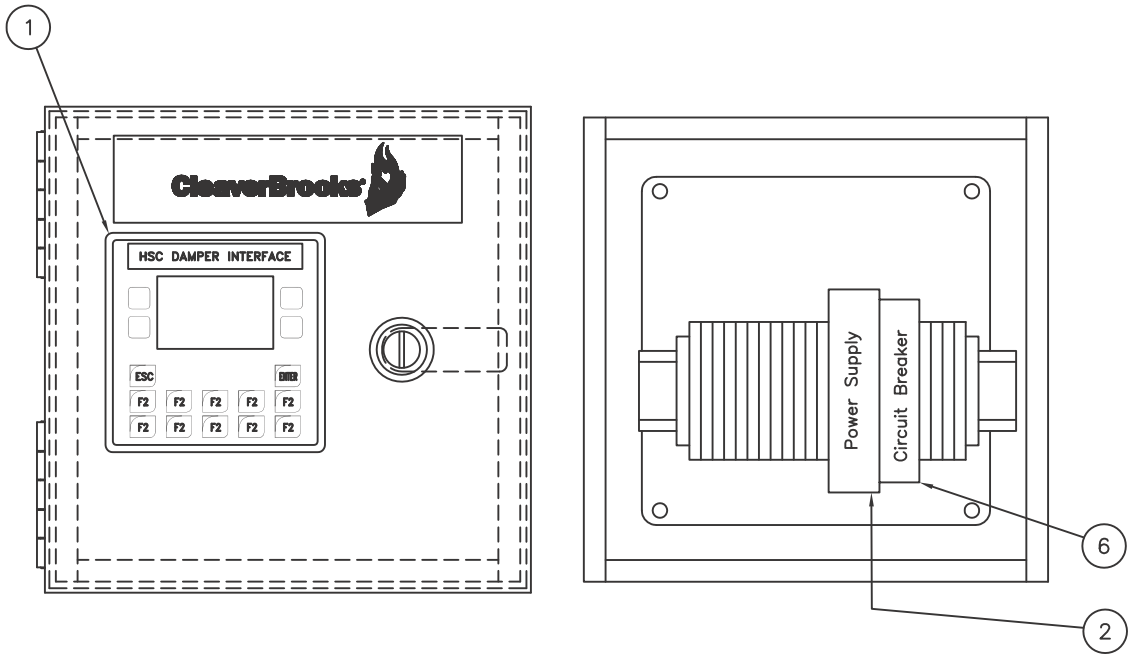


Pump Interface Module 283-03648



ITEM	QTY.	CB PART#	DESCRIPTION
1	1	833–04072–000	PLC/HMI, LCD DISPLAY, 2AI, 2AO, 12DI, 12DO
2	1	832–02575–000	POWER SUPPLY 24 VDC, 30 W
3	4	833–09942–000	RV RELAY & SV SOCKET, 6mm, 24V AC/DC
7	1	983–00085–000	CIRCUIT BREAKER
14	1	985–00490–000	PROGRAM, HSC, PUMP

Damper Interface Module 283-03649



ITEM	QTY.	CB PART#	DESCRIPTION
1	1	833-03813-000	PLC/HMI, LCD DISPLAY, 4AI, 12DI, 6DO
2	1	832-02575-000	POWER SUPPLY 24 VDC, 30 W
6	1	983-00085-000	CIRCUIT BREAKER
13	1	985-00491-000	PROGRAM, HSC, DAMPER

SECTION 3 - SYSTEM ADMINISTRATOR CONFIGURATION

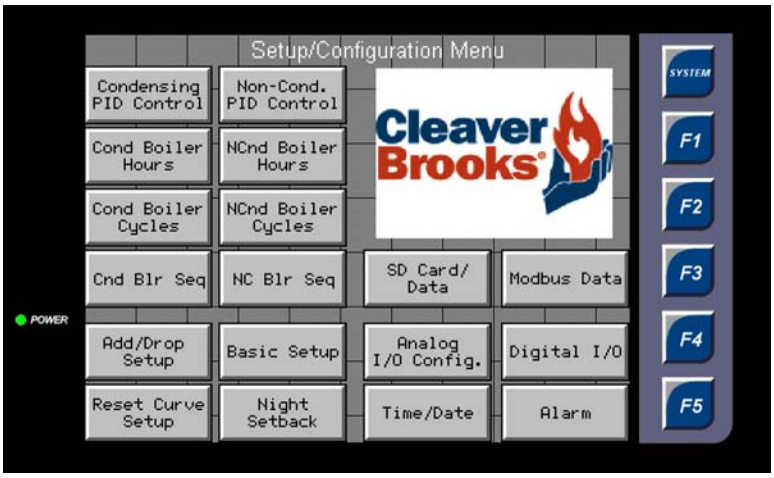
Supplying Power to the System

Before applying power to the unit inspect all wiring. Check that the supplied voltage is 120 VAC (+/- 10%). Turn on the main power breaker. The Administrator will power up and the HMI will display the Main Menu screen.

System Setup and Configuration

From the Main Menu, press <Setup>, then log in to access the setup configuration menu. Go to <Basic setup>.

Main Menu



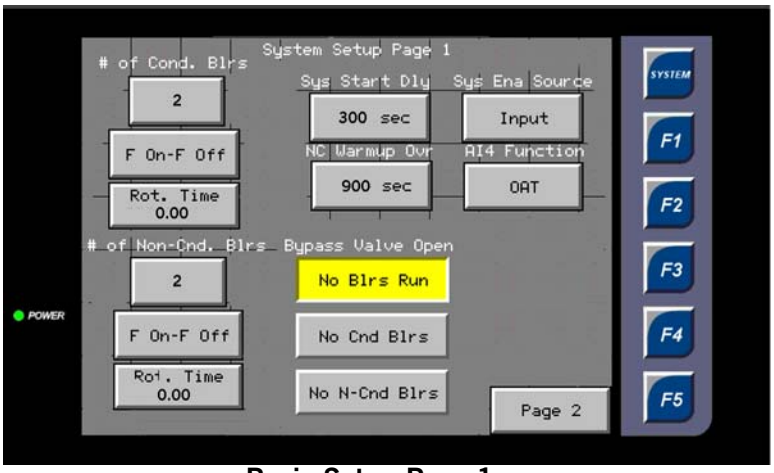
Setup/Configuration Menu

NOTE: See APPENDIX B for detailed parameter descriptions and default settings.

3.1 - Basic Setup

For both the Condensing and Non-Condensing groups, configure the following:

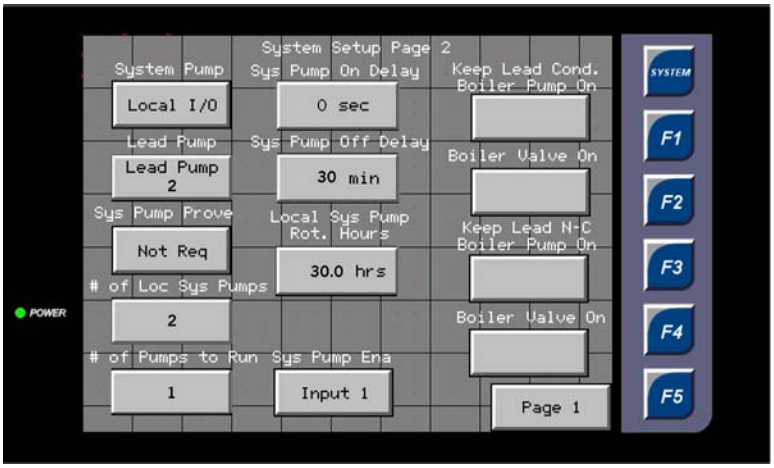
- **Number of boilers** - 0-10 for each group.
- **Lead lag rotation time** For no rotation, set to zero. The lead boiler will be rotated out of the lead position after running for the time specified by the 'Rot. Time' value.
- **Lead lag sequence mode** (First-on-first-off or Last-on-first-off) - In 'First on First Off' mode, the first boiler on will be the first boiler to be dropped when demand requires fewer boilers. 'Last on First Off' mode turns off the last boiler that was started when demand requires fewer boilers.



Basic Setup Page 1

Remaining parameters are as follows:

- **System Start Delay** - amount of time the system will wait upon a call for heat before calling the first boiler (the system pump will start immediately upon a call for heat).
- **System Enable** - HMI (Admin. touchscreen) or Remote (Admin. Input 1 discrete input).
- **NC Warmup Override** - overrides the minimum inlet temperature requirement when in non-condensing or non-condensing assist mode. If this time expires a boiler will be called even if minimum inlet temperature is not met.
- **AI 4 function** - Analog Input 4 can be set to outdoor temperature or remote setpoint.
- **System Pump** - local I/O or remote
- **Bypass Valve Open** - sets the enable condition for a bypass valve (for primary flow systems, to avoid dead-heading system pumps and to minimize standby losses in idle boilers).



Basic Setup Page 2

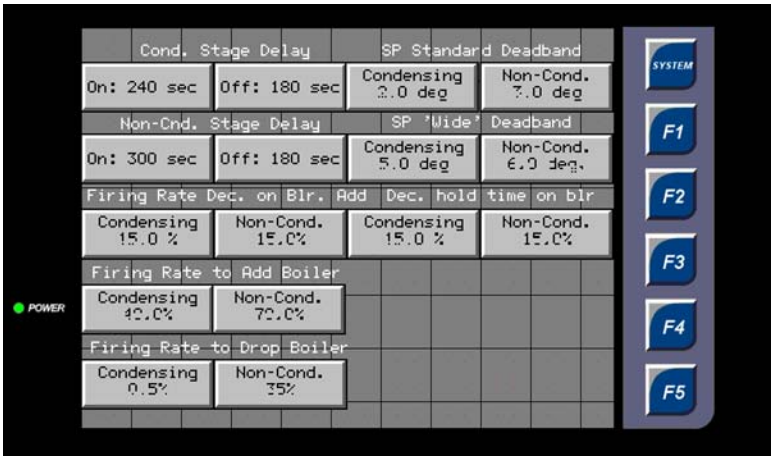
On Setup Page 2:

- **# of System Pumps**
- **# of Pumps to Run** - selects the number of system pumps that will run at the same time.
- **Lead Pump**
- **Pump On Delay -** delay time before pump(s) start on heat request or system pump enable demand).
- **Pump Off Delay -** delay time before pump shutdown after heat request or pump enable demand is removed.
- **Keep Boiler Pump (Valve) On** - Normally, boiler pump (valve) shuts off/closes after boiler shutdown and overrun time. With this function enabled, pump will remain on/valve will remain open even when all boilers in the group are off.
- **System Pump Enable** - default is Input 1

After basic setup is complete, proceed to Add/Drop Setup.

3.2 - Add/drop Setup

After completing basic setup, press [F1] to go back to the setup configuration menu. Press <Add/ Drop Setup>.



Add/Drop parameters are as follows:

- **Stage Delay** - an On and Off (Add stage and Drop Stage) delay can be selected for condensing and non-condensing groups. On a call to add (drop) a boiler, this timer will begin counting down. If it expires and setpoint is still not met (taking into account the **Deadband** below), another stage will be added (dropped).
- **Standard Deadband** if temperature is outside of this range after the Stage Delay expires, a boiler will be added (dropped).
- **Wide Deadband** - if temperature deviates outside of this range, a stage will be added (dropped) even if the Stage Delay timer is not met.
- **FR dec on blr add** - when a boiler is added to the rotation, the HSC will decrease the firing rate of any boilers currently firing by this amount.
- **Dec. hold time** - sets the period of time the **FR dec value** will remain active.
- **Firing Rate to Add Boiler** - if the (unison) firing rate of the currently firing boilers reaches this point and setpoint is still not met, an additional boiler will be called.
- **Firing Rate to Drop Boiler** - if the (unison) firing rate of the currently firing boilers falls to this point, a boiler will be dropped.

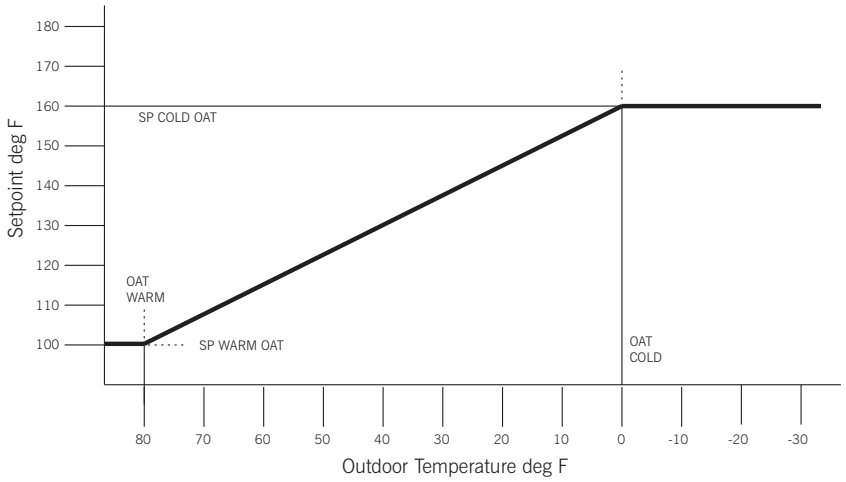
3.3 - Reset Curve Setup

This screen defines the curve used to determine the control setpoint for the hot water loop. The **OAT Cold** value represents the coldest Outside Air Temperature for the curve. The **OAT Warm** value represents the warmest Outside Air Temperature for the curve. These values make the x-axis of the curve. The **SP Cold** value represents the hot water loop temperature setpoint to be used when the outside air temperature is at the OAT Cold value. The **SP Warm** value represents the hot water loop temperature setpoint to be used when the outside air temperature is at the OAT Warm value. The SP Warm and **SP Cold** values make up the y-axis of the curve. The actual control setpoint is determined by this curve.

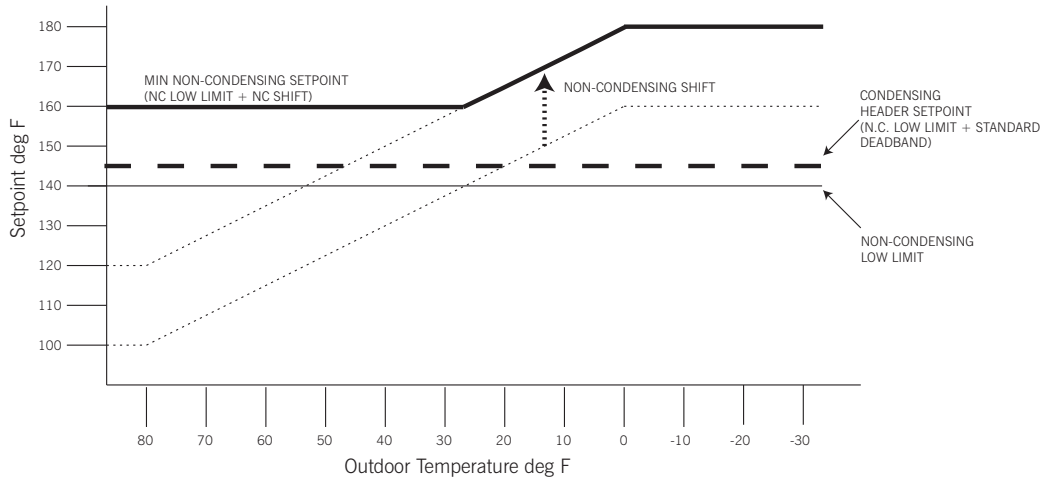
Reset Curve Screen

The **NC Reset Shift** value represents the offset applied to the hot water loop setpoint when running in Non-Condensing mode. The **Cnd. Reset Shift** value represents the offset applied to the condensing boiler outlet hot water setpoint when running condensing boilers while non-condensing boilers are also running.

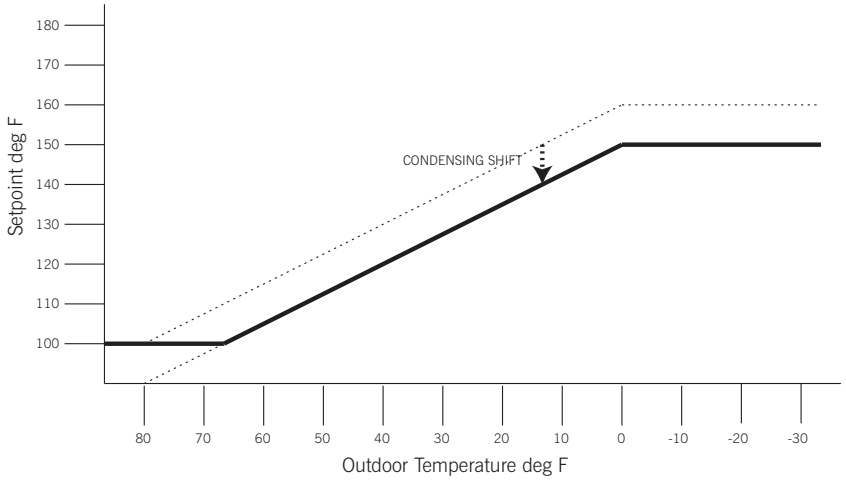
Basic Outdoor Reset



Non Condensing & N. C. Assist Modes



Condensing mode



HSC Calculated Reset Setpoint

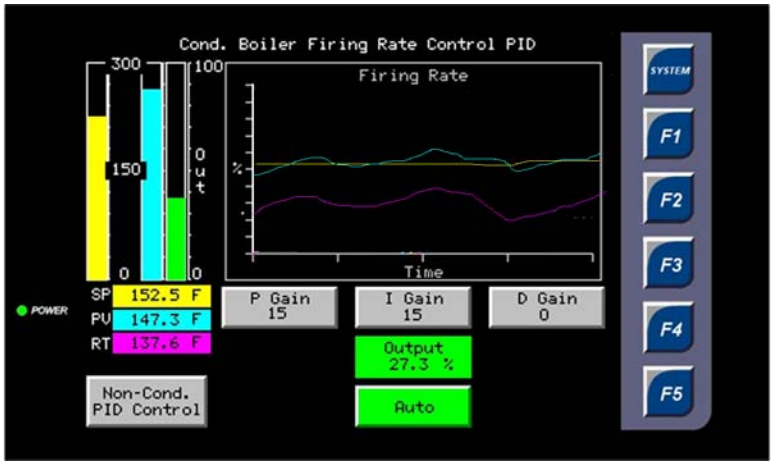
The **NC/Cond Switch Temp** value represents the temperature at which the system will determine the lead group of boilers (Condensing or Non-Condensing) to use. At an outside air temperature higher than this temperature, the Condensing boiler group will be favored as lead. At an outside air temperature lower than this temperature, the Non-Condensing boiler group will be favored as lead. The **Switch Deadband** value represents the temperature offset from the defined switch temperature that must be met when switching from one mode (Condensing or Non-Condensing) to the other.

The **DHW SP** value represents the minimum hot water loop temperature setpoint to maintain during a Domestic Hot Water override event. This event is triggered by an external contact closure based on a demand to supply domestic hot water with the hot water loop. This event will also activate a digital output. The state of this output may be delayed before turning on (after the beginning of the DHW event) and delayed before turning off (after the end of the DHW event) according to the **DHW Output Delay On** and **DHW Output Delay Off** values.

The **Cold Bldg SP** value represents the minimum hot water loop temperature setpoint to maintain during a **Cold Building** override event. This event is triggered by an external contact closure based on an abnormally low inside air temperature for the building.

3.4 - PID Control

The PID Control screens are used to set the PID parameters for the firing rate control response to meet the loop temperature setpoint. Toggling the 'Auto/Manual' button places the loop in manual control mode. The PID calculation is disabled and the user may enter a value for the control output value.

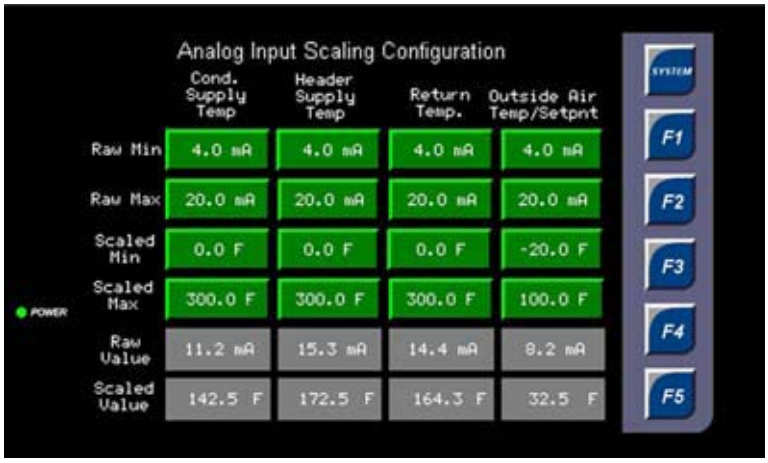


PID Screen (Condensing)

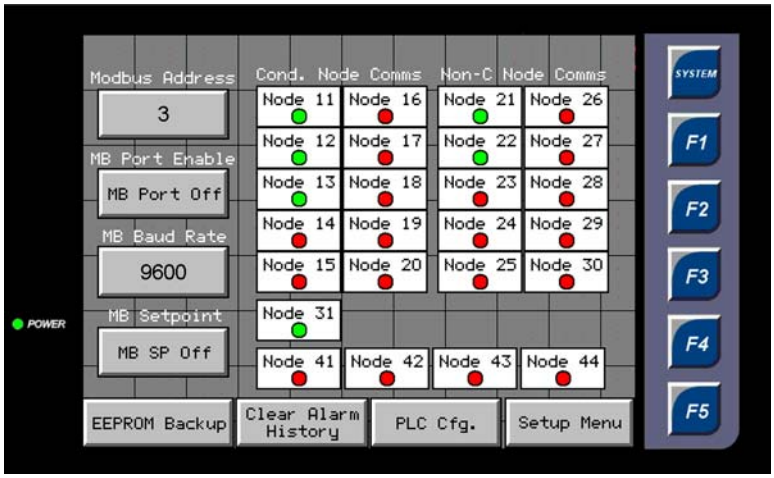
3.5 - Analog Input Scaling

There are two screens for analog input scaling with four (4) channels on each screen. The screen allows the operator to adjust the raw input and scaled values for each analog input point. Normal sig-

nal values are 4 and 20 mA. The scaled values should correspond to the engineering unit range of the level transmitter that is wired to the analog input.



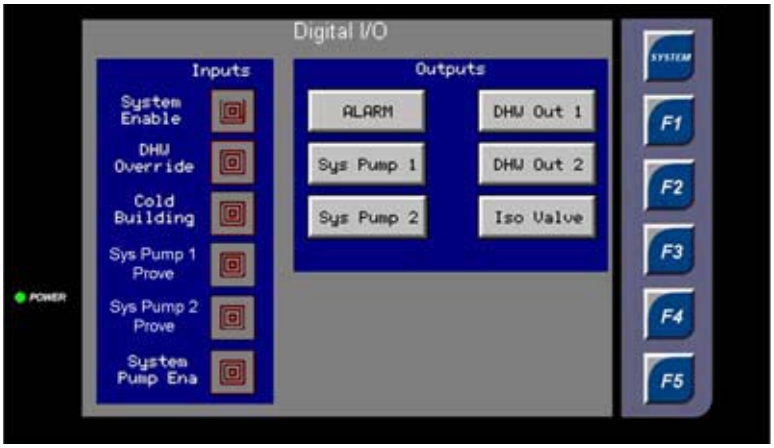
3.6 - Communications Setup and Status



This screen displays the communications status of all the nodes on the HSC network. Nodes 11-20 are designated for condensing boiler controllers. Nodes 21-30 are designated for non-condensing boiler controllers. Node 31 is designated for a system pump controller. Nodes 41-44 are designated for draft damper controllers.

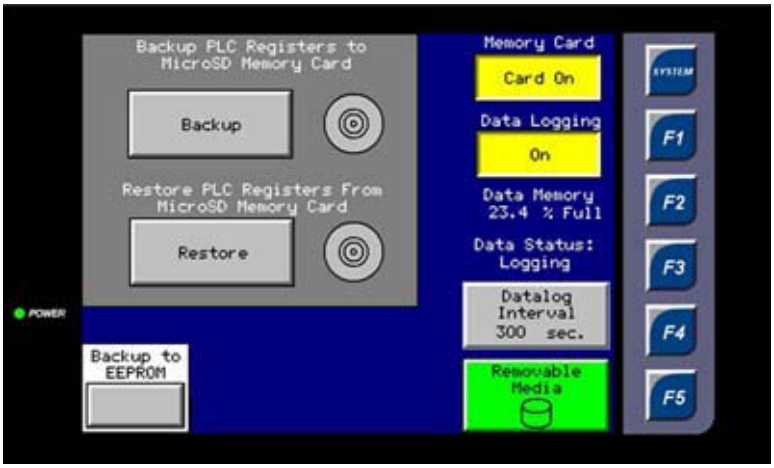
3.7 - Digital I/O

This screen allows the operator to view the status for each digital input point. When an input signal is ON (high), the corresponding indicator for that point is highlighted. When the input signal is OFF, the indicator is clear. The operator can also view the current status of the output points. The operator is able to 'force' each output to an ON state by pressing the button corresponding to the digital output point. Note: When the DO Status screen is displayed, the normal control values for the digital output points may be overridden by operator input. Changes should not be made while the system is in operation.



3.8 - Data Logging

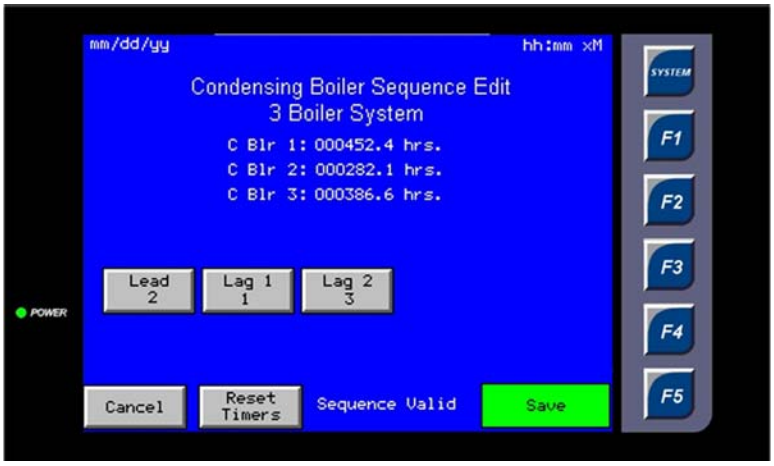
This screen is used to configure and enable data logging. The **Datalog Interval** determines the frequency at which data is written to the MicroSD card. The MicroSD card may be turned on or off (it should be turned off before removing the memory card). Data logging may be disabled or enabled. This screen also allows the program register data to be backed up to or restored from a Micro SD card.



3.9 - Night Setback

The Night Setback configuration screen allows the user to set a daily schedule where the setpoint calculated from the reset curve will be reduced by a specific amount. This is typically done for systems where the building is unoccupied during a portion of the day. Times are entered as military time for each day. A 'day' is defined as the period starting at 6 pm and ending at 6 pm the following day. The days are defined this way to avoid issues that may arise from having the day change at midnight during a night setback routine.

3.10 - Sequence Setup

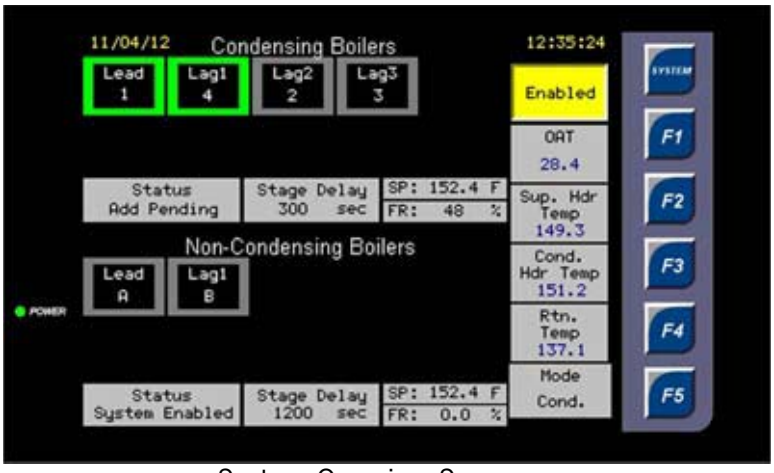


These screens are used to change the boiler Lead-Lag sequence. To select a Lead boiler, press the 'Lead' button and select the boiler number for that position. Repeat for the lag boiler positions. If a valid sequence has been entered, a green 'save' button will appear. Press the 'save' button to use the new sequence.

3.11 - Date & Time

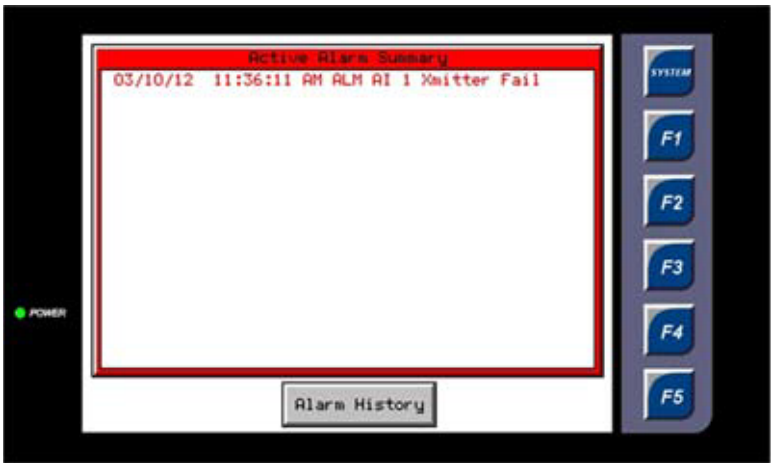
This screen is used to change the date and/or time for the system. Time and date changes made at the Administrator module will be sent to the remote modules once per hour, updating their clocks automatically.

The remaining System Administrator screens are primarily for monitoring system operation. The **System Overview** screen displays setpoint and value in both bar graph and trend format. Lead lag sequence positions (for both condensing and non-condensing boiler groups) and run/ready/fault and operation status are displayed. The current lead boiler run times, control setpoints and firing rates are displayed. Also displayed are current temperature readings for the hot water header (non-condesing boiler supply), the condensing boiler supply temperature, the header return temperature and outside air temperature.



System Overview Screen

The **Alarm** screen displays the current alarms. Each alarm is time stamped. The operator may acknowledge alarms at this screen. The button at the bottom of the screen accesses the **Alarm History** screen, which displays a historical record of all alarms with the acknowledge time for each.



Alarm Screen

3.12 - System Administrator Parameter List

System Administrator Parameter List

Setup/Configuration Screen or Parameter	Description	Units	Range	Default
<Basic Setup>, System Setup Page 1				
# of Condensing Boilers	Number of boilers in condensing group		0-10	0
Sequence Method for Cond group	Last On-First Off or First On-First Off			L On - F Off
Lead Rotation Time	Lead condensing boiler run hours accumulated before automatically switching lead	hours		0.0
# of Non-Condensing Boilers	Number of boilers in non-condensing group		0-10	0
Sequence Method for NC group	Last On - First Off or First On - First Off			L On - F Off
Lead Rotation Time	Lead non-condensing boiler run hours accumulated before automatically switching lead	hours		0.0
System Start Delay	Time delay before first call for boiler upon system enable heat request. Allows for system circulation for accurate system water temperature measurement.	seconds	0-9999	300
NC Warmup Ovr	Time allowed before calling first Non-Condensing boiler when entering Non-Condensing or Non-Condensing Assist modes. Regardless of the System Return Temperature -- i.e. the Return Temperature remains below the Non-Condensing Low Limit temperature -- a Non-Condensing boiler will be called after this delay time has completed.	seconds	0-9999	900
System Enable Source	Source request for System Enable heat request: "HMI" - touchscreen enable or discrete Input connect at Input 1 of the Administrator			HMI

System Administrator Parameter List (Continued)

Setup/Configuration Screen or Parameter	Description	Units	Range	Default
Analog Input 4 Function	Select use for Analog Input 4: Outdoor Air Temperature (OAT) or Remote Setpoint (Rem SP)			OAT
Bypass Valve Open Action	System Bypass valve enable/output -- Administrator Discrete Output 6 action. For primary flow systems with bypass valve to avoid deadheading system pumps and minimize standby losses in idle boilers.			No Boilers Run
< No Blrs Run>	Bypass valve open when no boilers are operating			
< No Cnd Blrs>	Bypass valve open when no Condensing boilers are operating			
< No N-Cond Blrs>	Bypass valve open when no Non-Condensing boilers are operating			
<Basic Setup>, System Setup Page 2				
System Pump	System Pump control: Local I/O or Remote (Pump Interface Module). With Local I/O, Administrator can directly enable/disable up to 2 connected system pumps in Lead-Standby-Rotation arrangement.			Local I/O
Lead Pump	Current Lead Pump assignment -- select desired Lead Pump by pressing button.			Lead Pump 1
System Pump Prove	Enable/disable system pump prove. With Prove Required, discrete input must be connected at Administrator Pump Prove Input(s).			Prove Not Required
# of Local System Pumps	Select number of system pumps connected directly to the HSC Administrator: 1 or 2. (If none, this function is ignored.) If there are more than 2 system pumps to control and/or VSD modulation is desired, the remote Pump Interface Module (PIM) is required.		1 - 2	2
# of Pumps to Run at same time	Select the number of system pumps to operate at the same time. If there are 2 pumps and 1 runs at a time (with pump prove connected), the idle pump in standby is available in case the Lead pump fails to operate.		1 - 2	1
System Pump On Delay	Delay time before system pump(s) start on system enable heat request or system pump enable demand.	seconds		0
System Pump Off Delay	Delay time for system pump(s) shutdown after system enable heat request or system pump enable demand is removed. Also delay time for system pump shutdown when Warm Weather Shutdown (WWSD) is active.	minutes		30
Local Sys. Pump Lead Rotation Hours	Elapsed time Lead system pump has run before Lead rotation occurs	hours		0
System Pump Enable Input	Discrete Input assignment at Administrator for system pump demand. Input 1 is the system enable heat request; Input 6 is system pump only enable. Input 6 could be wired as needed for independent system pump run request (e.g. DHW demand requires system pump(s) to run).		Input 1 or Input 6	Input 1
Keep Lead Boiler Pump On (Cond. group)	Normally, boiler pump shuts off following boiler shutdown and pump overrun time. With this function enabled, the Lead Condensing boiler's pump continues to run even when all Condensing boilers are off.			Disabled

System Administrator Parameter List (Continued)

Setup/Configuration Screen or Parameter	Description	Units	Range	Default
Keep Lead Boiler Isolation Valve On (Cond. group)	Normally, boiler isolation valve closes following boiler shutdown and valve overrun time. With this function enabled, the Lead Condensing boiler's isolation valve remains open even when all Condensing boilers are off.			Disabled
Keep Lead Boiler Pump On (N-C group)	Normally, boiler pump shuts off following boiler shutdown and pump overrun time. With this function enabled, the Lead Non-Condensing boiler's pump continues to run even when all Condensing boilers are off.			Disabled
Keep Lead Boiler Isolation Valve On (N-C group)	Normally, boiler isolation valve closes following boiler shutdown and valve overrun time. With this function enabled, the Lead Non-Condensing boiler's isolation valve remains open even when all Condensing boilers are off.			Disabled
<Add/Drop Setup>				
Cond. Stage Delay On	Time delay before additional Condensing boiler is added. This delay is triggered when the Condensing boiler group firing rate is greater than the Add stage threshold and the active header supply temperature is below the Condensing boiler goup setpoint (by the Condensing standard deadband).	Seconds		600
Cond. Stage Delay Off	Time delay before a Condensing boiler is dropped when more than one Condensing boilers are firing. This delay is triggered when the Condensing boiler group firing rate is less than the Drop stage threshold and the active header supply temperature is above the Condensing boiler goup setpoint (by the Condensing standard deadband).	Seconds		300
Non-cond. Stage Delay On	Time delay before additional Non-Condensing boiler is added. This delay is triggered when the Non-Condensing boiler group firing rate is greater than the Add stage threshold and the main header supply temperature is below the Main Supply Header setpoint (by the Non-Condensing standard deadband).	Seconds		900
Non-cond. Stage Delay Off	Time delay before a Non-Condensing boiler is dropped when more than one Non-Condensing boilers are firing. This delay is triggered when the Non-Condensing boiler group firing rate is less than the Drop stage threshold and the main supply header temperature is above the Main Supply Header setpoint (by the Non-Condensing standard deadband).	Seconds		600
Fire Rate Dec. on Boiler Add - Condensing	When a Condensing boiler stage is added, the Condensing group firing rate is temporarily reduced by this %. Intended to compensate for reduction in flow to firing boilers when the Add Stage boiler's isolation valve is opened. Also can be utilized to compensate for significant load addition of boilers with limited turndown.	%		20.0
Fire Rate Dec. on Boiler Add - Non-Cond.	When a Non-Condensing boiler stage is added, the Non-Condensing group firing rate is temporarily reduce by this %. Intended to compensate for reduction in flow to firing boilers when the Add stage boiler's isolation valve is opened. Also can be utilized to compensate for significant load addition of boilers with limited turndown.	%		20.0
Dec. Hold time on Boiler Add	The amount of time the temporary firing rate decrease is active upon boiler add stage. This time should account for light-off sequence time and possibly boiler Low Fire Hold time.	Seconds		300
Firing Rate to Add Boiler - Condensing	Condensing group firing rate (control output %) threshold to initiate Add stage	%		45.0

System Administrator Parameter List (Continued)

Setup/Configuration Screen or Parameter	Description	Units	Range	Default
Firing Rate to Add Boiler - Non-Cond.	Non-condensing group firing rate (control output %) threshold to initiate Add stage	%		70.0
Firing Rate to Drop Boiler - Condensing	Condensing group firing rate (control output %) threshold to initiate Drop stage	%		0.5
Firing Rate to Drop Boiler - Non-Cond.	Non-condensing group firing rate (control output %) threshold to initiate Drop stage	%		30.0
SP Standard Deadband - Condensing	Deadband value above and below the Condensing boiler group active setpoint. This deadband is one of the triggers to initiate Add or Drop Condensing boiler staging. A deadband that is too narrow can lead to unnecessary and inefficient boiler cycling. A deadband that is too large can lead to undesirable fluctuations in system supply temperatures.	deg F		2.5
SP Standard Deadband - Non-Cond.	Deadband value above and below the Non-Condensing boiler group active setpoint (i.e. Main Supply Header). This deadband is one of the triggers to initiate Add or Drop Non-Condensing boiler staging. A deadband that is too narrow can lead to unnecessary and inefficient boiler cycling. A deadband that is too large can lead to undesirable fluctuations in system supply temperatures.	deg F		3.0
SP 'Wide' Deadband - Condensing	Deadband value above and below the Condensing boiler group active setpoint. If the Condensing boiler group's header temperature exceeds this value above or below the active Condensing group header temperature setpoint, the stage delay time is ignored and the Condensing Add/Drop Stage is immediately initiated.	deg F		5.0
SP 'Wide' Deadband - Non-Cond.	Deadband value above and below the Non-Condensing boiler group active setpoint (i.e. Main Supply Header). If the Main Supply Header Temperature exceeds this value above or below the Main Supply header temperature setpoint, the stage delay time is ignored and the Non-Condensing Add/Drop Stage is immediately initiated.	deg F		6.0
<Reset Curve Setup>				
OAT Cold	Minimum Outdoor Air Temperature that defines the basic outdoor reset slope.	deg F		20.0
OAT Warm	Maximum Outdoor Air Temperature that defines the basic outdoor reset slope.	deg F		60.0
SP Cold OAT	Maximum Supply Temperature Setpoint corresponding to the OAT Cold value that defines the basic outdoor reset slope.	deg F		160.0
SP Warm OAT	Minimum Supply Temperature Setpoint corresponding to the OAT Warm value that defines the basic outdoor reset slope.	deg F		120.0
NC Reset Shift	Offset of Main Supply Header Temperature Setpoint from Administrator outdoor reset calculation when operating in Non-Condensing and Non-Condensing Assist modes.	deg F		20.0
Cond Reset Shift	Offset of Main Supply Header Temperature Setpoint from Administrator outdoor reset calculation when operating in Condensing mode.	deg F		-10.0
NC/Cond. Switch Temp	For hybrid systems. Represents the Outdoor Air Temperature setpoint to switch between Non-Condensing and Condensing operating modes.	deg F		30.0
Switch Deadband	Deadband value above and below the Outdoor Air Temperature setpoint for switching between Non-Condensing and Condensing operating modes.	deg F		3.0

System Administrator Parameter List (Continued)

Setup/Configuration Screen or Parameter	Description	Units	Range	Default
Non-Cond. Low Limit	Minimum allowable inlet temperature for Non-Condensing boiler group. For hybrid systems, this value is used to determine Condensing Header Temperature setpoint in Non-Condensing and Non-Condensing Assist modes. For Non-Condensing boiler only systems, this value -- along with the NC Wide deadband -- determine the minimum allowable Main Supply Header Setpoint.	deg F		140.0
WWSD Setpoint	Warm Weather Shut Down Setpoint - disables system control when outdoor temperature exceeds this setpoint. Set high value to disable this function.	deg F		140.0
Cold Bldg. SP	With Cold Building demand (Discrete Input 3) present, this setpoint overrides normal Administrator calculated main system supply header setpoint. Can be used for SP boost following unoccupied periods or triggered from a remote building temperature control.	deg F		180.0
DHW Setpoint	Domestic Hot Water (DHW) priority setpoint - Administrator high selects between DHW setpoint and calculated reset setpoint when DHW demand (Discrete Input 2) is present. DHW pump/valve outputs (Discrete Outputs 4 & 5) with time delays are active with DHW demand present.	deg F		150.0
DHW Output Delay Off	Upon DHW demand satisfied (Discrete Input 2 de-energized), time delay before DHW outputs are de-energized.	seconds		120
DHW Output Delay On	Upon initial DHW demand active (Discrete Input 2 energized), time delay before DHW outputs are energized.	seconds		180
System Pump for DHW?	Is system pump required to operate for DHW demand? Dependent on hydronic system arrangement (e.g. primary flow system where system pump operation is necessary for water flow through boiler). In the cases of WWSD active or System heat request disabled, system pump(s) can be requested for DHW demand priority.			Not Required
<Analog I/O Config>				
Condensing Supply Temp (Analog In 1)				
- Raw Min:	Zero value of current input signal	mA	3.0 - 12.0	4.0
- Raw Max:	Span value of current input signal	mA	12.0 - 22.0	20.0
- Scaled Min:	Zero temperature of transmitter	deg F	-40.0 - 100.0	0.0
- Scaled Max:	Span temperature of transmitter	deg F	0.0 - 999.9	300.0
Main Supply Header Temp (Analog In 2)				
- Raw Min:	Zero value of current input signal	mA	3.0 - 12.0	4.0
- Raw Max:	Span value of current input signal	mA	12.0 - 22.0	20.0
- Scaled Min:	Zero temperature of transmitter	deg F	-40.0 - 100.0	0.0
- Scaled Max:	Span temperature of transmitter	deg F	0.0 - 999.9	300.0
Return Header Temp Temp (Analog In 3)				
- Raw Min:	Zero value of current input signal	mA	3.0 - 12.0	4.0
- Raw Max:	Span value of current input signal	mA	12.0 - 22.0	20.0
- Scaled Min:	Zero temperature of transmitter	deg F	-40.0 - 100.0	0.0

System Administrator Parameter List (Continued)

Setup/Configuration Screen or Parameter	Description	Units	Range	Default
- Scaled Max:	Span temperature of transmitter	deg F	0.0 - 999.9	300.0
Outside Air Temp/Rem. SP (Analog In 4)				
- Raw Min:	Zero value of current input signal	mA	3.0 - 12.0	4.0
- Raw Max:	Span value of current input signal	mA	12.0 - 22.0	20.0
- Scaled Min:	Zero temperature of transmitter	deg F	-40.0 - 300.0	-40.0
- Scaled Max:	Span temperature of transmitter	deg F	0.0 - 999.9	140.0
<Digital I/O>				
Input Status	Current Input state of connected Discrete Inputs			
Output Status	Current Output state and momentary manual enable capability for testing Discrete Outputs			
<Cond. BIM I/O> - status	I/O status of remote Condensing BIM's (Press F5 & F4 keys to see all connected BIM's)			
<Non-Cond. BIM I/O> - status	I/O status of remote Non-Condensing BIM's (Press F5 & F4 keys to see all connected BIM's)			
<Rem Sys Pump I/O> - status	I/O status of remote PIM's			
<DIM I/O> - status	I/O status of remote DIM's			
<Cnd Blr Seq>	Condensing boiler sequence - assign sequence order for group -- Lead, Lag 1, Lag 2,...			Lead = 1
- <Reset Timers>	Switches to Condensing Boiler Elapsed Time Reset screen			
<Cond Boiler Hours>	Current elapsed run hours for each Condensing boiler. Hours can be reset by pressing respective boiler button.			0.0
- <Return>	Returns to Setup/Configuration Menu screen			
- <Cycle Count>	Switches to Condensing Boiler Cycles screen			
<Cond Boiler Cycles>	Current number of cycles for each Condensing boiler. Cycle count can be reset by pressing respective boiler button.			0
- <Return>	Returns to Setup/Configuration Menu screen			
- <Boiler Hours>	Switches to Condensing Boiler Elapsed Time screen			
<NC Blr Seq>	Non-Condensing boiler sequence - assign sequence order for group -- Lead, Lag 1, Lag 2,...			Lead = A
<NCnd Boiler Hours>	Current elapsed run hours for each Non-Condensing boiler. Hours can be reset by pressing respective boiler button.			0.0
- <Return>	Returns to Setup/Configuration Menu screen			
- <Cycle Count>	Switches to Non-Condensing Boiler Cycles screen			
<NCnd Boiler Cycles>	Current number of cycles for each Non-Condensing boiler. Cycle count can be reset by pressing respective boiler button.			0
- <Return>	Returns to Setup/Configuration Menu screen			
- <Boiler Hours>	Switches to Non-Condensing Boiler Elapsed Time screen			
<Condensing PID Control>	Condensing group PID gain settings and trending			

System Administrator Parameter List (Continued)

Setup/Configuration Screen or Parameter	Description	Units	Range	Default
<P Gain>	Proportional Gain			10
<I Gain>	Integral Gain			10
<D Gain>	Derivative Gain			0
- <Auto/Manual>	Switch from Auto to Manual or Manual to Auto			Auto
- <Output>	Current firing rate (control output) percentage; when in manual, firing rate can be forced	%		0.0
- <Non-Cond. PID Control>	Switch to Non-Condensing PID tuning screen			
<Non-Cond. PID Control>	Non-Condensing group PID gain settings and trending			
<P Gain>	Proportional Gain			10
<I Gain>	Integral Gain			10
<D Gain>	Derivative Gain			0
- <Auto/Manual>	Switch from Auto to Manual or Manual to Auto			Auto
- <Output>	Current firing rate (control output) percentage; when in manual, firing rate can be forced	%		0.0
- <Condensing PID Control>	Switch to Condensing PID tuning screen			
<Night Setback>				
Day X (Sat 6pm - Sun 6pm) Night Setback Start	7-day week scheduling of night setback (occupied/unoccupied) operation -- HSC setback "day" begins at 6:00PM (1800) and ends at 6:00AM (0600) the following day.			
<Hour>	Hour entered in 24 hour format		0 - 23	19
<Minute>			0 - 59	0
Day X (Sat 6pm - Sun 6pm) Night Setback End				
<Hour>	Hour entered in 24 hour format		0 - 23	5
<Minute>			0 - 59	0
Night Setback Temp SP	Temperature difference below (or above) the normal calculated Main Supply Header Temperature setpoint.	deg F		10.0
<Enabled/Disabled>	Select to Enable or Disable night setback operation.			Disabled
<Time/Date>				
Time	Current time set - 24 hour clock	hh:mm:ss		
Date	Current date set - Month/Day/Year	MM/DD/ YYYY		
<Alarm>				
Active Alarm Summary	Date and time stamped active and acknowledged alarm status - red indicates active and not acknowledged; blue indicates active and acknowledged			
Alarm History	Date and time stamped alarm and acknowledge history			
<SD Card/Data>	SD removable media card operations: Memory Card enable, Backup and Restore parameters, Data Logging, Backup program			
- Memory Card On/Off	Enable/disable removable media card operations - Memory card operation should be disabled before removal of SD card.			Card Off
- Data Logging On/Off	Enable/diable data logging operation; SD card must be installed and enabled			Off
- Data Log Interval	Time interval between each data log recording	seconds		0

System Administrator Parameter List (Continued)

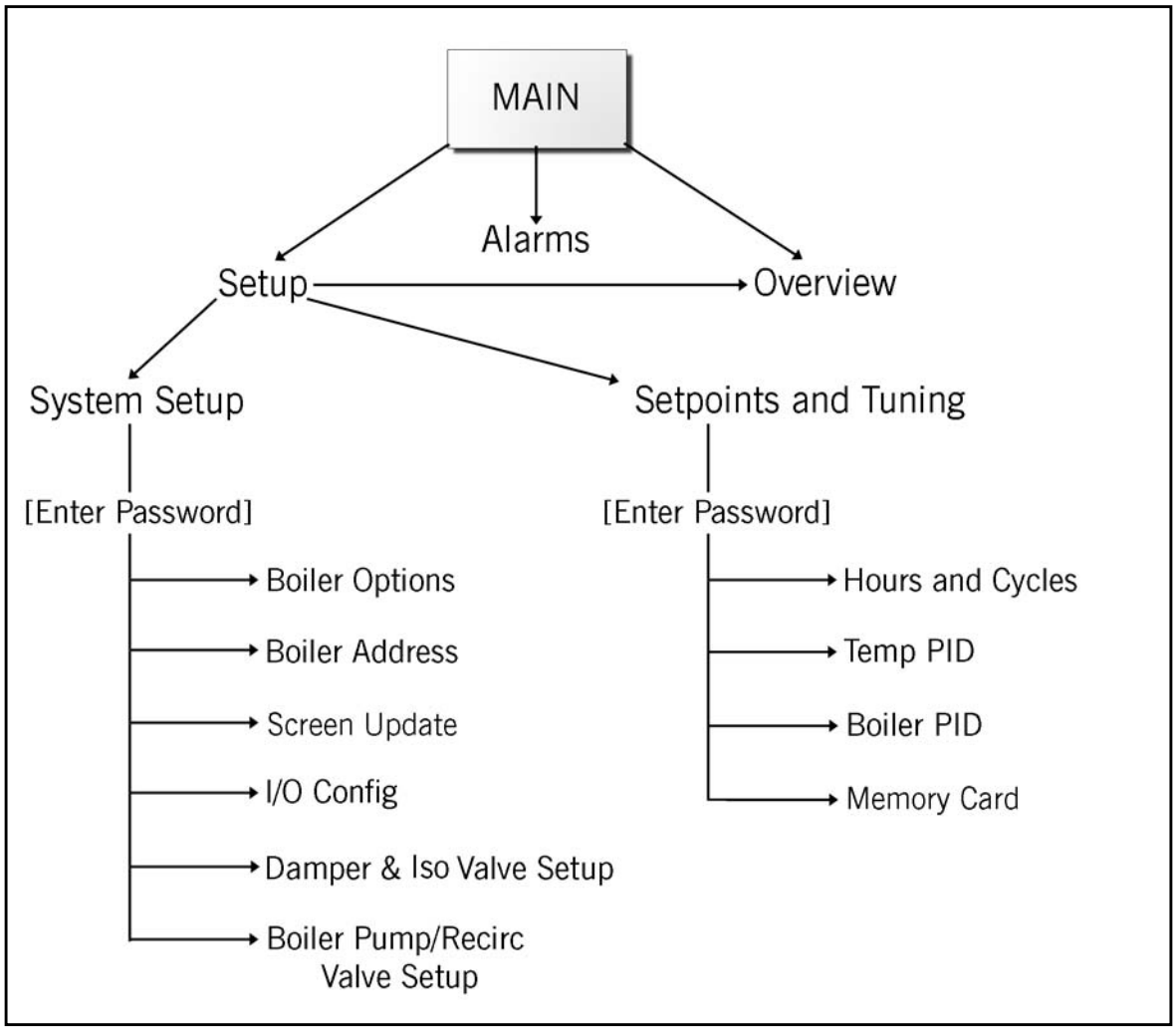
Setup/Configuration Screen or Parameter	Description	Units	Range	Default
- Removable Media status	Status of media card: green - SD card present and enabled; red - SD card disabled or not present			
- Backup Parameters to Memory Card	Backup of parameter settings to SD card - green indicator means successful backup of parameter settings			
- Restore Parameters to Memory Card	Restore parameter settings previously saved to SD Card - green indicator means successful restore of parameter settings			
- Backup program to EEPROM	Performed after initial commissioning to prevent loss of program and parameter settings in case of battery loss/replacement or program corruption. Can also be performed after any setup/tuning changes.			
- Screen Update	Response time for screen changes relative to touchscreen interface actions. 50 is fastest response rate.	2 - 50		50
<Comms Data>	Communications Setup and Status: Modbus RTU configuration for building EMS interfacing and HSC network CANbus status			
- Modbus Address	Address can be set for building EMS Modbus RTU network or connected protocol translator network		0 - 253	1
- Modbus Port Enable	Enable/disable Modbus Slave operations at Administrator			MB Port Off
- Modbus Baud Rate	Establish baud rate for Modbus RTU network: 9600, 19200, or 38400.			38400
- Modbus Setpoint	Enable/disable remote Modbus Setpoint writes; when enabled, remote Modbus SP writes override HSC Administrator calculated outdoor reset set point (if outdoor temperature reset is enabled). HSC may override Modbus SP write for Non-Condensing boiler protection, DHW demand priority, and Cold Building SP override. HSC will high select the appropriate main heating system supply SP as required to protect boilers and service the active demand priority.			MB SP Off
- Modbus Outdoor Air Temperature	Enable/disable Modbus write of Outdoor Air Temperature (OAT) in lieu of connected OAT temperature transmitter -- cannot be enabled if Modbus SP write is enabled. If enabled, the HSC Administrator will use the Modbus OAT for outdoor reset SP calculation, Condensing/Non-Condensing switchover, and Warm Weather Shutdown.			MB OAT Off
- Modbus System Enable	Enable/disable remote Modbus write heat request (enable/disable HSC system operation) . If disabled, HSC Administrator may still respond to DHW demand and System Pump enable demand.			MB Sys Off
- Clear Alarm History	Switches to Alarm History screen -- by pressing any logged alarm, it allows the entire alarm history to be cleared.			
- PLC Config	Switch to hardware utilities screen -- used for utilities such as setting screen contrast, troubleshooting operational status, program version upgrades, etc.			

SECTION 4 - INTERFACE MODULE CONFIGURATION

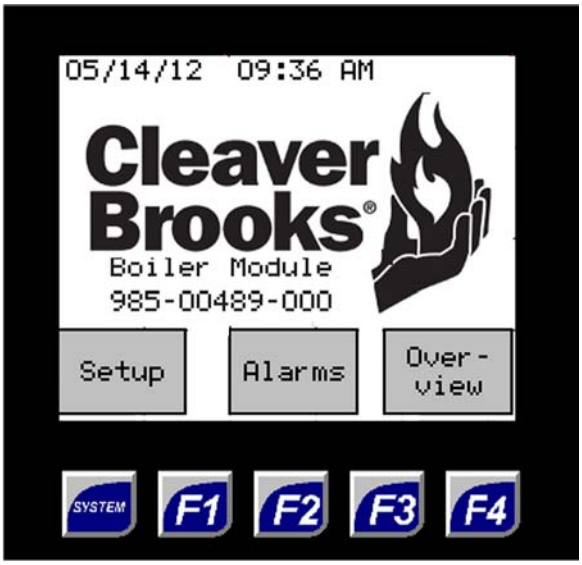
After configuring the System Administrator, proceed with configuring the Boiler, Pump, and Damper modules. **NOTE:** Some alarms/error messages should be expected while the Administrator establishes communication with its associated interface modules. If desired, the Administrator can be powered down while completing system configuration.

4.1 - Boiler Interface Module (BIM)

Each boiler in the system communicates with the Administrator through a Boiler Interface Module. The chart below shows the BIM's menu structure. The [F1] key goes to the previous screen or back to the Main screen. After reaching the Main screen, [F1] toggles between the Main and Overview screens.



First set the CANbus Node Address. BIMs for condensing boilers use the address range 11-20 and for non- condensing boilers 21-30. To set the address, from the BIM main screen press <Setup>, then <System Setup>. A password prompt will appear. After entering the password, press <Boiler Add> to enter the address for this BIM. NOTE: condensing boilers must start at 11 and be numbered consecutively. Non-condensing boilers must start at 21 and be numbered consecutively



BIM main screen

Next, select <Boiler Options> from the system setup menu. Configure the following parameters:

Temp Input - Set to RTD (4-20mA not used at present release).

Inlet Temp - set to YES if using ∆T for pump control.

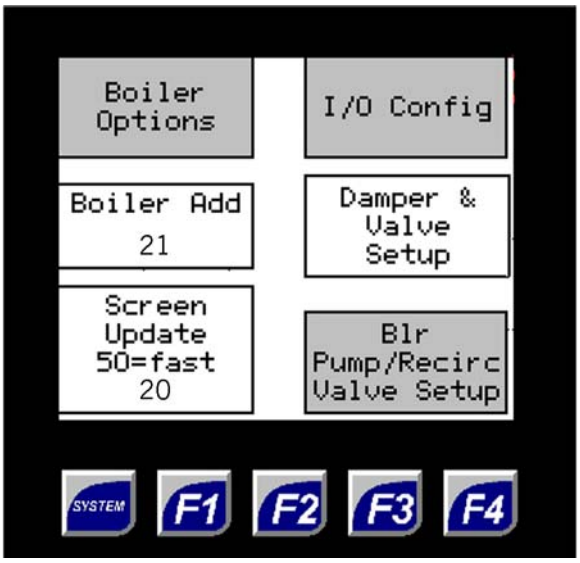
Low Fire Hold - upon startup, boiler will remain at low fire for this interval before beginning modulated firing.

Max Temp - should be set at or below boiler's local high limit setting. This parameter will prevent boiler dropping out of rotation due to a high limit alarm.

FR Dec - when **Max Temp** reached, boiler will modulate down by this amount.

Hold Hyst - when **Max Temp** minus **Hold Hyst** is reached, boiler will return to firing rate signal from Administrator.

Fire Delay - if boiler is called but does not start, Administrator will wait for this interval before calling next boiler in sequence.



BIM system setup menu

Next, select <Boiler Pump/Recirc Valve Setup>. Parameters are as follows:

Output - select Constant for enable/disable signal (no modulation) or Modulation if a modulating pump/valve.

On/Off Delay

Prove Required - if Yes, boiler will not start unless pump/valve proven.

PID Action - determines how the control variable responds to a change in the process variable. Select **Reverse** action if using ∆**T** as process variable. Select **Direct** if using **Min Temp**.

Next, go to <Damper & Valve Setup> and configure the following:

Valve (Damper) - select Yes if a valve or damper is associated with this boiler.

Valve On Delay

Valve (Damper) Off Delay

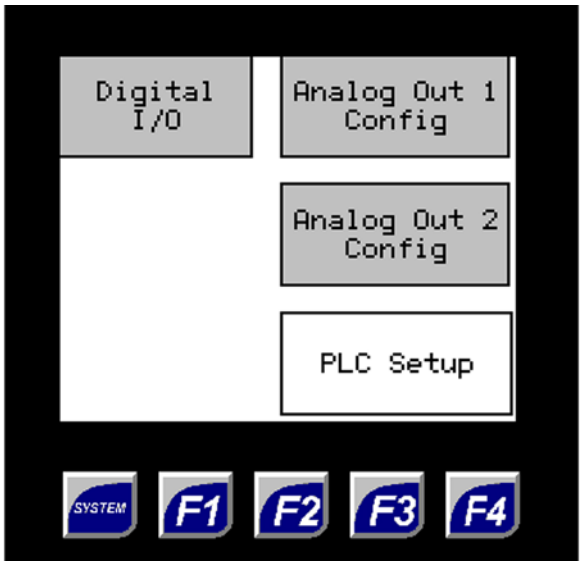
Additional damper parameters:

Time to Prove - if damper not proven within this time, an alarm will result.

Control - select **Remote** if this damper is controlled by a DIM.

DIM - if **Remote** is selected above, enter the number of the associated **DIM**

Damper # - number of the damper associated with this boiler. Any number of boilers may be assigned to the same damper.



I/O Configuration Screen

<I/O config>accesses various features related to the BIM's digital and analog inputs and outputs.

Pressing <I/O config>, then <Digital I/O> brings up the Digital Input Status screen. A solid black indicator means the input is on/energized.

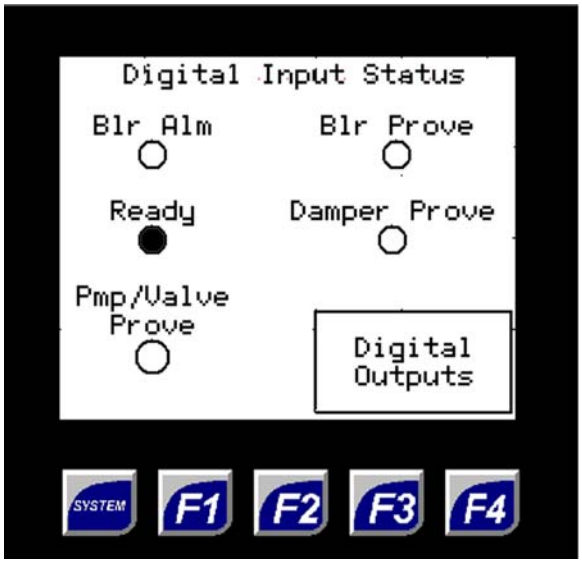
<Digital Outputs> goes to the DO Status/Test screen. The buttons serve as status indicators and as manual force switches:

White border indicates output is OFF.

Black border indicates output is ON.

Press and hold a button that is ON to force the output OFF, and vice-versa.

These are momentary switches - releasing the button will return the output to its former state.



Digital Input Status Screen

The Analog Out 1 (Firing Rate) and Analog Out 2 (Pump/Recirc Valve) screens have identical parameters:

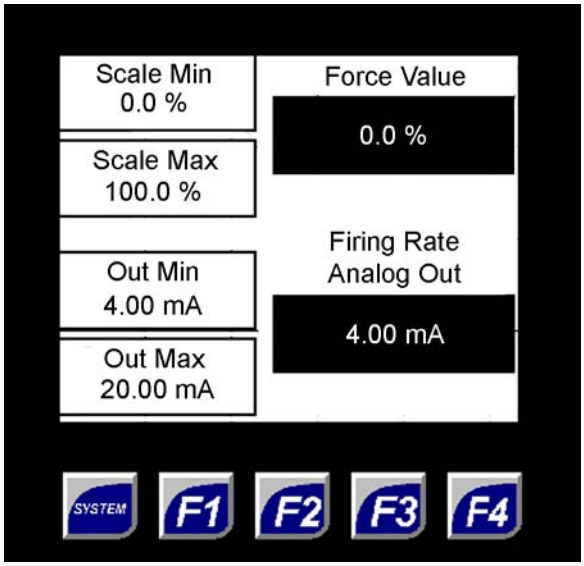
Scale Min - percent control output corresponding to **Out Min** (minimum desired mA output within the 4-20 mA range).

Scale Max - percent control output corresponding to **Out Max** (maximum desired mA output within the 4-20 mA range).

Example: For firing rate limiting, lower the Analog Out 1 **Out Max** value.

Force Value - manual control of the analog output. Pressing <Force Value> will bring up a numeric keypad where the desired % output can be entered.

Firing Rate (Boiler Pump) Analog Out - shows the mA output corresponding to the entered **Force Value.**



Analog Output 1 Screen

Also accessible from the I/O configuration screen is <PLC Setup> - this provides access to diagnostic information and various BIM hardware settings. Screen contrast, screen saver, beeper enable, and date/time settings can be accessed here (date/time will be overridden by the Administrator settings).

The diagnostic features under PLC Setup are primarily for troubleshooting the BIM's internal processor.

The remaining System Setup function is <Screen Update> - this adjusts the refresh time of the BIM screen (from 20=slowest to 50=fastest). Faster update times may slow down overall processor performance.

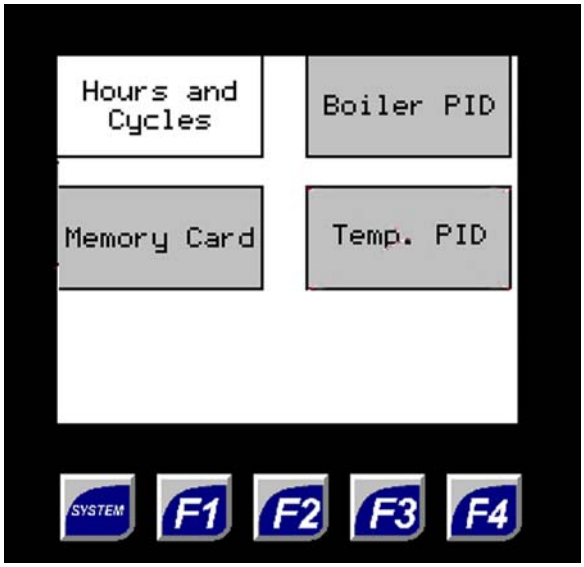
The other menu under Setup is <SP & Tuning>. Options here are <Hours and Cycles>, <Boiler PID>, <Temp. PID>, and <Memory Card>.

Hours and Cycles displays the number of on/off cycles and cumulative run time for this boiler.

Boiler PID accesses setpoint and PID settings for boiler firing rate (for local control in the event of loss of communication with the Administrator).

Temp. PID accesses setpoint and PID settings for temperature control.

Memory Card functions are used to back up and restore the BIM's parameter settings, to clone settings from one BIM to another, and for data logging.



Setpoints and Tuning menu

Boiler Interface Module Parameter List

Setup/Configuration Screen or Parameter	Description	Units	Range	Default
<System Setup>				
<Boiler Add>	Boiler CANbus Node Address assignment -- Condensing Boilers start with 11 and are addressed in sequential order up to 20; Non-Condensing Boilers start with 21 and are addressed in sequential order up to 30.		11 - 30	11
<Boiler Options>	Boiler configuration screen			
- Temp. Input: <RTD> or <4-20mA>	Boiler Inlet/Outlet Temperature Input type -- Hardware/program default is RTD (PT100). (Contact factory for non-standard 4-20mA inputs.)			RTD
- Inlet Temp?	Boiler Inlet Temperature sensor connected? Inlet Temperature sensor required for Boiler Pump speed control.			No
- Low Fire Hold	Low Fire Hold Time after initial Boiler Prove --	seconds		
- Max Temp	Maximum allowable operating temperature for boiler -- this temperature limit is used for the HSC's Boiler Outlet Limiting function. This firing rate limiting function prevents nuisance high limit shutdowns where there may be a mismatch between firing rate and water flow rate through the boiler.	deg F		180.0
- Hold Hyst	Boiler Outlet Limiting hold temperature differential. Boiler Outlet Limiting remains active until the outlet temperature drops to a temperature below Max Temp minus this value.	deg F		10.0
- FR Dec	Percentage decrease in the boiler's firing rate when the Boiler Outlet Limiting function is activated.	%		25.0
- Fire Delay	Upon Boiler Start request, Fire Delay is the time allowed for Boiler Prove input. If Boiler Prove is not present within this setting, the Administrator will call the next Lag boiler in the sequence.	seconds		180
<I/O Config>				
<Digital I/O>	Digital Input status			
- <Digital Outputs>	Switch to Digital Output status screen -- each DO can be momentarily energized to test by pressing the respective output button.			
<Analog Out 1 Config>	Switch to Analog Output 1 screen - Boiler Modulation signal			
- Scale Min	Minimum control output percentage corresponding to Output Min setting	%		0.0
- Scale Max	Maximum control output percentage corresponding to Output Max setting	%		100.0
- Output Min	Minimum current output signal corresponding to Scale Min setting -- used for zero value of modulation input signal of boiler (i.e. Low Fire).	mA		4.0
- Output Max	Maximum current output signal corresponding to Scale Max setting -- used for 100% modulation input signal of boiler. Can be utilized to limit maximum firing rate.	mA		20.0
<Analog Out 2 Config>	Switch to Analog Output 2 screen - Boiler Pump Modulation signal			
- Scale Min	Minimum control output percentage corresponding to Output Min setting	%		0.0
- Scale Max	Maximum control output percentage corresponding to Output Max setting	%		100.0

Boiler Interface Module Parameter List (Continued)

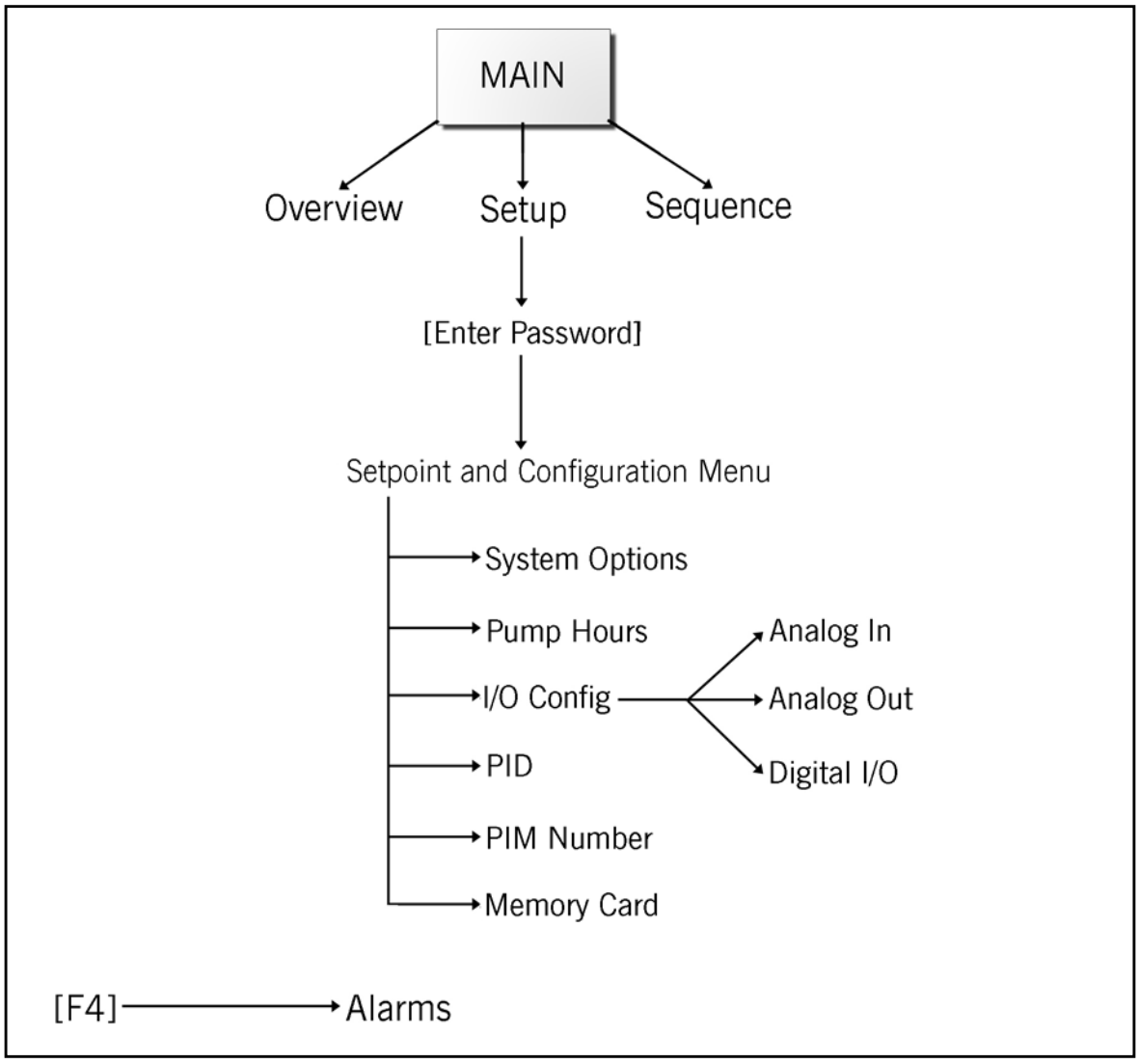
Setup/Configuration Screen or Parameter	Description	Units	Range	Default
- Output Min	Minimum current output signal corresponding to Scale Min setting -- used for zero value of modulation input signal of VSD boiler pump. Can be utilized to limit minimum pump speed.	mA		4.0
- Output Max	Maximum current output signal corresponding to Scale Max setting -- used for 100% modulation input signal of VSD boiler pump. Can be utilized to limit maximum pump speed.	mA		20.0
<PLC Setup>	Switch to hardware utilities screen -- used for utilities such as setting screen contrast, troubleshooting operational status, program version upgrades, etc.			
<Damper & Valve Setup>	Configuration of damper/draft control interlock and connected isolation valve			
<Damper Setup>	Switches to Damper Interlock (combustion air dampers, draft controls, gas boosters, etc.) with Boiler Start configuration screen.			
- Damper control	Is there a damper, draft control, gas booster, etc. Boiler Start interlock required?			No
- Control: Local or Remote	Select Local for device (e.g. damper) connected directly to Boiler; select Remote for device(s) connected to remote HSC Damper Interface Module (DIM)			Local
- DIM Module	DIM number assignment for connected Boiler Start interlock device.			DIM1
- Damper #	Specific Discrete Output assignment for the specified DIM to interlock this Boiler's Start			1
- Off Delay	Damper request Off Delay time after boiler shutdown. If more than one boiler is assigned to the same DIM output device, all assigned boilers must be off before the specific digital output is de-energized.	seconds		120
- Time to Prove	Time allowed for device (e.g. damper) Prove input before indicating Boiler Start failure and moving to next Lag Boiler in sequence.	seconds		45
- Valve control	Is an isolation valve connected to BIM?			No
- Valve Off Delay	Valve close delay time after boiler shutdown	seconds		600
- Valve On Delay	Valve open delay upon Boiler Start request	seconds		0
<Blr Pump/Recirc Valve Setup>	Switches to connected Boiler Pump/Recirc Valve configuration screen			
- Output	Select Constant speed or Modulation speed Boiler Pump			
- Pump Off Delay	Boiler Pump overrun time after boiler shutdown	seconds		600
- Pump On Delay	Boiler Pump start delay after Boiler Start request	seconds		5
- Prove Required	Is Pump or Valve Prove required prior to Boiler Start?			No
- Temp. PID Action	Select control action to match pump or valve action (e.g. for Delta T SP control with VSD pump, select Reverse -- increase pump speed to decrease Delta T)			Reverse
- Process Variable select: Delta T or Temp.	Delta T or Minimum Temp modulation control			Delta T
<SP & Tuning>				

Boiler Interface Module Parameter List (Continued)

Setup/Configuration Screen or Parameter	Description	Units	Range	Default
< Hours and Cycles>				
<Memory Card>	Switches to Memory Card screen for BIM SD Card operations			
- Card On/Off	Enable BIM SD Card operations			Card Off
- Data On/Off	Enable Data Logging at BIM			Data Off
- Log Interval	Data log interval time	seconds		60
- <Backup>	Backup of parameters settings -- press once and wait 30 seconds for indicator to indicate successful Backup			
- <Restore>	Restore of previously backed up parameter settings -- press once and wait 30 seconds for indicator to indicate successful Restore			
- Memory Card capacity	Indicates memory used on card			
<Boiler PID>	Switches to Local Boiler modulation PID tuning screen			
- <P Gain>	Proportional Gain			10
- <I Gain>	Integral Gain			10
- <D Gain>	Derivative Gain			0
- <Auto/Manual>	Switch from Auto to Manual or Manual to Auto			Auto
- <Out>	Current firing rate (control output) percentage; when in manual, firing rate can be forced	%		0.0
- <Setpoint>	In the case of loss of communication with Administrator, local Boiler Outlet Temperature Setpoint can established for local boiler modulation control.	deg F		160.0
<Temp. PID>	Switches to Boiler Pump/Valve modulation PID tuning for Delta T or Minimum Temp control			
- <P Gain>	Proportional Gain			10
- <I Gain>	Integral Gain			10
- <D Gain>	Derivative Gain			0
- <Auto/Manual>	Switch from Auto to Manual or Manual to Auto			Auto
- <Out>	Current modulation (control output) percentage; when in manual, modulation output can be forced	%		0.0
- <Setpoint>	Delta T Setpoint for Delta T modulation; Minimum Inlet Temperature Setpoint for Temp. modulation (set at Admin NC Low Limit).	deg F		30.0

4.2 - Pump Interface Module (PIM)

System pumps are controlled by a Pump Interface Module (at present the HSC supports two PIMs, 8 pumps maximum). Below is the PIM menu structure. The [F1] key goes to the previous screen or back to the Main screen. After reaching the Main screen, [F1] toggles between the Main and Overview screens. [F4] accesses the Alarm screen.



To configure the PIM, first press <Setup> and enter password. Go to <System Options> for the following parameters.

Number of System Pumps (4 maximum)

Number of Pumps to Run - number of pumps that will run simultaneously

Control Select - Delta T, Pressure, or Temperature control. For pump pressure control, a 4-20mA input (differential or gauge pressure) is needed.

Temp/Press Source - select Admin or Local (4-20mA input to this PIM).

Prove Required - if yes, lag pump will be called if lead pump does not prove.

On Page 2:

Modulation Delay - when called, the pump will run at the **Hold Speed** for this amount of time.

Pump Type - Constant or VSD.

PID Action - Direct for pump Delta T control or Reverse for Delta P.

On Page 3:

NC Start Speed - when in Condensing mode and a non-condensing boiler is called pumps will be forced to this speed for the duration of the **NC Start Override Time**

On/Off Delay - time delay applied to a call for pump start/stop.

Screen Update - this adjusts the refresh time of the PIM screen (from 20=slowest to 50=fastest). Faster update times may slow down overall processor performance.

The next item in the Setpoint and Configuration Menu, <Pump Hours>, shows the total elapsed run time for each pump, and allows for resetting the totalizers.

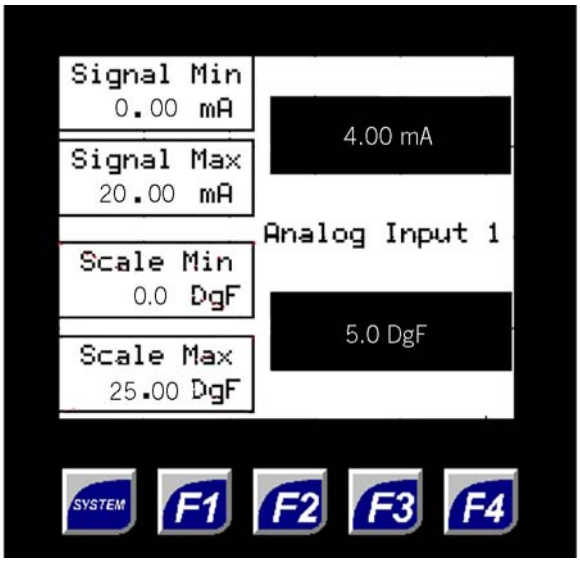
<I/O Config> gives three options, <Analog In Config>, Analog Out Config>, and Digital I/O

<Analog In Config> has the following parameters:

Scale Min - input (deg F or psi, depending on type of pump control) corresponding to **Signal Min** (minimum input within the 4-20 mA range).

Scale Max - input (deg F or psi, depending on type of pump control) corresponding to **Signal Max** (maximum input within the 4-20 mA range).

Input signal in mA and engineering units (deg F or psi, depending on type of pump control) are also displayed.



Analog In Config (PIM)

<Analog Out Config> has the following parameters:

Scale Min - percent control output corresponding to **Out Min** (minimum desired mA output within the 4-20 mA range).

Scale Max - percent control output corresponding to **Out Max** (maximum desired mA output within the 4-20 mA range).

Force Value - manual control of the analog output. Pressing <Force Value> will bring up a numeric keypad where the desired % output can be entered.

Pump VSD Analog Out - shows the mA output corresponding to the entered **Force Value.**

<Digital I/O> shows the status of the digital inputs and allows manual control of the digital outputs.

Press <Dig. Outs> for the manual force buttons. These are 'latched' buttons; button will remain in its current state until pressed again.

Remaining items under the Setpoint and Configuration menu are <Pump Hours>, <PID>, <PIM Number>, and <Memory Card>.

The **PID** screen accesses setpoint and PID settings for pump control. The process value (PV) depends on which type of pump control is selected under System Options (see above).

If this is the second PIM on the network (node address 32), set its **PIM Number** to 2.

Memory Card functions are used to back up and restore the BIM's parameter settings, to clone settings from one BIM to another, and for data logging.

The **Pump Hours** screen is used to view and reset the total run time for each pump.

The last item on the PIM main menu is the pump sequence screen; press <Seq.> to access. This is where the order of rotation of the pumps is set. After entering the desired sequence, press <Save>.

Pump Interface Module Parameter List

Setup/Configuration Screen or Parameter	Description	Units	Range	Default
<System Setup>				
<PIM Number>	Pump Interface Module No. -- equates to CANbus node address: #1 = 31 (CANbus); #2 = 32 (CANbus)		1 or 2	1
<System Options>, Page 1	PIM configuration			
<Number of System Pumps>	Number of pumps connected to PIM.		1 - 4	2
<Number of Pumps to Run>	Designate number of pumps to run at any time.		1 - 4	1
<Prove Req.> or <No Prove>	Specify if pump/flow prove is connected for each pump.			Prove Required
<Control Select>	Select process variable (PV) -- Pressure (DP or Head), Delta T, or single-point Temperature -- for pump speed modulation control			Pressure
<Temp/Pressure Source>	Local (PIM) analog input or Admin Delta T			Local
<System Options>, Page 2				
<Modulation Delay>	Time delay before releasing pump speed modulation	minutes		5
<Hold Speed>	For modulation control, initial pump speed to hold until Modulation Delay is completed	%		75
- PID Action: <Direct> or <Reverse>	PID modulating output control action			Direct
- Pump Type: <VSD> or <Constant>	VSD modulating or constant speed pump			VSD
<NC Start Speed>	Pump speed to hold upon initial Non-Condensing boiler request	%		85
<NC Start Override Time>	Hold time for pump speed hold upon initial Non-Condensing boiler request	seconds		900

Pump Interface Module Parameter List (Continued)

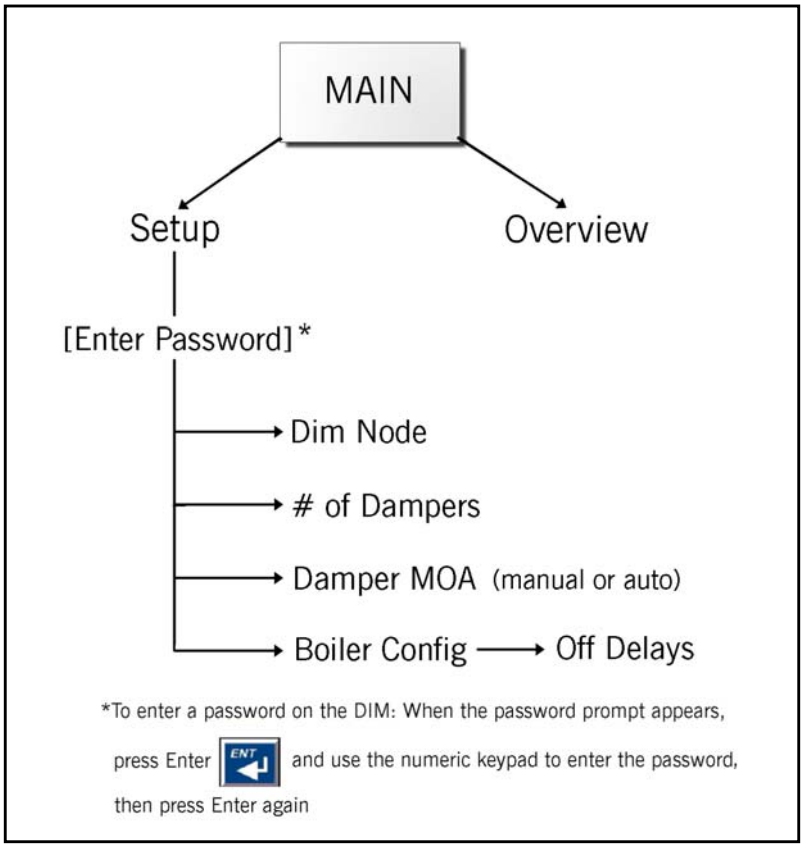
Setup/Configuration Screen or Parameter	Description	Units	Range	Default
<On Delay>	Pump on delay upon initial pump run request	seconds		0
<Off Delay>	Pump off delay upon removal of pump run request	minutes		30
<Pump Hours>	Elapsed Run Time for each pump			
<P_ ET Reset>	Reset elapsed run time for respective pump to zero.			
<I/O Config>	Switches to Analog and Digital I/O menu screen			
<Analog In Config>	Analog input scaling			
- <Signal Min>	Minimum analog input signal value	mA	0 - 10	4.00
- <Signal Max>	Maximum analog input signal value	mA	10 - 30	20.00
- <Scale Min>	Measured value corresponding to Signal Min	psi / degF		0.0
- <Scale Max>	Measured value corresponding to Signal Max	psi / degF		100.0
<Analog Out Config>	Analog Output scaling			
- <Scale Min>	Minimum control output percentage corresponding to Output Min setting	%	0 - 10	4.00
- <Scale Max>	Maximum control output percentage corresponding to Output Max setting	%	10 - 30	20.00
- <Out Min>	Minimum current output signal corresponding to Scale Min setting -- used for zero value of modulation output signal of VSD system pump. Can be utilized to limit minimum pump speed.	mA		0.0
- <Out Max>	Maximum current output signal corresponding to Scale Max setting -- used for 100% modulation output signal of VSD system pump. Can be utilized to limit maximum pump speed.	mA		20.0
<Digital I/O>				
- DI Status	Digital Input status			
- DO Status	Digital Output status -- momentary buttons to test outputs			
- Screen Update	Response time for screen changes relative to touchscreen interface actions. 50 is fastest response rate.	2 - 50		50
<Memory Card>	Switches to Memory Card screen for PIM SD card operations			
- Card On/Off	Enable BIM SD Card operations			Card Off
- Data On/Off	Enable Data Logging at BIM			Data Off
- Log Interval	Data log interval time	seconds		60
- <Backup>	Backup of parameters settings -- press once and wait 30 seconds for indicator to indicate successful Backup			
- <Restore>	Restore of previously backed up parameter settings -- press once and wait 30 seconds for indicator to indicate successful Restore			
- Memory Card capacity	Indicates memory used on card			

Pump Interface Module Parameter List (Continued)

Setup/Configuration Screen or Parameter	Description	Units	Range	Default
<PID>	Switches to system pump modulation PID tuning screen			
- <P Gain>	Proportional Gain			10
- <I Gain>	Integral Gain			10
- <D Gain>	Derivative Gain			0
- <Auto/Manual>	Switch between Auto and Manual modulation output			Auto
- <Out>	Current modulation (control output) percentage; when in manual, modulation can be forced	%		0.0
- <Setpoint>	In the case of loss of communication with Administrator, local PIM Setpoint can established for local pump modulation control.	psi / deg F		
<Seq>	Switches to system pump lead-lag sequence screen -- allows for assignment of sequence order; includes elapsed run time of each connected pump			

4.3 - Damper Interface Module (DIM)

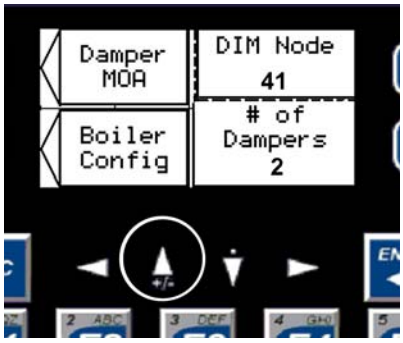
The DIM lacks a touchscreen; navigation and data entry are accomplished using the arrow buttons and keypad.



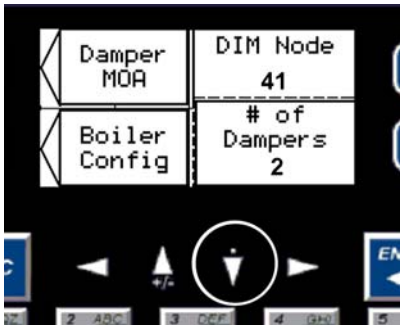
Under <Setup> first set the CANbus **DIM Node** address for the module (41-44 are reserved for DIMs). Next, set the **# of Dampers** (up to six) associated with this DIM.

To navigate between the **DIM Node** and **# of Dampers** selections, use the up and down arrows. Note the dotted line around the selected item. With the desired item selected, press <ENTER>. Enter the desired value using the numeric keypad, then press <ENTER> again.

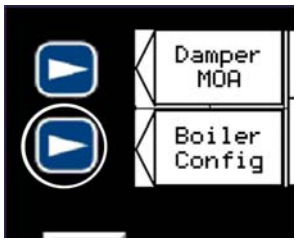
DIM Node



of
Dampers



Next, go to <Boiler Config>. Parameters here are:

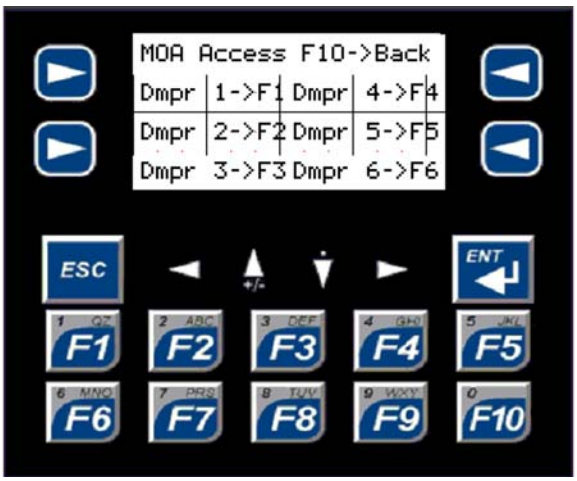


# of Condensing Boilers and **# of Non-Condensing Boilers** - these are the number of total boilers of each type on the system. Values should match those entered in the System Administrator.

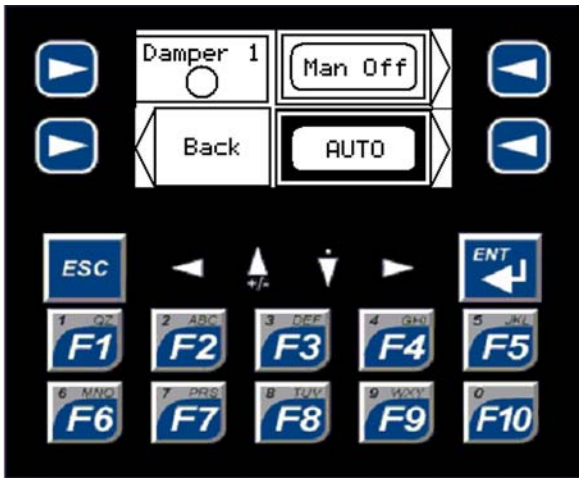
Off Delays for each damper on this DIM. Off delay should be at least as long as the associated boiler(s) post-purge time. A setting of 2-5 minutes should be sufficient to prevent cycling of the dampers.

As with other DIM parameters taking a numeric value, select the item, press <ENTER>, enter the value using the numeric keys, then press <ENTER> again.

For manual damper control, select <Damper MOA> (Manual or Auto). The following screen will appear (when on this screen [F10] is the Back button):



Press the function key (F1-F6) for the desired damper.



The <AUTO (MAN)> switch toggles between auto and manual mode. When in manual, use <Man On (Off)> to turn the damper on and off.

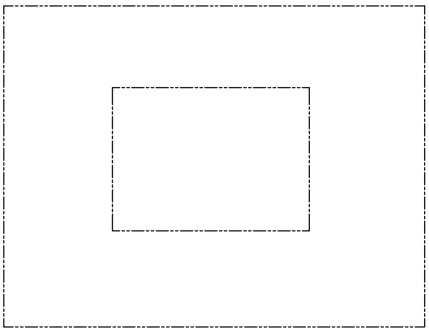
Damper Interface Module Parameter List

Setup/Configuration Screen or Parameter	Description	Units	Range	Default
<Setup>	Password required			
DIM Node	Damper Interface Module No. -- starts with CANbus address 41		41 - 44	41
# of Dampers	Identify the number of connected devices (dampers, draft control, gas booster, etc.) for boiler start interlock		1 - 6	1
Boiler Config	Configure number of boilers on network			
- # of Condensing Boilers	Identify the number of Condensing boilers in the network			1
- # of Non-Condensing Boilers	Identify the number of Non-Condensing boilers in the network			0
- Off Delays	Set respective Damper Close/Off Delay time following boiler shutdown	seconds	0 - 9999	180
Damper MOA	Damper Manual-Off-Auto configuration - each device can be forced on or off in Manual mode; Auto means Damper Output enabled by specifically configured boiler(s) run request			
- Auto/Manual	Switch between Auto and Manual device enable/disable			Auto
- Manual On/Off	When in Manual, force respective Damper Output On or Off			Off

SECTION 5 - WIRING DIAGRAMS

5.1 - System Administrator (page 1 of 2)

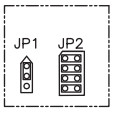
HYDRONIC SYSTEM CONTROL – ADMINISTRATOR PANEL



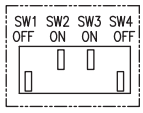
CUSTOMER CONNECTIONS

DEVICE	TERMINALS
MAIN POWER, 120VAC	1,4
SYSTEM ENABLE	11,20
DHW DEMAND *	12,20
COLD BLDG/BOOST DEMAND *	13,20
SYSTEM PUMP PROVE *	14,20
NIGHT SETBACK *	15,20
SYSTEM ALARM OUTPUT *	CR–1 COM, NC OR NO
SYSTEM PUMP ENABLE (2) *	31,32 & 33,34
DHW AUX1 ENABLE *	35,36
DHW AUX2 ENABLE *	37,38
BYPASS VALVE OPEN *	39,40
CONDENSING SUPPLY HEADER TEMP *	21, F–1
MAIN SYSTEM SUPPLY TEMPERATURE	22, F–2
RETURN HEADER TEMPERATURE	23, F–3
OUTDOOR AIR TEMPERATURE	24, F–4
CANBUS CONTROL NETWORK	PLC (V–,CNL,SH,CNH,V+)
BLDG COMMUNICATION INTERFACE (MODBUS RTU)	49,50

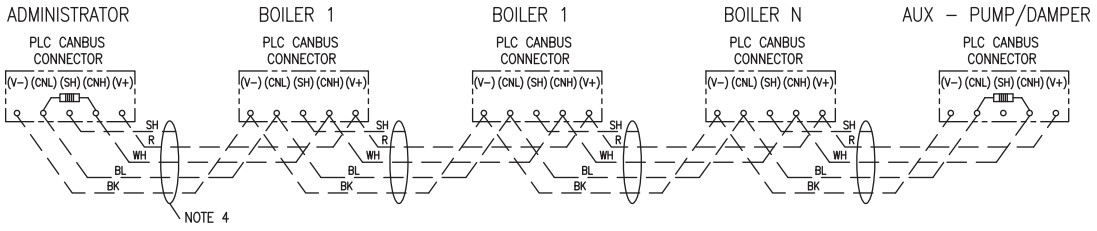
I/O CONFIG JUMPER SETTINGS



MJ PORT DIP SWITCH SETTINGS



TYPICAL CANBUS NETWORK WIRING



NOTES:

1. GROUND SHIELD OF MULIT–CONDUCTOR ANALOG SIGNAL WIRE AT ONE END ONLY
2. REFER TO BOILER WD FOR SPECIFIC BOILER CONNECTIONS
3. REFER TO HSC MANUAL FOR CONFIGURATION DETAILS
4. FOR CANBUS, USE 4C SHIELDED CABLE, 24 AWG OR LARGER; CONNECT DEVICES IN DAISY CHAIN TOPOLOGY; CONNECT 121 OHM TERMINATION RESISTOR AT EACH END OF BUSS ONLY.
5. FOR MODBUS, USE CAT 5E ETHERNET CABLE, 24 AWG, EIA/TIA 568B STD, W/ RJ45 CONNECTOR; LAND WIRES CONNECTED TO PINS 1 & 2 AT TERMINALS – REGARDLESS OF WIRE COLOR.

◇ ADMINISTRATOR PANEL TERMINAL

( ) TERMINAL DESIGNATION ON DEVICE

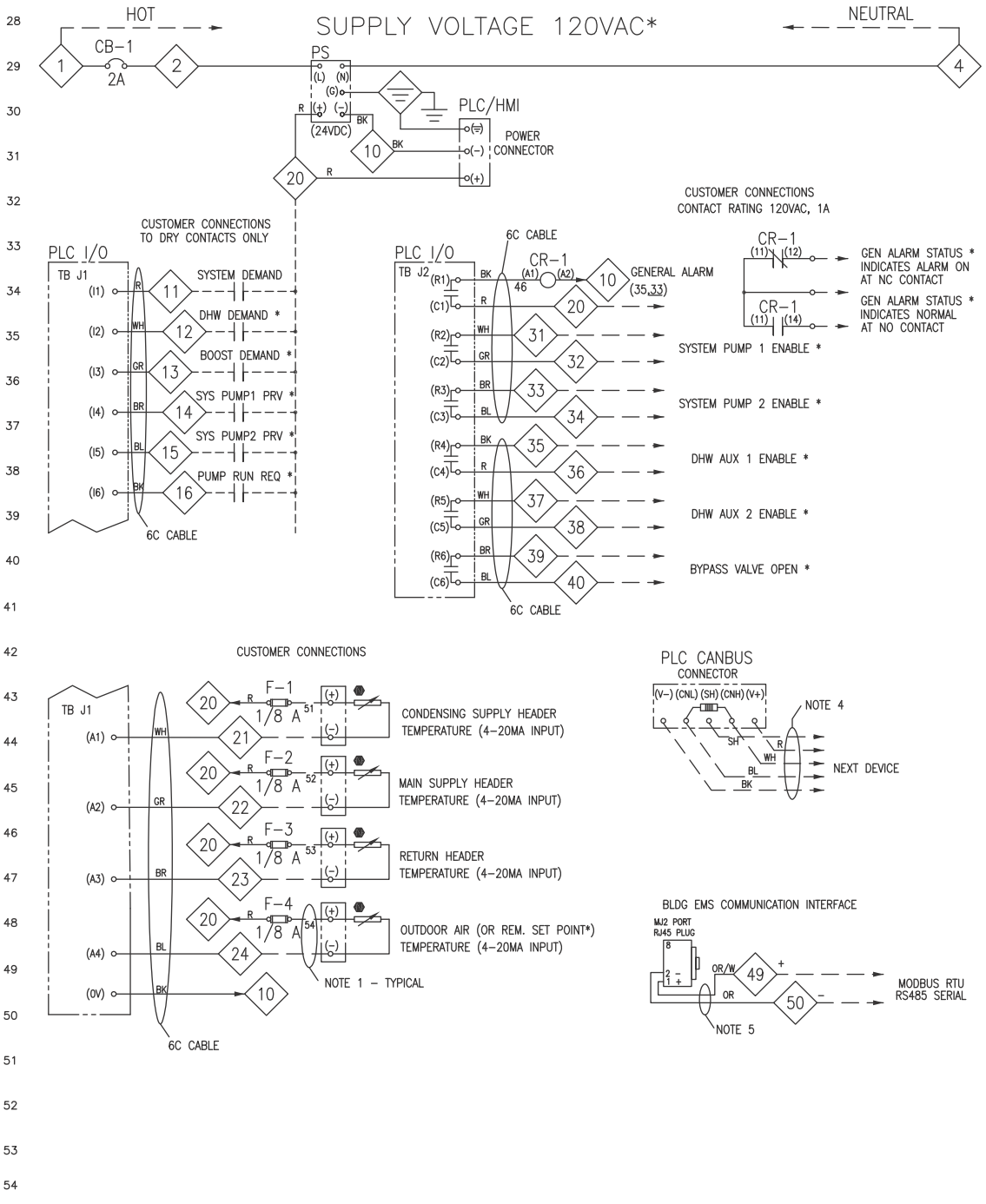
—— —— WIRING BY OTHERS

⬢ COMPONENT MOUNTED OUTSIDE ADMIN CONTROL PANEL

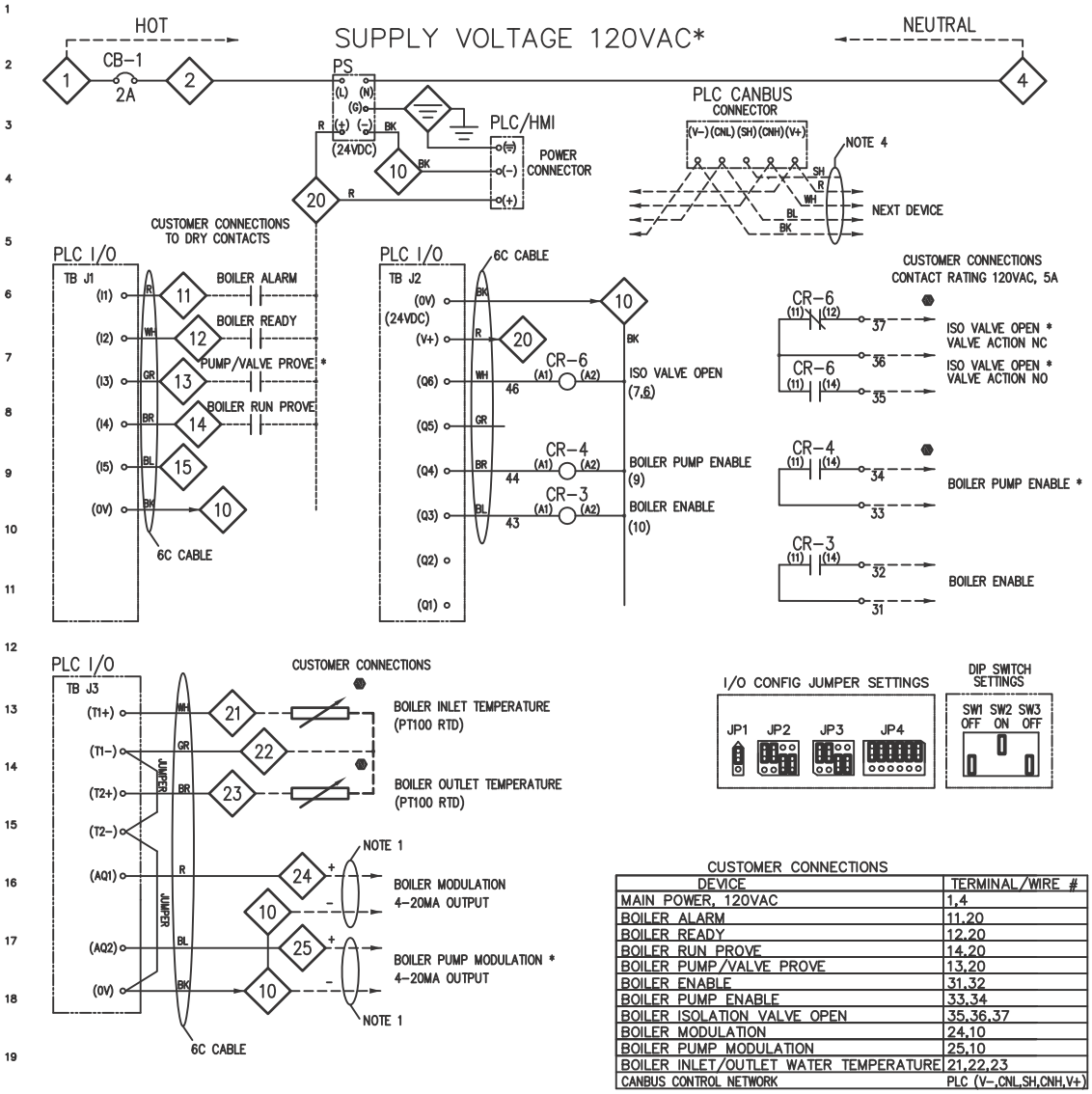
* OPTIONAL FUNCTION OR EQUIPMENT NOT SUPPLIED BY CLEAVER–BROOKS

SEE FORM C23–3862 FOR FULL DESCRIPTION OF ALL MNEMONIC DESIGNATIONS

System Administrator (page 2 of 2)



5.2 - Boiler Interface Module



CUSTOMER CONNECTIONS

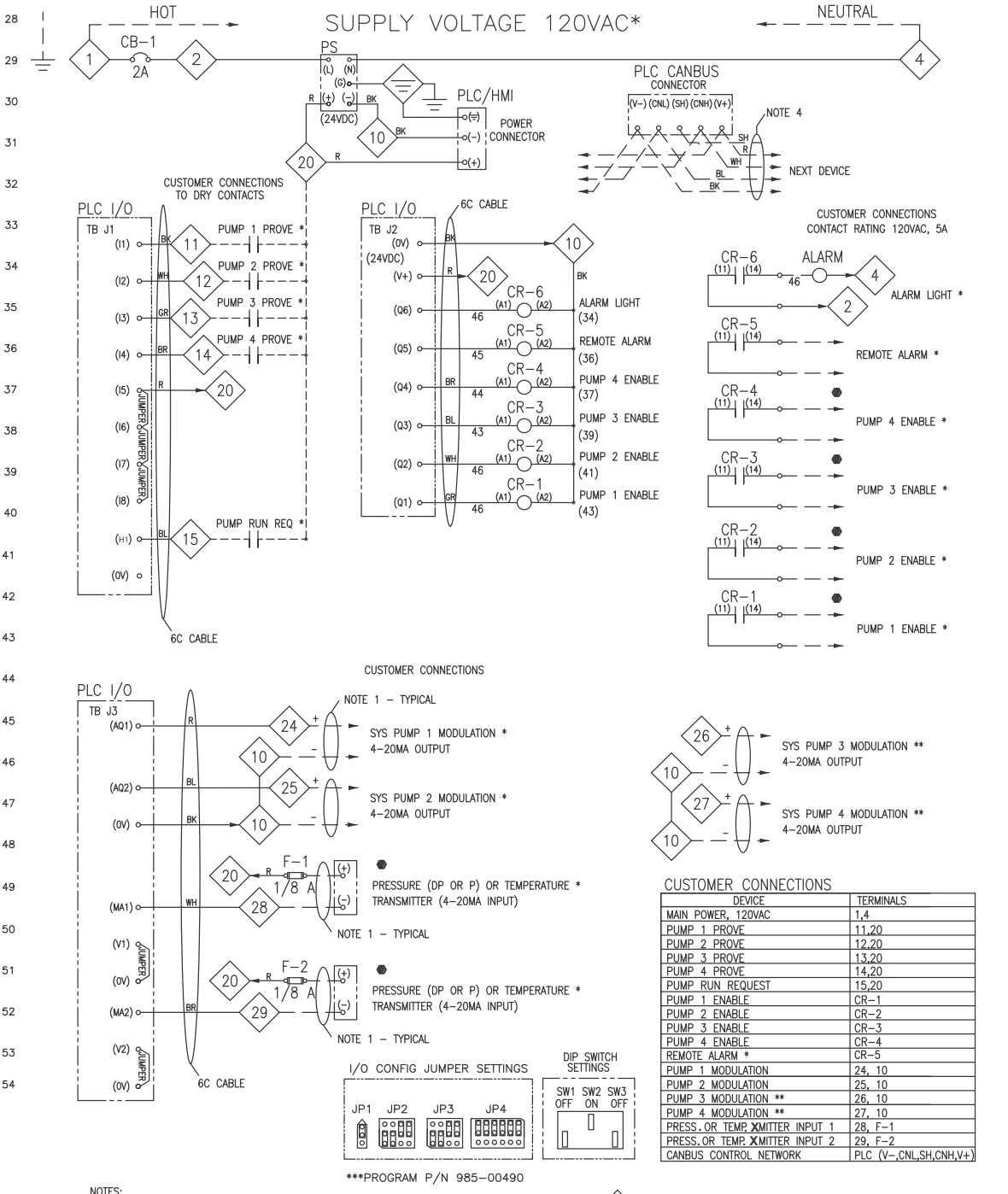
DEVICE	TERMINAL/WIRE #
MAIN POWER, 120VAC	1,4
BOILER ALARM	11,20
BOILER READY	12,20
BOILER RUN PROVE	14,20
BOILER PUMP/VALVE PROVE	13,20
BOILER ENABLE	31,32
BOILER PUMP ENABLE	33,34
BOILER ISOLATION VALVE OPEN	35,36,37
BOILER MODULATION	24,10
BOILER PUMP MODULATION	25,10
BOILER INLET/OUTLET WATER TEMPERATURE	21,22,23
CANBUS CONTROL NETWORK	PLC (V-,CNL,SH,CNH,V+)

NOTES:
1. GROUND SHIELD OF 2-CONDUCTOR ANALOG SIGNAL WIRE AT PANEL END ONLY
2. REFER TO BOILER WD FOR SPECIFIC BOILER CONNECTIONS
3. REFER TO HSC MANUAL FOR CONFIGURATION DETAILS
4. FOR CANBUS, USE 4C SHIELDED CABLE, 24 AWG OR LARGER; CONNECT DEVICES IN DAISY CHAIN TOPOLOGY; CONNECT 121 OHM TERMINATION RESISTOR AT EACH END OF BUSS ONLY.

HSC BOILER INTERFACE MODULE

◇ BOILER I/O MODULE TERMINAL
( ) TERMINAL DESIGNATION ON DEVICE
---- WIRING BY OTHERS
⬣ COMPONENT MOUNTED OUTSIDE BOILER CONTROL PANEL
* OPTIONAL FUNCTION OR EQUIPMENT NOT SUPPLIED BY CLEAVER-BROOKS
SEE FORM C23-3862 FOR FULL DESCRIPTION OF ALL MNEMONIC DESIGNATIONS

5.3 - Pump Interface Module



CUSTOMER CONNECTIONS

DEVICE	TERMINALS
MAIN POWER, 120VAC	1,4
PUMP 1 PROVE	11,20
PUMP 2 PROVE	12,20
PUMP 3 PROVE	13,20
PUMP 4 PROVE	14,20
PUMP RUN REQUEST	15,20
PUMP 1 ENABLE	CR-1
PUMP 2 ENABLE	CR-2
PUMP 3 ENABLE	CR-3
PUMP 4 ENABLE	CR-4
REMOTE ALARM *	CR-5
PUMP 1 MODULATION	24, 10
PUMP 2 MODULATION	25, 10
PUMP 3 MODULATION **	26, 10
PUMP 4 MODULATION **	27, 10
PRESS.OR TEMP. XMITTER INPUT 1	28, F-1
PRESS.OR TEMP. XMITTER INPUT 2	29, F-2
CANBUS CONTROL NETWORK	PLC (V-,CNL,SH,CNH,V+)

***PROGRAM P/N 985-00490

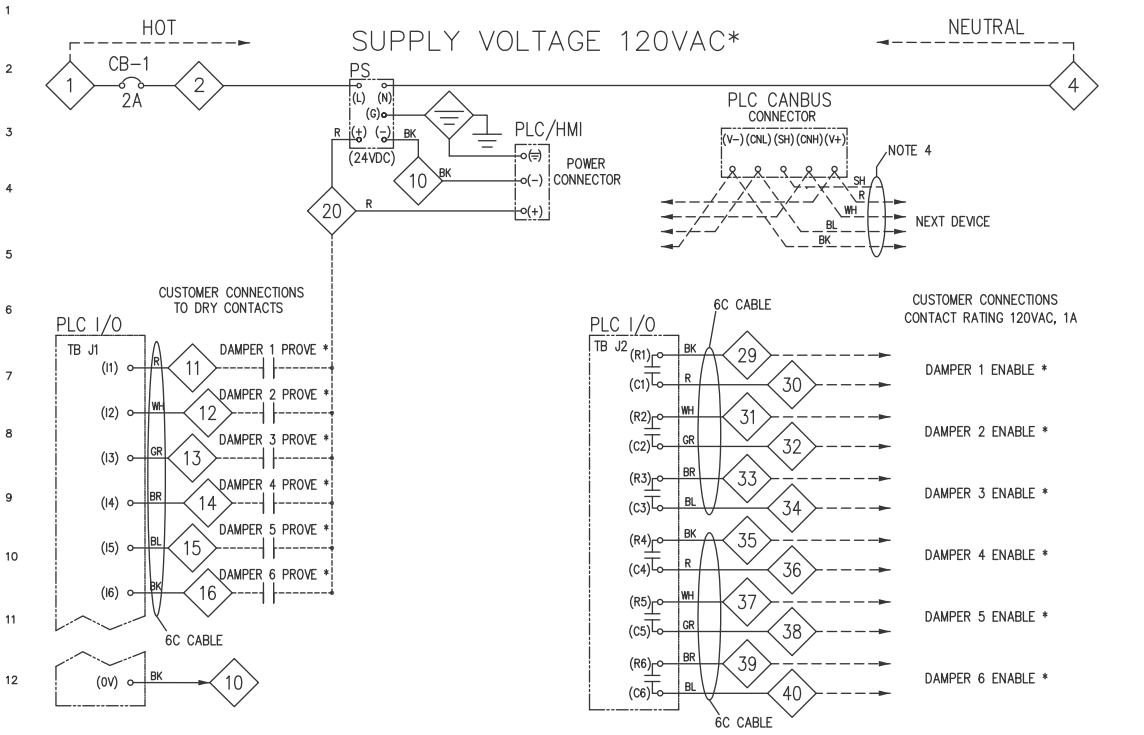
NOTES:

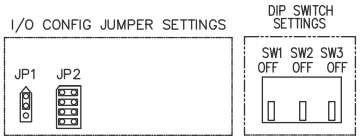
1. GROUND SHIELD OF MULIT-CONDUCTOR ANALOG SIGNAL WIRE AT ONE END ONLY
2. REFER TO PUMP/VSD WD FOR SPECIFIC PUMP INTERFACE CONNECTIONS
3. REFER TO HSC MANUAL FOR CONFIGURATION DETAILS
4. FOR CANBUS, USE 4C SHIELDED CABLE, 24 AWG OR LARGER; CONNECT DEVICES IN DAISY CHAIN TOPOLOGY; CONNECT 121 OHM TERMINATION RESISTOR AT EACH END OF BUSS ONLY.
5. FOR MODBUS, USE CAT 5E ETHERNET CABLE, 24 AWG, EIA/TIA 568B STD, W/ RJ45 CONNECTOR; LAND WIRES CONNECTED TO PINS 1 & 2 AT TERMINALS - REGARDLESS OF WIRE COLOR.
6. MINIMUM WIRE SIZE#18 AWG FOR CONTROL VOLTAGE WIRING

◇ PUMP INTERFACE PANEL TERMINAL
( ) TERMINAL DESIGNATION ON DEVICE
—— —— WIRING BY OTHERS
⬣ COMPONENT MOUNTED OUTSIDE PUMP INTERFACE PANEL
* OPTIONAL FUNCTION OR EQUIPMENT NOT SUPPLIED BY CLEAVER-BROOKS

SEE FORM C23-3862 FOR FULL DESCRIPTION OF ALL MNEMONIC DESIGNATIONS

5.4 - Damper Interface Module





CUSTOMER CONNECTIONS

DEVICE	TERMINAL/WIRE #
MAIN POWER, 120VAC	1,4
DAMPER 1 ENABLE	29,30
DAMPER 2 ENABLE	31,32
DAMPER 3 ENABLE	33,34
DAMPER 4 ENABLE	35,36
DAMPER 5 ENABLE	37,38
DAMPER 6 ENABLE	39,40
DAMPER 1 PROVE	11,20
DAMPER 2 PROVE	12,20
DAMPER 3 PROVE	13,20
DAMPER 4 PROVE	14,20
DAMPER 5 PROVE	15,20
DAMPER 6 PROVE	16,20
CANBUS CONTROL NETWORK	PLC (V-,CNL,SH,CNH,V+)

NOTES:
1. GROUND SHIELD OF 2-CONDUCTOR ANALOG SIGNAL WIRE AT PANEL END ONLY
2. REFER TO SYSTEM SCHEMATIC FOR NUMBER OF DAMPERS OR OTHER START INTERLOCK DEVICES.
3. REFER TO HSC MANUAL FOR CONFIGURATION DETAILS
4. FOR CANBUS, USE 4C SHIELDED CABLE, 24 AWG OR LARGER; CONNECT DEVICES IN DAISY CHAIN TOPOLOGY; CONNECT 121 OHM TERMINATION RESISTOR AT EACH END OF BUSS ONLY.

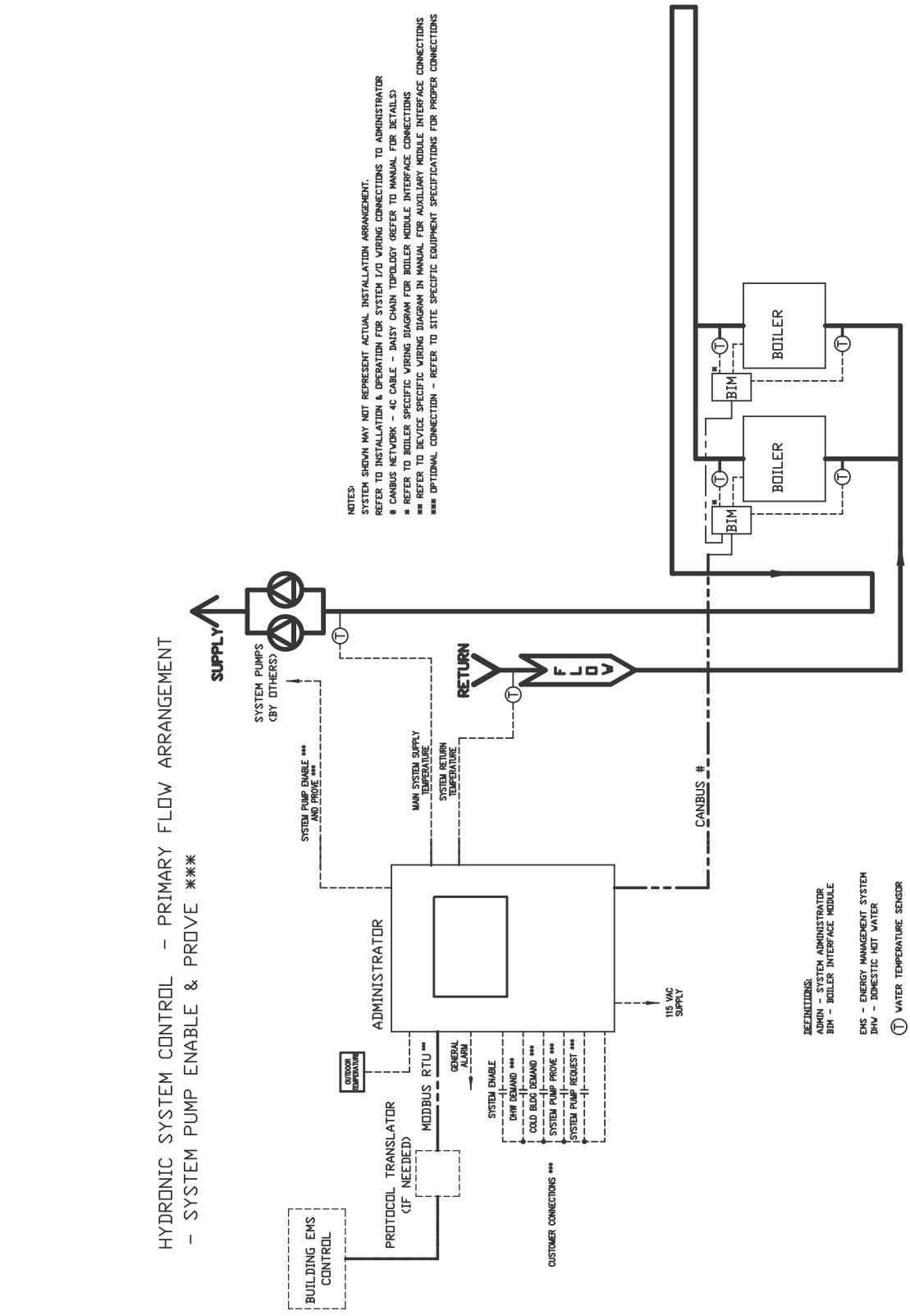
◇ BOILER I/O MODULE TERMINAL
( ) TERMINAL DESIGNATION ON DEVICE
– – – – WIRING BY OTHERS
⬣ EQUIPMENT MOUNTED OUTSIDE BOILER CONTROL PANEL
* OPTIONAL FUNCTION OR EQUIPMENT NOT SUPPLIED BY CLEAVER-BROOKS
SEE FORM C23-3862 FOR FULL DESCRIPTION OF ALL MNEMONIC DESIGNATIONS

HSC DAMPER INTERFACE MODULE

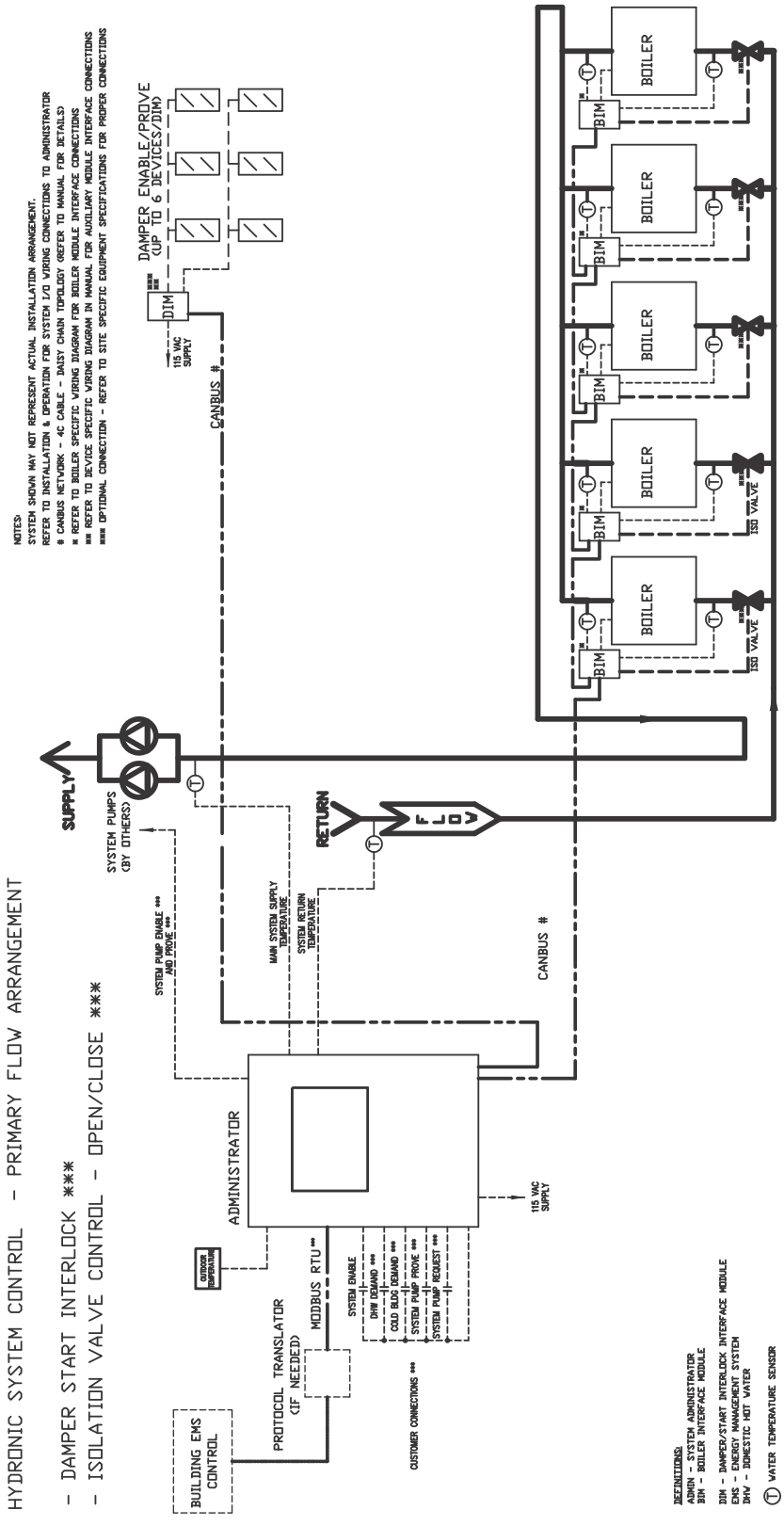
SECTION 6 - EXAMPLE SYSTEMS

The following examples illustrate some possible applications of the HSC hydronic system control. These are not intended as an exhaustive list, but merely to show some typical ways to take advantage of the control capabilities of the HSC.

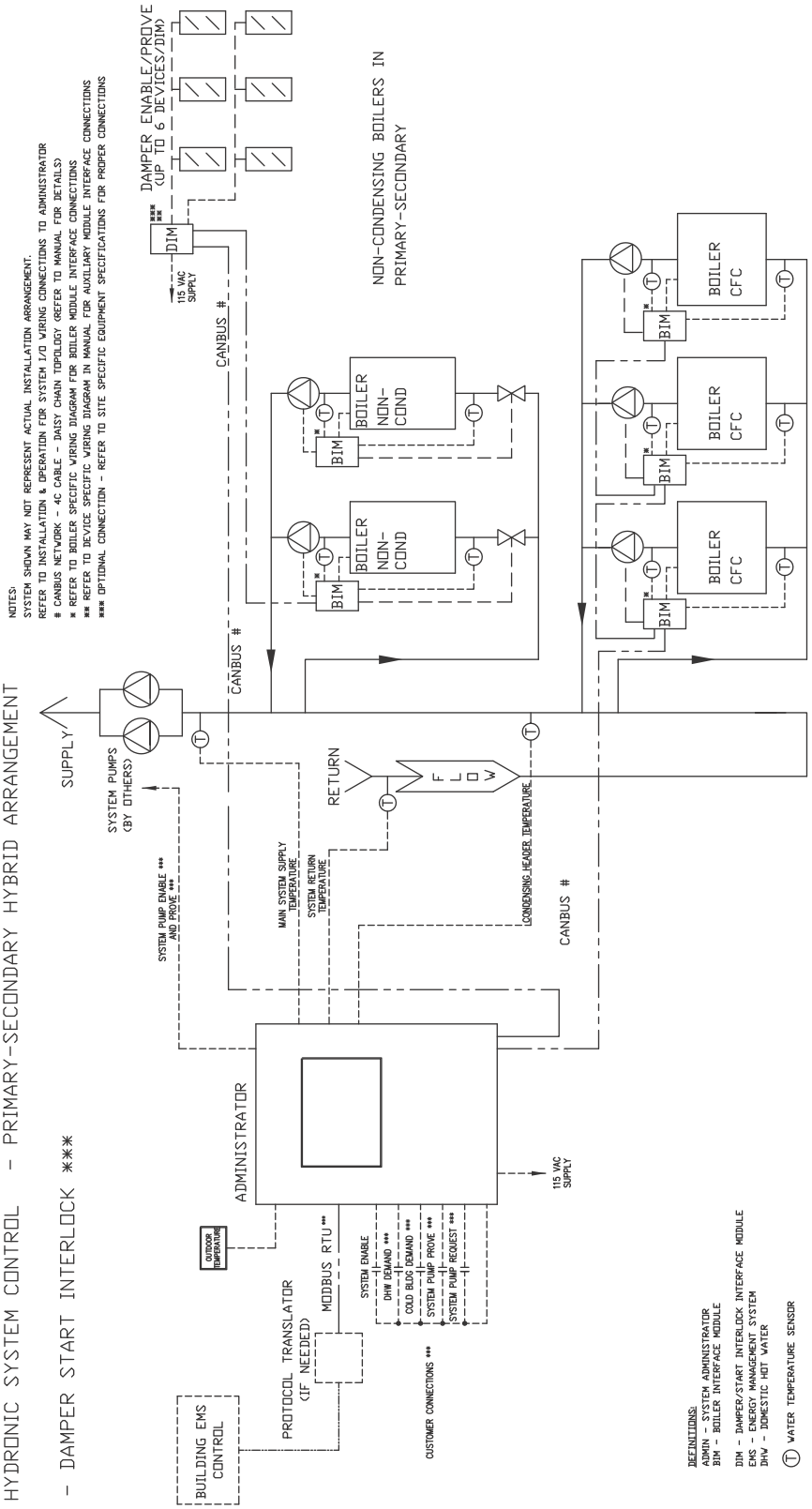
6.1 - 2 boilers, primary flow & system pumps



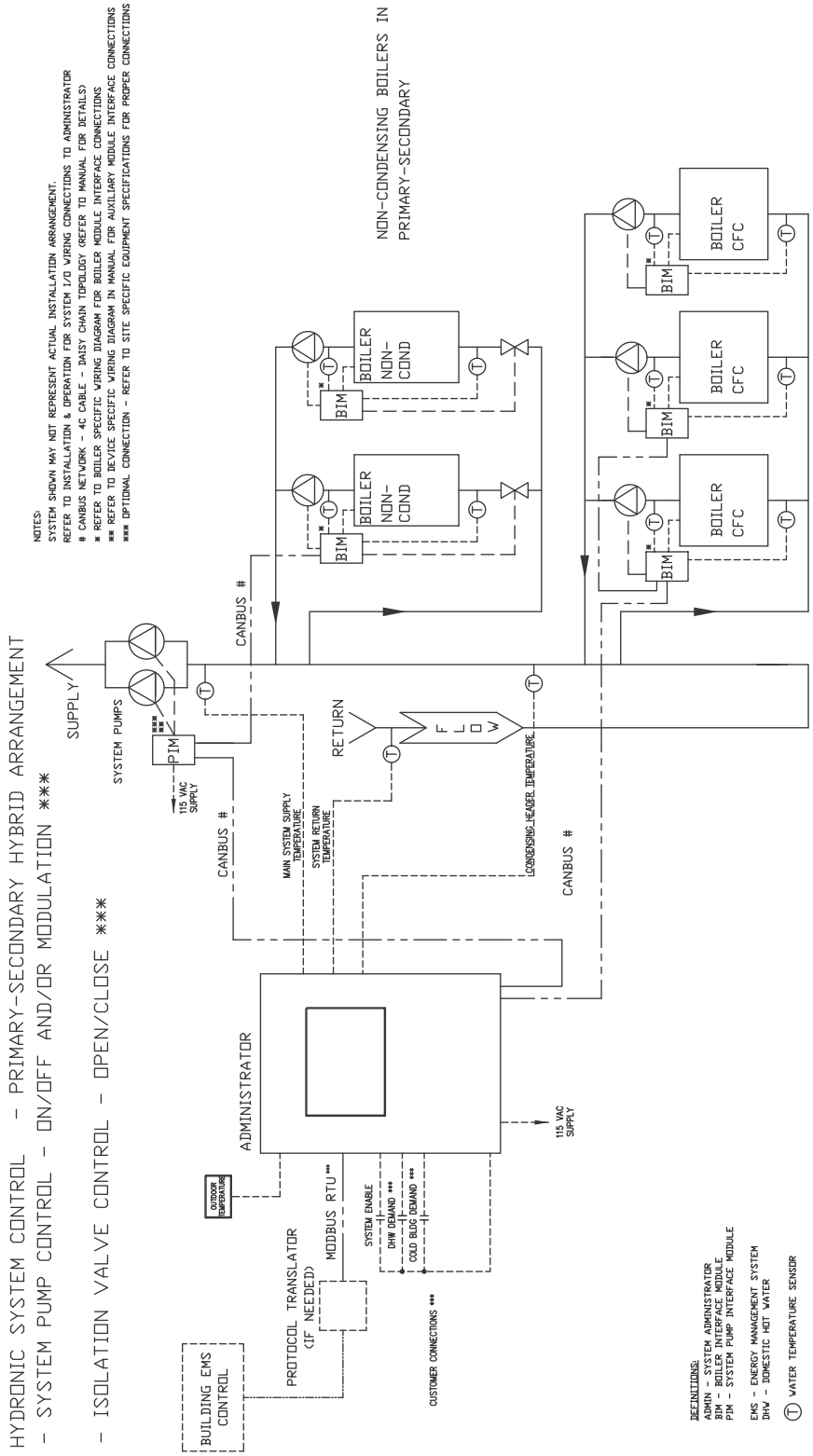
6.2 - Primary flow, iso. valves & damper start interlocks



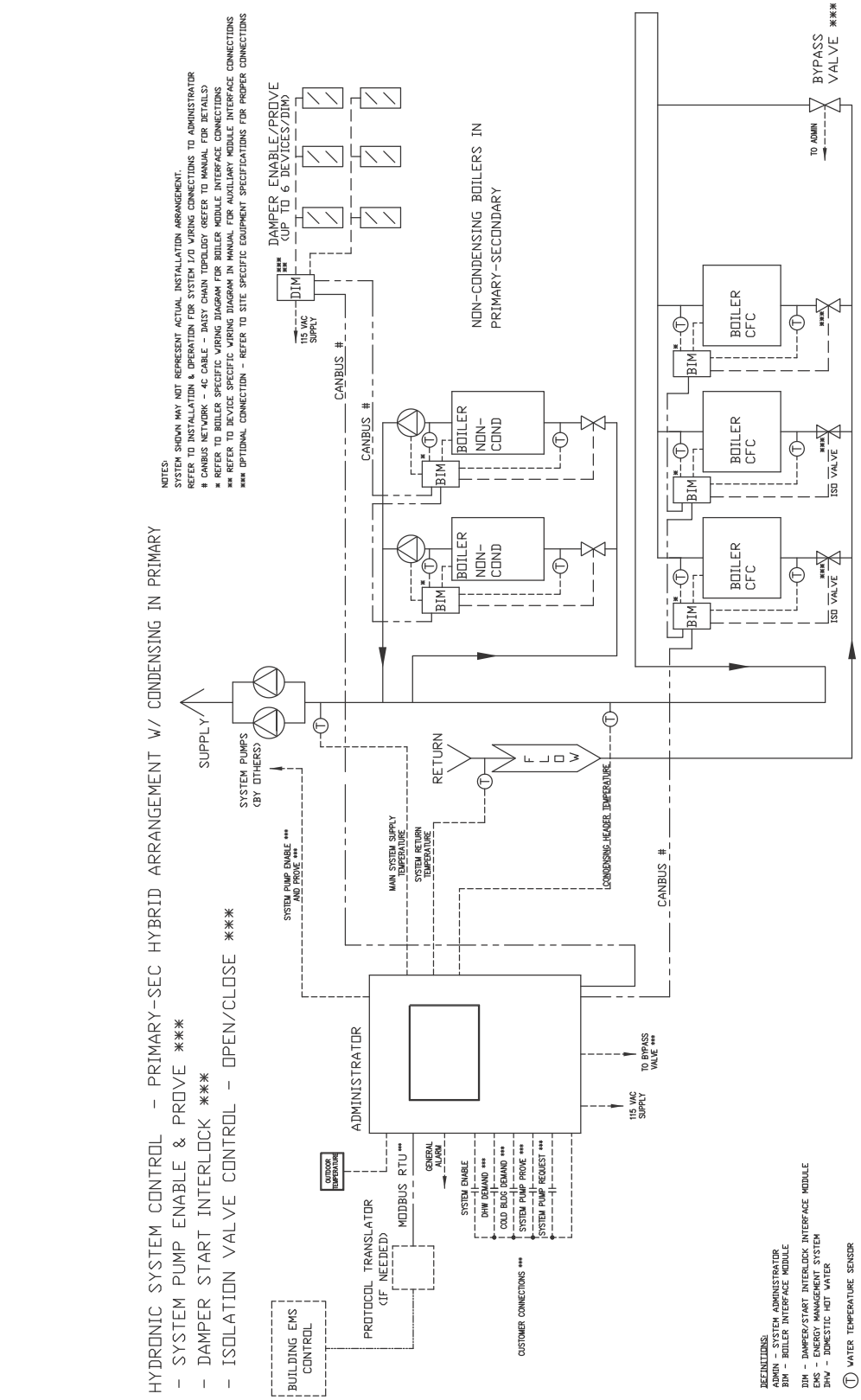
6.3 - Hybrid system, primary-secondary



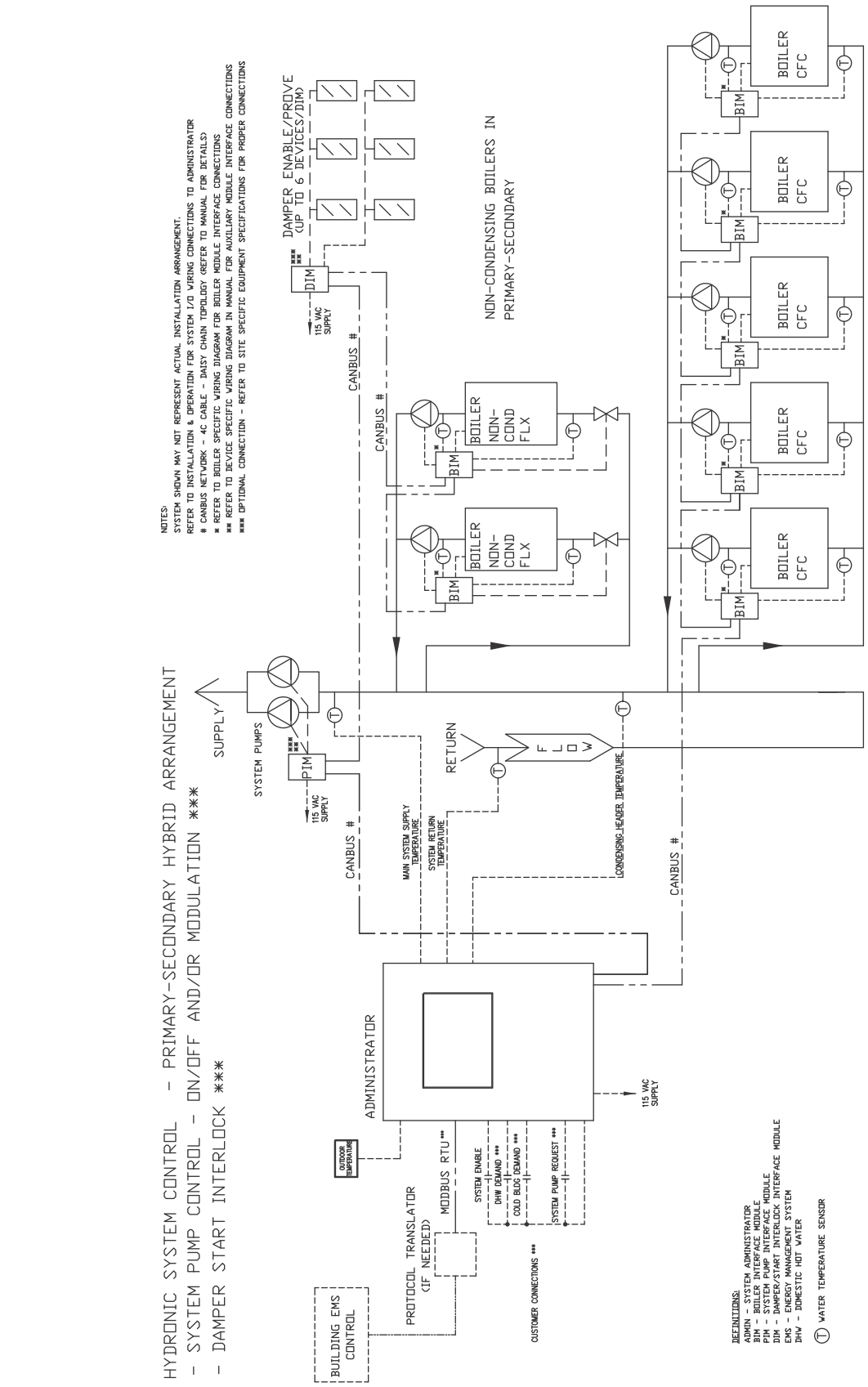
6.4 - Hybrid system, primary-secondary w/ system pump control



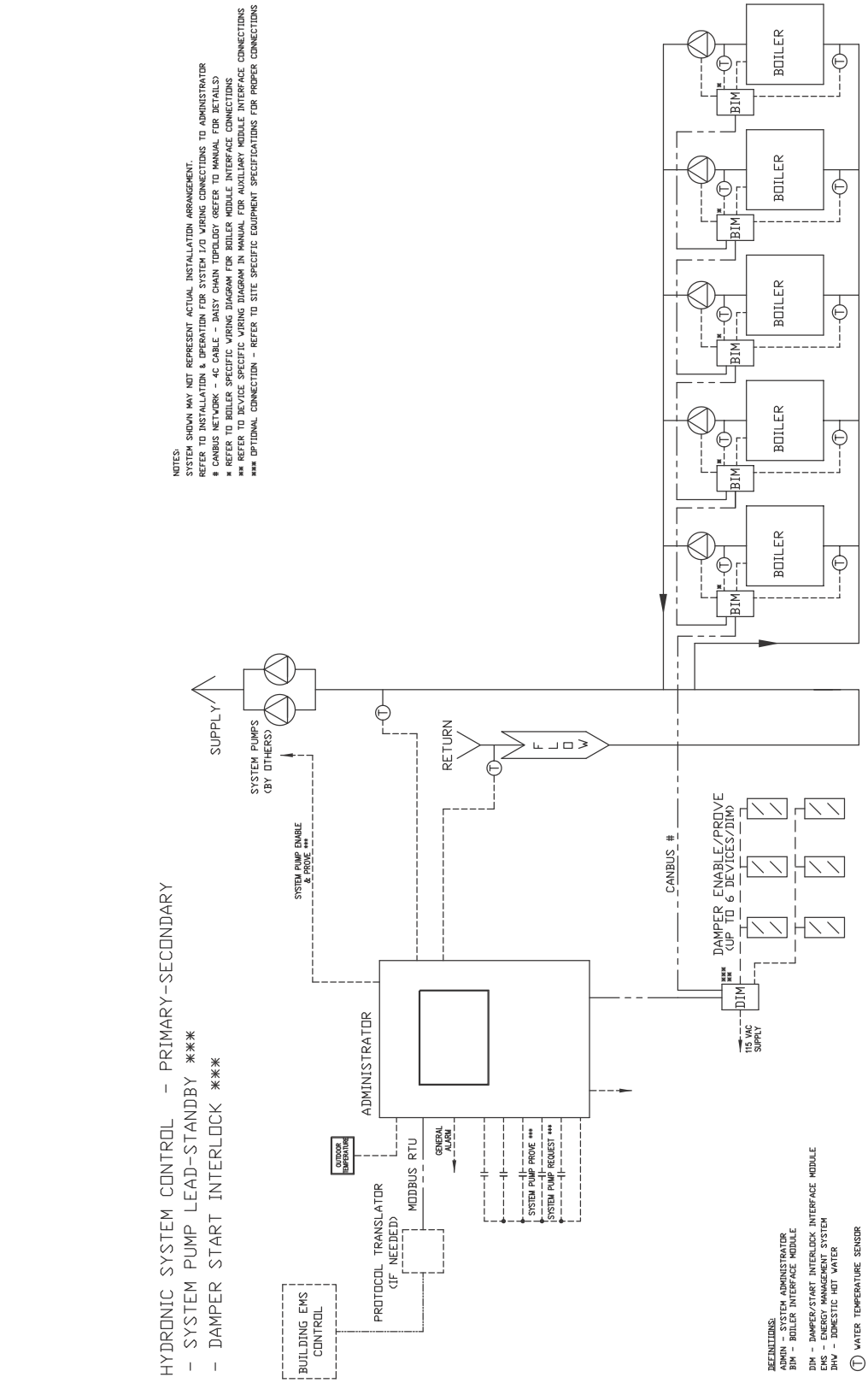
6.5 - Hybrid system, condensing boilers in primary



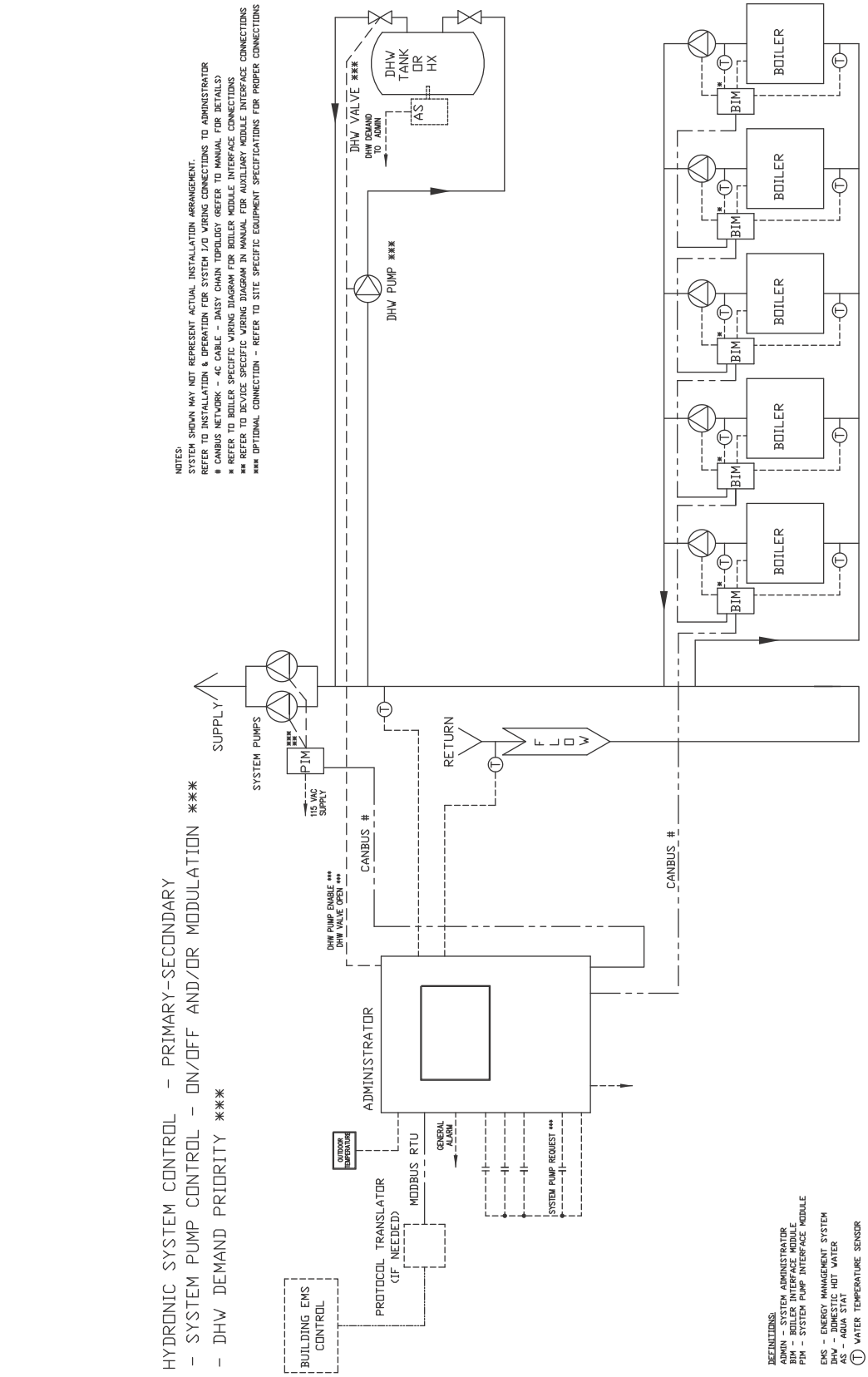
6.6 - Hybrid primary/secondary - system pump and damper control



6.7 - Primary/secondary w/ DHW



6.8 - Primary/secondary w/ DHW & system pump control



APPENDIX A - MODBUS

HSC Modbus specs	
Baud rate	Selectable: 9600 19,200 38,400
Parity	None
Data Bits	8
Stop Bits	1
Handshake	Multi-drop Half Duplex
Protocol	Modbus RTU
Mode	RS-485

HSC Modbus Map

Modbus Address	Data Type	Description	Notes
30021	Signed 16	Condensing Boiler 1 State	See Table 1
30022	Signed 16	Condensing Boiler 1 Alarm Word	See Table 2
30023	Signed 16	Condensing Boiler 1 Hours Word 1	
30024	Signed 16	Condensing Boiler 1 Hours Word 2	
30025	Signed 16	Condensing Boiler 1 Cycles Word 1	
30026	Signed 16	Condensing Boiler 1 Cycles Word 2	
30027	Signed 16	Condensing Boiler 1 Status Bits	
30028	Signed 16	Condensing Boiler 1 Inlet Temp	Implied tenths, degrees F
30029	Signed 16	Condensing Boiler 1 Fire Delay	
30030	Signed 16	Condensing Boiler 1 Outlet Temp	Implied tenths, degrees F
30031	Signed 16	Condensing Boiler 2 State	See Table 1
30032	Signed 16	Condensing Boiler 2 Alarm Word	See Table 2
30033	Signed 16	Condensing Boiler 2 Hours Word 1	
30034	Signed 16	Condensing Boiler 2 Hours Word 2	
30035	Signed 16	Condensing Boiler 2 Cycles Word 1	
30036	Signed 16	Condensing Boiler 2 Cycles Word 2	
30037	Signed 16	Condensing Boiler 2 Status Bits	
30038	Signed 16	Condensing Boiler 2 Inlet Temp	Implied tenths, degrees F
30039	Signed 16	Condensing Boiler 2 Fire Delay	

HSC Modbus Map (Continued)

Modbus Address	Data Type	Description	Notes
30040	Signed 16	Condensing Boiler 2 Outlet Temp	Implied tenths, degrees F
30041	Signed 16	Condensing Boiler 3 State	See Table 1
30042	Signed 16	Condensing Boiler 3 Alarm Word	See Table 2
30043	Signed 16	Condensing Boiler 3 Hours Word 1	
30044	Signed 16	Condensing Boiler 3 Hours Word 2	
30045	Signed 16	Condensing Boiler 3 Cycles Word 1	
30046	Signed 16	Condensing Boiler 3 Cycles Word 2	
30047	Signed 16	Condensing Boiler 3 Status Bits	
30048	Signed 16	Condensing Boiler 3 Inlet Temp	Implied tenths, degrees F
30049	Signed 16	Condensing Boiler 3 Fire Delay	
30050	Signed 16	Condensing Boiler 3 Outlet Temp	Implied tenths, degrees F
30051	Signed 16	Condensing Boiler 4 State	See Table 1
30052	Signed 16	Condensing Boiler 4 Alarm Word	See Table 2
30053	Signed 16	Condensing Boiler 4 Hours Word 1	
30054	Signed 16	Condensing Boiler 4 Hours Word 2	
30055	Signed 16	Condensing Boiler 4 Cycles Word 1	
30056	Signed 16	Condensing Boiler 4 Cycles Word 2	
30057	Signed 16	Condensing Boiler 4 Status Bits	
30058	Signed 16	Condensing Boiler 4 Inlet Temp	Implied tenths, degrees F
30059	Signed 16	Condensing Boiler 4 Fire Delay	
30060	Signed 16	Condensing Boiler 4 Outlet Temp	Implied tenths, degrees F
30061	Signed 16	Condensing Boiler 5 State	See Table 1
30062	Signed 16	Condensing Boiler 5 Alarm Word	See Table 2
30063	Signed 16	Condensing Boiler 5 Hours Word 1	
30064	Signed 16	Condensing Boiler 5 Hours Word 2	
30065	Signed 16	Condensing Boiler 5 Cycles Word 1	
30066	Signed 16	Condensing Boiler 5 Cycles Word 2	
30067	Signed 16	Condensing Boiler 5 Status Bits	
30068	Signed 16	Condensing Boiler 5 Inlet Temp	Implied tenths, degrees F
30069	Signed 16	Condensing Boiler 5 Fire Delay	
30070	Signed 16	Condensing Boiler 5 Outlet Temp	Implied tenths, degrees F

HSC Modbus Map (Continued)

Modbus Address	Data Type	Description	Notes
30071	Signed 16	Condensing Boiler 6 State	See Table 1
30072	Signed 16	Condensing Boiler 6 Alarm Word	See Table 2
30073	Signed 16	Condensing Boiler 6 Hours Word 1	
30074	Signed 16	Condensing Boiler 6 Hours Word 2	
30075	Signed 16	Condensing Boiler 6 Cycles Word 1	
30076	Signed 16	Condensing Boiler 6 Cycles Word 2	
30077	Signed 16	Condensing Boiler 6 Status Bits	
30078	Signed 16	Condensing Boiler 6 Inlet Temp	Implied tenths, degrees F
30079	Signed 16	Condensing Boiler 6 Fire Delay	
30080	Signed 16	Condensing Boiler 6 Outlet Temp	Implied tenths, degrees F
30081	Signed 16	Condensing Boiler 7 State	See Table 1
30082	Signed 16	Condensing Boiler 7 Alarm Word	See Table 2
30083	Signed 16	Condensing Boiler 7 Hours Word 1	
30084	Signed 16	Condensing Boiler 7 Hours Word 2	
30085	Signed 16	Condensing Boiler 7 Cycles Word 1	
30086	Signed 16	Condensing Boiler 7 Cycles Word 2	
30087	Signed 16	Condensing Boiler 7 Status Bits	
30088	Signed 16	Condensing Boiler 7 Inlet Temp	Implied tenths, degrees F
30089	Signed 16	Condensing Boiler 7 Fire Delay	
30090	Signed 16	Condensing Boiler 7 Outlet Temp	Implied tenths, degrees F
30091	Signed 16	Condensing Boiler 8 State	See Table 1
30092	Signed 16	Condensing Boiler 8 Alarm Word	See Table 2
30093	Signed 16	Condensing Boiler 8 Hours Word 1	
30094	Signed 16	Condensing Boiler 8 Hours Word 2	
30095	Signed 16	Condensing Boiler 8 Cycles Word 1	
30096	Signed 16	Condensing Boiler 8 Cycles Word 2	
30097	Signed 16	Condensing Boiler 8 Status Bits	
30098	Signed 16	Condensing Boiler 8 Inlet Temp	Implied tenths, degrees F
30099	Signed 16	Condensing Boiler 8 Fire Delay	
30100	Signed 16	Condensing Boiler 8 Outlet Temp	Implied tenths, degrees F
30101	Signed 16	Condensing Boiler 9 State	See Table 1

HSC Modbus Map (Continued)

Modbus Address	Data Type	Description	Notes
30102	Signed 16	Condensing Boiler 9 Alarm Word	See Table 2
30103	Signed 16	Condensing Boiler 9 Hours Word 1	
30104	Signed 16	Condensing Boiler 9 Hours Word 2	
30105	Signed 16	Condensing Boiler 9 Cycles Word 1	
30106	Signed 16	Condensing Boiler 9 Cycles Word 2	
30107	Signed 16	Condensing Boiler 9 Status Bits	
30108	Signed 16	Condensing Boiler 9 Inlet Temp	Implied tenths, degrees F
30109	Signed 16	Condensing Boiler 9 Fire Delay	
30110	Signed 16	Condensing Boiler 9 Outlet Temp	Implied tenths, degrees F
30111	Signed 16	Condensing Boiler 10 State	See Table 1
30112	Signed 16	Condensing Boiler 10 Alarm Word	See Table 2
30113	Signed 16	Condensing Boiler 10 Hours Word 1	
30114	Signed 16	Condensing Boiler 10 Hours Word 2	
30115	Signed 16	Condensing Boiler 10 Cycles Word 1	
30116	Signed 16	Condensing Boiler 10 Cycles Word 2	
30117	Signed 16	Condensing Boiler 10 Status Bits	
30118	Signed 16	Condensing Boiler 10 Inlet Temp	Implied tenths, degrees F
30119	Signed 16	Condensing Boiler 10 Fire Delay	
30120	Signed 16	Condensing Boiler 10 Outlet Temp	Implied tenths, degrees F
30121	Signed 16	Non-Condensing Boiler A State	See Table 1
30122	Signed 16	Non-Condensing Boiler A Alarm Word	See Table 2
30123	Signed 16	Non-Condensing Boiler A Hours Word 1	
30124	Signed 16	Non-Condensing Boiler A Hours Word 2	
30125	Signed 16	Non-Condensing Boiler A Cycles Word 1	
30126	Signed 16	Non-Condensing Boiler A Cycles Word 2	
30127	Signed 16	Non-Condensing Boiler A Status Bits	
30128	Signed 16	Non-Condensing Boiler A Inlet Temp	Implied tenths, degrees F
30129	Signed 16	Non-Condensing Boiler A Fire Delay	
30130	Signed 16	Non-Condensing Boiler A Outlet Temp	Implied tenths, degrees F
30131	Signed 16	Non-Condensing Boiler B State	See Table 1

HSC Modbus Map (Continued)

Modbus Address	Data Type	Description	Notes
30132	Signed 16	Non-Condensing Boiler B Alarm Word	See Table 2
30133	Signed 16	Non-Condensing Boiler B Hours Word 1	
30134	Signed 16	Non-Condensing Boiler B Hours Word 2	
30135	Signed 16	Non-Condensing Boiler B Cycles Word 1	
30136	Signed 16	Non-Condensing Boiler B Cycles Word 2	
30137	Signed 16	Non-Condensing Boiler B Status Bits	
30138	Signed 16	Non-Condensing Boiler B Inlet Temp	Implied tenths, degrees F
30139	Signed 16	Non-Condensing Boiler B Fire Delay	
30140	Signed 16	Non-Condensing Boiler B Outlet Temp	Implied tenths, degrees F
30141	Signed 16	Non-Condensing Boiler C State	See Table 1
30142	Signed 16	Non-Condensing Boiler C Alarm Word	See Table 2
30143	Signed 16	Non-Condensing Boiler C Hours Word 1	
30144	Signed 16	Non-Condensing Boiler C Hours Word 2	
30145	Signed 16	Non-Condensing Boiler C Cycles Word 1	
30146	Signed 16	Non-Condensing Boiler C Cycles Word 2	
30147	Signed 16	Non-Condensing Boiler C Status Bits	
30148	Signed 16	Non-Condensing Boiler C Inlet Temp	Implied tenths, degrees F
30149	Signed 16	Non-Condensing Boiler C Fire Delay	
30150	Signed 16	Non-Condensing Boiler C Outlet Temp	Implied tenths, degrees F
30151	Signed 16	Non-Condensing Boiler D State	See Table 1
30152	Signed 16	Non-Condensing Boiler D Alarm Word	See Table 2
30153	Signed 16	Non-Condensing Boiler D Hours Word 1	
30154	Signed 16	Non-Condensing Boiler D Hours Word 2	
30155	Signed 16	Non-Condensing Boiler D Cycles Word 1	
30156	Signed 16	Non-Condensing Boiler D Cycles Word 2	
30157	Signed 16	Non-Condensing Boiler D Status Bits	
30158	Signed 16	Non-Condensing Boiler D Inlet Temp	Implied tenths, degrees F
30159	Signed 16	Non-Condensing Boiler D Fire Delay	
30160	Signed 16	Non-Condensing Boiler D Outlet Temp	Implied tenths, degrees F
30161	Signed 16	Non-Condensing Boiler E State	See Table 1
30162	Signed 16	Non-Condensing Boiler E Alarm Word	See Table 2

HSC Modbus Map (Continued)

Modbus Address	Data Type	Description	Notes
30163	Signed 16	Non-Condensing Boiler E Hours Word 1	
30164	Signed 16	Non-Condensing Boiler E Hours Word 2	
30165	Signed 16	Non-Condensing Boiler E Cycles Word 1	
30166	Signed 16	Non-Condensing Boiler E Cycles Word 2	
30167	Signed 16	Non-Condensing Boiler E Status Bits	
30168	Signed 16	Non-Condensing Boiler E Inlet Temp	Implied tenths, degrees F
30169	Signed 16	Non-Condensing Boiler E Fire Delay	
30170	Signed 16	Non-Condensing Boiler E Outlet Temp	Implied tenths, degrees F
30171	Signed 16	Non-Condensing Boiler F State	See Table 1
30172	Signed 16	Non-Condensing Boiler F Alarm Word	See Table 2
30173	Signed 16	Non-Condensing Boiler F Hours Word 1	
30174	Signed 16	Non-Condensing Boiler F Hours Word 2	
30175	Signed 16	Non-Condensing Boiler F Cycles Word 1	
30176	Signed 16	Non-Condensing Boiler F Cycles Word 2	
30177	Signed 16	Non-Condensing Boiler F Status Bits	
30178	Signed 16	Non-Condensing Boiler F Inlet Temp	Implied tenths, degrees F
30179	Signed 16	Non-Condensing Boiler F Fire Delay	
30180	Signed 16	Non-Condensing Boiler F Outlet Temp	Implied tenths, degrees F
30181	Signed 16	Non-Condensing Boiler G State	See Table 1
30182	Signed 16	Non-Condensing Boiler G Alarm Word	See Table 2
30183	Signed 16	Non-Condensing Boiler G Hours Word 1	
30184	Signed 16	Non-Condensing Boiler G Hours Word 2	
30185	Signed 16	Non-Condensing Boiler G Cycles Word 1	
30186	Signed 16	Non-Condensing Boiler G Cycles Word 2	
30187	Signed 16	Non-Condensing Boiler G Status Bits	
30188	Signed 16	Non-Condensing Boiler G Inlet Temp	Implied tenths, degrees F
30189	Signed 16	Non-Condensing Boiler G Fire Delay	
30190	Signed 16	Non-Condensing Boiler G Outlet Temp	Implied tenths, degrees F
30191	Signed 16	Non-Condensing Boiler H State	See Table 1
30192	Signed 16	Non-Condensing Boiler H Alarm Word	See Table 2
30193	Signed 16	Non-Condensing Boiler H Hours Word 1	

HSC Modbus Map (Continued)

Modbus Address	Data Type	Description	Notes
30194	Signed 16	Non-Condensing Boiler H Hours Word 2	
30195	Signed 16	Non-Condensing Boiler H Cycles Word 1	
30196	Signed 16	Non-Condensing Boiler H Cycles Word 2	
30197	Signed 16	Non-Condensing Boiler H Status Bits	
30198	Signed 16	Non-Condensing Boiler H Inlet Temp	Implied tenths, degrees F
30199	Signed 16	Non-Condensing Boiler H Fire Delay	
30200	Signed 16	Non-Condensing Boiler H Outlet Temp	Implied tenths, degrees F
30201	Signed 16	Non-Condensing Boiler I State	See Table 1
30202	Signed 16	Non-Condensing Boiler I Alarm Word	See Table 2
30203	Signed 16	Non-Condensing Boiler I Hours Word 1	
30204	Signed 16	Non-Condensing Boiler I Hours Word 2	
30205	Signed 16	Non-Condensing Boiler I Cycles Word 1	
30206	Signed 16	Non-Condensing Boiler I Cycles Word 2	
30207	Signed 16	Non-Condensing Boiler I Status Bits	
30208	Signed 16	Non-Condensing Boiler I Inlet Temp	Implied tenths, degrees F
30209	Signed 16	Non-Condensing Boiler I Fire Delay	
30210	Signed 16	Non-Condensing Boiler I Outlet Temp	Implied tenths, degrees F
30211	Signed 16	Non-Condensing Boiler J State	See Table 1
30212	Signed 16	Non-Condensing Boiler J Alarm Word	See Table 2
30213	Signed 16	Non-Condensing Boiler J Hours Word 1	
30214	Signed 16	Non-Condensing Boiler J Hours Word 2	
30215	Signed 16	Non-Condensing Boiler J Cycles Word 1	
30216	Signed 16	Non-Condensing Boiler J Cycles Word 2	
30217	Signed 16	Non-Condensing Boiler J Status Bits	
30218	Signed 16	Non-Condensing Boiler J Inlet Temp	Implied tenths, degrees F
30219	Signed 16	Non-Condensing Boiler J Fire Delay	
30220	Signed 16	Non-Condensing Boiler J Outlet Temp	Implied tenths, degrees F
30221	Signed 16	Rem. System Pump Module Input Word	See Table for bit definition
30222	Signed 16	Rem. System Pump Module Output Word	See Table for bit definition
30223	Signed 16	Number of Remote System Pumps	

HSC Modbus Map (Continued)

Modbus Address	Data Type	Description	Notes
30224	Float 32	Pump Module Analog In 1 Scaled Value	
30226	Float 32	Pump Module Analog In 2 Scaled Value	
30228	Float 32	System Pump Speed Requested	
30230	Float 32	Pump PID Process Variable	
30232	Float 32	Pump PID Setpoint	
30234	Signed 16	Rem. System Pump Lead Pump Number	
30235	Signed 16	Rem. System Pump Lag1 Pump Number	
30236	Signed 16	Rem. System Pump Lag2 Pump Number	
30237	Signed 16	Rem. System Pump Lag3 Pump Number	
30300	Signed 16	Alarm Word 1 Value	See Table 5
30301	Signed 16	Alarm Word 2 Value	See Table 5
30302	Signed 16	Digital Input Word Value	See Table 6
30303	Signed 16	Digital Output Word 1 Value	See Table 7
30304	Signed 16	Digital Output Word 2 Value	See Table 7
30305	Signed 16	Number of Condensing Boilers Running	
30306	Signed 16	Number of Condensing Boilers Requested	
30307	Signed 16	Number of Non-Condensing Boilers Running	
30308	Signed 16	Number of Non-Condensing Boilers Requested	
30309	Signed 16	Number of Condensing Boilers in System	
30310	Signed 16	Number of Non-Condensing Boilers in System	
30311	Signed 16	Condensing Lead Boiler Number	
30312	Signed 16	Condensing Lag1 Boiler Number	
30313	Signed 16	Condensing Lag2 Boiler Number	
30314	Signed 16	Condensing Lag3 Boiler Number	
30315	Signed 16	Condensing Lag4 Boiler Number	
30316	Signed 16	Condensing Lag5 Boiler Number	
30317	Signed 16	Condensing Lag6 Boiler Number	
30318	Signed 16	Condensing Lag7 Boiler Number	
30319	Signed 16	Condensing Lag8 Boiler Number	
30320	Signed 16	Condensing Lag9 Boiler Number	

HSC Modbus Map (Continued)

Modbus Address	Data Type	Description	Notes
30321	Signed 16	Non-Condensing Lead Boiler Number	
30322	Signed 16	Non-Condensing Lag1 Boiler Number	
30323	Signed 16	Non-Condensing Lag2 Boiler Number	
30324	Signed 16	Non-Condensing Lag3 Boiler Number	
30325	Signed 16	Non-Condensing Lag4 Boiler Number	
30326	Signed 16	Non-Condensing Lag5 Boiler Number	
30327	Signed 16	Non-Condensing Lag6 Boiler Number	
30328	Signed 16	Non-Condensing Lag7 Boiler Number	
30329	Signed 16	Non-Condensing Lag8 Boiler Number	
30330	Signed 16	Non-Condensing Lag9 Boiler Number	
30340	Signed 16	Damper Module 1 Input (Damper Prove) Data	See table
30341	Signed 16	Damper Module 1 Output (Damper Reqired) Data	See table
30342	Signed 16	Damper Module 2 Input (Damper Prove) Data	See table
30343	Signed 16	Damper Module 2 Output (Damper Reqired) Data	See table
30344	Signed 16	Damper Module 3 Input (Damper Prove) Data	See table
30345	Signed 16	Damper Module 3 Output (Damper Reqired) Data	See table
30346	Signed 16	Damper Module 4 Input (Damper Prove) Data	See table
30347	Signed 17	Damper Module 4 Output (Damper Reqired) Data	See table
40280	Float 32	Condensing Boiler Header Temperature	
40282	Float 32	Main Supply Header Temperature	
40284	Float 32	System Return Temperature	
40286	Float 32	Outside Air Temp or Remote Analog Setpoint Value	
40300	Float 32	DHW Setpoint	
40304	Float 32	Cold Building Setpoint	
40306	Float 32	Remote Analog Input Setpoint Value	
40308	Float 32	Remote Modbus Setpoint Value	Write Point, real value
40310	Float 32	Remote Modbus Outdoor Air Temperature	Write Point, real value
40312	Signed 16	Remote Modbus System Enable	Write Point 0=disable, 1 = enable

HSC Modbus Map (Continued)

Modbus Address	Data Type	Description	Notes
40314	Signed 16	Modbus Heartbeat	Write Point, Need to write value of 1**
40318	Float 32	Deadband for Cond/Non-Cond. Mode Switch Temp	
40320	Float 32	Outside Air Temp Low Value for Reset Curve	
40322	Float 32	Outside Air Temp High Value for Reset Curve	
40324	Float 32	Loop Setpoint at Cold (low) OAT	
40326	Float 32	Loop Setpoint at Warm (high) OAT	
40328	Float 32	Minimum Inlet Temp for Non-Condensing Boilers	
40336	Float 32	Non-Condensing Reset Shift	
40338	Float 32	NC/Condensing Switch Temperature	
40340	Float 32	Read only Non-CondensingHeader Setpoint (active)	
40342	Float 32	Read only Cond. Header Setpoint (active)	
40344	Signed 16	System Mode (See table)	See Table 4
40346	Signed 16	Condensing Boiler Status	See Table 8
40346	Signed 16	Non-Condensing Boiler Status	See Table 8
40348	Float 32	Firing rate for condensing boiler group	
40350	Float 32	Firing rate for non-condensing boiler group	
40352	Float 32	Warm Weather Shutdown Temperature	
40390	Float 32	Condensing Boiler 1 Run Hours	
40392	Float 32	Condensing Boiler 2 Run Hours	
40394	Float 32	Condensing Boiler 3 Run Hours	
40396	Float 32	Condensing Boiler 4 Run Hours	
40398	Float 32	Condensing Boiler 5 Run Hours	
40400	Float 32	Condensing Boiler 6 Run Hours	
40402	Float 32	Condensing Boiler 7 Run Hours	
40404	Float 32	Condensing Boiler 8 Run Hours	
40406	Float 32	Condensing Boiler 9 Run Hours	
40408	Float 32	Condensing Boiler 10 Run Hours	
40410	Float 32	Non-Condensing Boiler A Run Hours	
40412	Float 32	Non-Condensing Boiler B Run Hours	
40414	Float 32	Non-Condensing Boiler C Run Hours	

HSC Modbus Map (Continued)

Modbus Address	Data Type	Description	Notes
40416	Float 32	Non-Condensing Boiler D Run Hours	
40418	Float 32	Non-Condensing Boiler E Run Hours	
40420	Float 32	Non-Condensing Boiler F Run Hours	
40422	Float 32	Non-Condensing Boiler G Run Hours	
40424	Float 32	Non-Condensing Boiler H Run Hours	
40426	Float 32	Non-Condensing Boiler I Run Hours	
40428	Float 32	Non-Condensing Boiler J Run Hours	
40430	Signed 32	Condensing Boiler 1 Run Cycles	
40432	Signed 32	Condensing Boiler 2 Run Cycles	
40434	Signed 32	Condensing Boiler 3 Run Cycles	
40436	Signed 32	Condensing Boiler 4 Run Cycles	
40438	Signed 32	Condensing Boiler 5 Run Cycles	
40440	Signed 32	Condensing Boiler 6 Run Cycles	
40442	Signed 32	Condensing Boiler 7 Run Cycles	
40444	Signed 32	Condensing Boiler 8 Run Cycles	
40446	Signed 32	Condensing Boiler 9 Run Cycles	
40448	Signed 32	Condensing Boiler 10 Run Cycles	
40450	Signed 32	Non-Condensing Boiler A Run Cycles	
40452	Signed 32	Non-Condensing Boiler B Run Cycles	
40454	Signed 32	Non-Condensing Boiler C Run Cycles	
40456	Signed 32	Non-Condensing Boiler D Run Cycles	
40458	Signed 32	Non-Condensing Boiler E Run Cycles	
40460	Signed 32	Non-Condensing Boiler F Run Cycles	
40462	Signed 32	Non-Condensing Boiler G Run Cycles	
40464	Signed 32	Non-Condensing Boiler H Run Cycles	
40466	Signed 32	Non-Condensing Boiler I Run Cycles	
40468	Signed 32	Non-Condensing Boiler J Run Cycles	

** Periodically writing a value of 1 to register 40314 allows the HSC Administrator to monitor valid Modbus communication write values when configured (example: Modbus Set Point or Modbus Outdoor Air Temperature). If the value reads zero for 60 seconds, the Administrator will indicate a BAS Comms alarm.

TABLES

Table 1	
Boiler State Word	
0	Not Ready
2	Ready, not running
12	Running

Table 2	
Boiler Alarm Bits	
1	Boiler Pump Prove Fault
2	Boiler Run Fault
3	Boiler Comms Fault
4	Low Battery Fault
5	Damper Prove Fault

Table 3	
Boiler Status Bits	
1	Lowfire Hold Active
2	Minimun Inlet Temperature Met
3	Firing Rate Limit Active
4	BIM Alarm Output
5	Spare (not used)
6	Boiler Run Output
7	Boiler Pump Output
8	Damper Output
9	Boiler Valve Output
10	Boiler Alarm Input
11	Boiler Ready Input
12	Boiler Pump Prove
13	Boiler Run Prove
14	Damper Prove

Table 4	
System Mode	
0	Idle
1	Condensing Mode
2	Non-Condensing Mode
3	Non-Condensing Assist Mode
4	Non-Condensing Assist Mode
5	Warm weather shutdown
6	DHW Priority
7	Cold Building Priority

Table 5	
Alarm Word Bit Definition	
Word 1, Bit 1	Condensing Boiler 1 Fault
Word 1, Bit 2	Condensing Boiler 2 Fault
Word 1, Bit 3	Condensing Boiler 3 Fault
Word 1, Bit 4	Condensing Boiler 4 Fault
Word 1, Bit 5	Condensing Boiler 5 Fault
Word 1, Bit 6	Condensing Boiler 6 Fault
Word 1, Bit 7	Condensing Boiler 7 Fault
Word 1, Bit 8	Condensing Boiler 8 Fault
Word 1, Bit 9	Condensing Boiler 9 Fault
Word 1, Bit 10	Condensing Boiler 10 Fault
Word 1, Bit 11	Analog Input #1 Fault
Word 1, Bit 12	Analog Input #2 Fault
Word 1, Bit 13	Analog Input #3 Fault
Word 1, Bit 14	Analog Input #4 Fault
Word 1, Bit 15	Low Battery Fault
Word 1, Bit 16	Comms Fault
Word 2, Bit 1	Non-Condensing Boiler 1 Fault
Word 2, Bit 2	Non-Condensing Boiler 2 Fault
Word 2, Bit 3	Non-Condensing Boiler 3 Fault
Word 2, Bit 4	Non-Condensing Boiler 4 Fault
Word 2, Bit 5	Non-Condensing Boiler 5 Fault
Word 2, Bit 6	Non-Condensing Boiler 6 Fault
Word 2, Bit 7	Non-Condensing Boiler 7 Fault
Word 2, Bit 8	Non-Condensing Boiler 8 Fault
Word 2, Bit 9	Non-Condensing Boiler 9 Fault
Word 2, Bit 10	Non-Condensing Boiler 10 Fault
Word 2, Bit 11	Spare
Word 2, Bit 12	Spare
Word 2, Bit 13	Spare
Word 2, Bit 14	Spare
Word 2, Bit 15	Spare
Word 2, Bit 16	Spare

Table 6	
Digital Input Bit Definition	
Word 1, Bit 1	System Enable Input
Word 1, Bit 2	DHW Demand Input
Word 1, Bit 3	Cold Building Demand Input
Word 1, Bit 4	System Pump 1 Prove
Word 1, Bit 5	System Pump 2 Prove
Word 1, Bit 6	System Pump Remote Enable
Word 1, Bit 7	
Word 1, Bit 8	
Word 1, Bit 9	
Word 1, Bit 10	
Word 1, Bit 11	
Word 1, Bit 12	
Word 1, Bit 13	
Word 1, Bit 14	
Word 1, Bit 15	
Word 1, Bit 16	

APPENDIX B - PARAMETER LISTS

System Administrator

HSC ADMINISTRATOR PARAMETER SETTINGS

Setup/Configuration Screen or Parameter	Description	Units	Range	Default	User Setting
<Basic Setup>, System Setup Page 1					
# of Condensing Boilers	Number of boilers in condensing group		0-10	0	
Sequence Method for Cond group	Last On-First Off or First On-First Off			L On - F Off	
Lead Rotation Time	Lead condensing boiler run hours accumulated before automatically switching lead	hours		0.0	
# of Non-Condensing Boilers	Number of boilers in non-condensing group		0-10	0	
Sequence Method for NC group	Last On - First Off or First On - First Off			L On - F Off	
Lead Rotation Time	Lead non-condensing boiler run hours accumulated before automatically switching lead	hours		0.0	
System Start Delay	Time delay before first call for boiler upon system enable heat request. Allows for system circulation for accurate system water temperature measurement.	seconds	0-9999	300	
NC Warmup Ovr	Time allowed before calling first Non-Condensing boiler when entering Non-Condensing or Non-Condensing Assist modes. Regardless of the System Return Temperature -- i.e. the Return Temperature remains below the Non-Condensing Low Limit temperature -- a Non-Condensing boiler will be called after this delay time has completed.	seconds	0-9999	900	
System Enable Source	Source request for System Enable heat request: "HMI" - touchscreen enable or discrete Input connect at Input 1 of the Administrator			HMI	
Analog Input 4 Function	Select use for Analog Input 4: Outdoor Air Temperature (OAT) or Remote Setpoint (Rem SP)			OAT	
Bypass Valve Open Action	System Bypass valve enable/output -- Administrator Discrete Output 6 action. For primary flow systems with bypass valve to avoid deadheading system pumps and minimize standby losses in idle boilers.			No Boilers Run	
< No Blrs Run>	Bypass valve open when no boilers are operating				
< No Cnd Blrs>	Bypass valve open when no Condensing boilers are operating				
< No N-Cond Blrs>	Bypass valve open when no Non-Condensing boilers are operating				
<Basic Setup>, System Setup Page 2					
System Pump	System Pump control: Local I/O or Remote (Pump Interface Module). With Local I/O, Administrator can directly enable/disable up to 2 connected system pumps in Lead-Standby-Rotation arrangement.			Local I/O	
Lead Pump	Current Lead Pump assignment -- select desired Lead Pump by pressing button.			Lead Pump 1	

HSC ADMINISTRATOR PARAMETER SETTINGS (Continued)

Setup/Configuration Screen or Parameter	Description	Units	Range	Default	User Setting
System Pump Prove	Enable/disable system pump prove. With Prove Required, discrete input must be connected at Administrator Pump Prove Input(s).			Prove Not Required	
# of Local System Pumps	Select number of system pumps connected directly to the HSC Administrator: 1 or 2. (If none, this function is ignored.) If there are more than 2 system pumps to control and/or VSD modulation is desired, the remote Pump Interface Module (PIM) is required.		1 - 2	2	
# of Pumps to Run at same time	Select the number of system pumps to operate at the same time. If there are 2 pumps and 1 runs at a time (with pump prove connected), the idle pump in standby is available in case the Lead pump fails to operate.		1 - 2	1	
System Pump On Delay	Delay time before system pump(s) start on system enable heat request or system pump enable demand.	seconds		0	
System Pump Off Delay	Delay time for system pump(s) shutdown after system enable heat request or system pump enable demand is removed. Also delay time for system pump shutdown when Warm Weather Shutdown (WWSD) is active.	minutes		30	
Local Sys. Pump Lead Rotation Hours	Elapsed time Lead system pump has run before Lead rotation occurs	hours		0	
System Pump Enable Input	Discrete Input assignment at Administrator for system pump demand. Input 1 is the system enable heat request; Input 6 is system pump only enable. Input 6 could be wired as needed for independent system pump run request (e.g. DHW demand requires system pump(s) to run).		Input 1 or Input 6	Input 1	
Keep Lead Boiler Pump On (Cond. group)	Normally, boiler pump shuts off following boiler shutdown and pump overrun time. With this function enabled, the Lead Condensing boiler's pump continues to run even when all Condensing boilers are off.			Disabled	
Keep Lead Boiler Isolation Valve On (Cond. group)	Normally, boiler isolation valve closes following boiler shutdown and valve overrun time. With this function enabled, the Lead Condensing boiler's isolation valve remains open even when all Condensing boilers are off.			Disabled	
Keep Lead Boiler Pump On (N-C group)	Normally, boiler pump shuts off following boiler shutdown and pump overrun time. With this function enabled, the Lead Non-Condensing boiler's pump continues to run even when all Condensing boilers are off.			Disabled	
Keep Lead Boiler Isolation Valve On (N-C group)	Normally, boiler isolation valve closes following boiler shutdown and valve overrun time. With this function enabled, the Lead Non-Condensing boiler's isolation valve remains open even when all Condensing boilers are off.			Disabled	
<Add/Drop Setup>					
Cond. Stage Delay On	Time delay before additional Condensing boiler is added. This delay is triggered when the Condensing boiler group firing rate is greater than the Add stage threshold and the active header supply temperature is below the Condensing boiler goup setpoint (by the Condensing standard deadband).	Seconds		600	

HSC ADMINISTRATOR PARAMETER SETTINGS (Continued)

Setup/Configuration Screen or Parameter	Description	Units	Range	Default	User Setting
Cond. Stage Delay Off	Time delay before a Condensing boiler is dropped when more than one Condensing boilers are firing. This delay is triggered when the Condensing boiler group firing rate is less than the Drop stage threshold and the active header supply temperature is above the Condensing boiler goup setpoint (by the Condensing standard deadband).	Seconds		300	
Non-cond. Stage Delay On	Time delay before additional Non-Condensing boiler is added. This delay is triggered when the Non-Condensing boiler group firing rate is greater than the Add stage threshold and the main header supply temperature is below the Main Supply Header setpoint (by the Non-Condensing standard deadband).	Seconds		900	
Non-cond. Stage Delay Off	Time delay before a Non-Condensing boiler is dropped when more than one Non-Condensing boilers are firing. This delay is triggered when the Non-Condensing boiler group firing rate is less than the Drop stage threshold and the main supply header temperature is above the Main Supply Header setpoint (by the Non-Condensing standard deadband).	Seconds		600	
Fire Rate Dec. on Boiler Add - Condensing	When a Condensing boiler stage is added, the Condensing group firing rate is temporarily reduced by this %. Intended to compensate for reduction in flow to firing boilers when the Add Stage boiler's isolation valve is opened. Also can be utilized to compensate for significant load addition of boilers with limited turndown.	%		20.0	
Fire Rate Dec. on Boiler Add - Non-Cond.	When a Non-Condensing boiler stage is added, the Non-Condensing group firing rate is temporarily reduce by this %. Intended to compensate for reduction in flow to firing boilers when the Add stage boiler's isolation valve is opened. Also can be utilized to compensate for significant load addition of boilers with limited turndown.	%		20.0	
Dec. Hold time on Boiler Add	The amount of time the temporary firing rate decrease is active upon boiler add stage. This time should account for light-off sequence time and possibly boiler Low Fire Hold time.	Seconds		300	
Firing Rate to Add Boiler - Condensing	Condensing group firing rate (control output %) threshold to initiate Add stage	%		45.0	
Firing Rate to Add Boiler - Non-Cond.	Non-condensing group firing rate (control output %) threshold to initiate Add stage	%		70.0	
Firing Rate to Drop Boiler - Condensing	Condensing group firing rate (control output %) threshold to initiate Drop stage	%		0.5	
Firing Rate to Drop Boiler - Non-Cond.	Non-condensing group firing rate (control output %) threshold to initiate Drop stage	%		30.0	
SP Standard Deadband - Condensing	Deadband value above and below the Condensing boiler group active setpoint. This deadband is one of the triggers to initiate Add or Drop Condensing boiler staging. A deadband that is too narrow can lead to unnecessary and inefficient boiler cycling. A deadband that is too large can lead to undesirable fluctuations in system supply temperatures.	deg F		2.5	

HSC ADMINISTRATOR PARAMETER SETTINGS (Continued)

Setup/Configuration Screen or Parameter	Description	Units	Range	Default	User Setting
SP Standard Deadband - Non-Cond.	Deadband value above and below the Non-Condensing boiler group active setpoint (i.e. Main Supply Header). This deadband is one of the triggers to initiate Add or Drop Non-Condensing boiler staging. A deadband that is too narrow can lead to unnecessary and inefficient boiler cycling. A deadband that is too large can lead to undesirable fluctuations in system supply temperatures.	deg F		3.0	
SP 'Wide' Deadband - Condensing	Deadband value above and below the Condensing boiler group active setpoint. If the Condensing boiler group's header temperature exceeds this value above or below the active Condensing group header temperature setpoint, the stage delay time is ignored and the Condensing Add/Drop Stage is immediately initiated.	deg F		5.0	
SP 'Wide' Deadband - Non-Cond.	Deadband value above and below the Non-Condensing boiler group active setpoint (i.e. Main Supply Header). If the Main Supply Header Temperature exceeds this value above or below the Main Supply header temperature setpoint, the stage delay time is ignored and the Non-Condensing Add/Drop Stage is immediately initiated.	deg F		6.0	
<Reset Curve Setup>					
OAT Cold	Minimum Outdoor Air Temperature that defines the basic outdoor reset slope.	deg F		20.0	
OAT Warm	Maximum Outdoor Air Temperature that defines the basic outdoor reset slope.	deg F		60.0	
SP Cold OAT	Maximum Supply Temperature Setpoint corresponding to the OAT Cold value that defines the basic outdoor reset slope.	deg F		160.0	
SP Warm OAT	Minimum Supply Temperature Setpoint corresponding to the OAT Warm value that defines the basic outdoor reset slope.	deg F		120.0	
NC Reset Shift	Offset of Main Supply Header Temperature Setpoint from Administrator outdoor reset calculation when operating in Non-Condensing and Non-Condensing Assist modes.	deg F		20.0	
Cond Reset Shift	Offset of Main Supply Header Temperature Setpoint from Administrator outdoor reset calculation when operating in Condensing mode.	deg F		-10.0	
NC/Cond. Switch Temp	For hybrid systems. Represents the Outdoor Air Temperature setpoint to switch between Non-Condensing and Condensing operating modes.	deg F		30.0	
Switch Deadband	Deadband value above and below the Outdoor Air Temperature setpoint for switching between Non-Condensing and Condensing operating modes.	deg F		3.0	
Non-Cond. Low Limit	Minimum allowable inlet temperature for Non-Condensing boiler group. For hybrid systems, this value is used to determine Condensing Header Temperature setpoint in Non-Condensing and Non-Condensing Assist modes. For Non-Condensing boiler only systems, this value -- along with the NC Wide deadband -- determine the minimum allowable Main Supply Header Setpoint.	deg F		140.0	
WWSD Setpoint	Warm Weather Shut Down Setpoint - disables system control when outdoor temperature exceeds this setpoint. Set high value to disable this function.	deg F		140.0	

HSC ADMINISTRATOR PARAMETER SETTINGS (Continued)

Setup/Configuration Screen or Parameter	Description	Units	Range	Default	User Setting
Cold Bldg. SP	With Cold Building demand (Discrete Input 3) present, this setpoint overrides normal Administrator calculated main system supply header setpoint. Can be used for SP boost following unoccupied periods or triggered from a remote building temperature control.	deg F		180.0	
DHW Setpoint	Domestic Hot Water (DHW) priority setpoint - Administrator high selects between DHW setpoint and calculated reset setpoint when DHW demand (Discrete Input 2) is present. DHW pump/valve outputs (Discrete Outputs 4 & 5) with time delays are active with DHW demand present.	deg F		150.0	
DHW Output Delay Off	Upon DHW demand satisfied (Discrete Input 2 de-energized), time delay before DHW outputs are de-energized.	seconds		120	
DHW Output Delay On	Upon initial DHW demand active (Discrete Input 2 energized), time delay before DHW outputs are energized.	seconds		180	
System Pump for DHW?	Is system pump required to operate for DHW demand? Dependent on hydronic system arrangement (e.g. primary flow system where system pump operation is necessary for water flow through boiler.) In the cases of WWSD active or System heat request disabled, system pump(s) can be requested for DHW demand priority.			Not Required	
<Analog I/O Config>					
Condensing Supply Temp (Analog In 1)					
- Raw Min:	Zero value of current input signal	mA	3.0 - 12.0	4.0	
- Raw Max:	Span value of current input signal	mA	12.0 - 22.0	20.0	
- Scaled Min:	Zero temperature of transmitter	deg F	-40.0 - 100.0	0.0	
- Scaled Max:	Span temperature of transmitter	deg F	0.0 - 999.9	300.0	
Main Supply Header Temp (Analog In 2)					
- Raw Min:	Zero value of current input signal	mA	3.0 - 12.0	4.0	
- Raw Max:	Span value of current input signal	mA	12.0 - 22.0	20.0	
- Scaled Min:	Zero temperature of transmitter	deg F	-40.0 - 100.0	0.0	
- Scaled Max:	Span temperature of transmitter	deg F	0.0 - 999.9	300.0	
Return Header Temp Temp (Analog In 3)					
- Raw Min:	Zero value of current input signal	mA	3.0 - 12.0	4.0	
- Raw Max:	Span value of current input signal	mA	12.0 - 22.0	20.0	
- Scaled Min:	Zero temperature of transmitter	deg F	-40.0 - 100.0	0.0	
- Scaled Max:	Span temperature of transmitter	deg F	0.0 - 999.9	300.0	
Outside Air Temp/Rem. SP (Analog In 4)					
- Raw Min:	Zero value of current input signal	mA	3.0 - 12.0	4.0	
- Raw Max:	Span value of current input signal	mA	12.0 - 22.0	20.0	
- Scaled Min:	Zero temperature of transmitter	deg F	-40.0 - 300.0	-40.0	
- Scaled Max:	Span temperature of transmitter	deg F	0.0 - 999.9	140.0	
<Digital I/O>					

HSC ADMINISTRATOR PARAMETER SETTINGS (Continued)

Setup/Configuration Screen or Parameter	Description	Units	Range	Default	User Setting
Input Status	Current Input state of connected Discrete Inputs				
Output Status	Current Output state and momentary manual enable capability for testing Discrete Outputs				
<Cond. BIM I/O> - status	I/O status of remote Condensing BIM's (Press F5 & F4 keys to see all connected BIM's)				
<Non-Cond. BIM I/O> - status	I/O status of remote Non-Condensing BIM's (Press F5 & F4 keys to see all connected BIM's)				
<Rem Sys Pump I/O> - status	I/O status of remote PIM's				
<DIM I/O> - status	I/O status of remote DIM's				
<Cnd Blr Seq>	Condensing boiler sequence - assign sequence order for group -- Lead, Lag 1, Lag 2,...			Lead = 1	
- <Reset Timers>	Switches to Condensing Boiler Elapsed Time Reset screen				
<Cond Boiler Hours>	Current elapsed run hours for each Condensing boiler. Hours can be reset by pressing respective boiler button.			0.0	
- <Return>	Returns to Setup/Configuration Menu screen				
- <Cycle Count>	Switches to Condensing Boiler Cycles screen				
<Cond Boiler Cycles>	Current number of cycles for each Condensing boiler. Cycle count can be reset by pressing respective boiler button.			0	
- <Return>	Returns to Setup/Configuration Menu screen				
- <Boiler Hours>	Switches to Condensing Boiler Elapsed Time screen				
<NC Blr Seq>	Non-Condensing boiler sequence - assign sequence order for group -- Lead, Lag 1, Lag 2,...			Lead = A	
<NCnd Boiler Hours>	Current elapsed run hours for each Non-Condensing boiler. Hours can be reset by pressing respective boiler button.			0.0	
- <Return>	Returns to Setup/Configuration Menu screen				
- <Cycle Count>	Switches to Non-Condensing Boiler Cycles screen				
<NCnd Boiler Cycles>	Current number of cycles for each Non-Condensing boiler. Cycle count can be reset by pressing respective boiler button.			0	
- <Return>	Returns to Setup/Configuration Menu screen				
- <Boiler Hours>	Switches to Non-Condensing Boiler Elapsed Time screen				
<Condensing PID Control>	Condensing group PID gain settings and trending				
<P Gain>	Proportional Gain			10	
<I Gain>	Integral Gain			10	
<D Gain>	Derivative Gain			0	
- <Auto/Manual>	Switch from Auto to Manual or Manual to Auto			Auto	
- <Output>	Current firing rate (control output) percentage; when in manual, firing rate can be forced	%		0.0	
- <Non-Cond. PID Control>	Switch to Non-Condensing PID tuning screen				

HSC ADMINISTRATOR PARAMETER SETTINGS (Continued)

Setup/Configuration Screen or Parameter	Description	Units	Range	Default	User Setting
<Non-Cond. PID Control>	Non-Condensing group PID gain settings and trending				
<P Gain>	Proportional Gain			10	
<I Gain>	Integral Gain			10	
<D Gain>	Derivative Gain			0	
- <Auto/Manual>	Switch from Auto to Manual or Manual to Auto			Auto	
- <Output>	Current firing rate (control output) percentage; when in manual, firing rate can be forced	%		0.0	
- <Condensing PID Control>	Switch to Condensing PID tuning screen				
<Night Setback>					
Day X (Sat 6pm - Sun 6pm) Night Setback Start	7-day week scheduling of night setback (occupied/unoccupied) operation -- HSC setback "day" begins at 6:00PM (1800) and ends at 6:00AM (0600) the following day.				
<Hour>	Hour entered in 24 hour format		0 - 23	19	
<Minute>			0 - 59	0	
Day X (Sat 6pm - Sun 6pm) Night Setback End					
<Hour>	Hour entered in 24 hour format		0 - 23	5	
<Minute>			0 - 59	0	
Night Setback Temp SP	Temperature difference below (or above) the normal calculated Main Supply Header Temperature setpoint.	deg F		10.0	
<Enabled/Disabled>	Select to Enable or Disable night setback operation.			Disabled	
<Time/Date>					
Time	Current time set - 24 hour clock	hh:mm:ss			
Date	Current date set - Month/Day/Year	MM/DD/YYYY			
<Alarm>					
Active Alarm Summary	Date and time stamped active and acknowledged alarm status - red indicates active and not acknowledged; blue indicates active and acknowledged				
Alarm History	Date and time stamped alarm and acknowledge history				
<SD Card/Data>	SD removable media card operations: Memory Card enable, Backup and Restore parameters, Data Logging, Backup program				
- Memory Card On/Off	Enable/disable removable media card operations - Memory card operation should be disabled before removal of SD card.			Card Off	
- Data Logging On/Off	Enable/diable data logging operation; SD card must be installed and enabled			Off	
- Data Log Interval	Time interval between each data log recording	seconds		0	
- Removable Media status	Status of media card: green - SD card present and enabled; red - SD card disabled or not present				
- Backup Parameters to Memory Card	Backup of parameter settings to SD card - green indicator means successful backup of parameter settings				

HSC ADMINISTRATOR PARAMETER SETTINGS (Continued)

Setup/Configuration Screen or Parameter	Description	Units	Range	Default	User Setting
- Restore Parameters to Memory Card	Restore parameter settings previously saved to SD Card - green indicator means successful restore of parameter settings				
- Backup program to EEPROM	Performed after initial commissioning to prevent loss of program and parameter settings in case of battery loss/replacement or program corruption. Can also be performed after any setup/tuning changes.				
- Screen Update	Response time for screen changes relative to touchscreen interface actions. 50 is fastest response rate.	2 - 50		50	
<Comms Data>	Communications Setup and Status: Modbus RTU configuration for building EMS interfacing and HSC network CANbus status				
- Modbus Address	Address can be set for building EMS Modbus RTU network or connected protocol translator network		0 - 253	1	
- Modbus Port Enable	Enable/disable Modbus Slave operations at Administrator			MB Port Off	
- Modbus Baud Rate	Establish baud rate for Modbus RTU network: 9600, 19200, or 38400.			38400	
- Modbus Setpoint	Enable/disable remote Modbus Setpoint writes; when enabled, remote Modbus SP writes override HSC Administrator calculated outdoor reset set point (if outdoor temperature reset is enabled). HSC may override Modbus SP write for Non-Condensing boiler protection, DHW demand priority, and Cold Building SP override. HSC will high select the appropriate main heating system supply SP as required to protect boilers and service the active demand priority.			MB SP Off	
- Modbus Outdoor Air Temperature	Enable/disable Modbus write of Outdoor Air Temperature (OAT) in lieu of connected OAT temperature transmitter -- cannot be enabled if Modbus SP write is enabled. If enabled, the HSC Administrator will use the Modbus OAT for outdoor reset SP calculation, Condensing/Non-Condensing switchover, and Warm Weather Shutdown.			MB OAT Off	
- Modbus System Enable	Enable/disable remote Modbus write heat request (enable/disable HSC system operation) . If disabled, HSC Administrator may still respond to DHW demand and System Pump enable demand.			MB Sys Off	
- Clear Alarm History	Switches to Alarm History screen -- by pressing any logged alarm, it allows the entire alarm history to be cleared.				
- PLC Config	Switch to hardware utilities screen -- used for utilities such as setting screen contrast, troubleshooting operational status, program version upgrades, etc.				

Boiler Interface Module

HSC BOILER INTERFACE MODULE (BIM) PARAMETER SETTINGS

Setup/Configuration Screen or Parameter	Description	Units	Range	Default	User Setting
<System Setup>					
<Boiler Add>	Boiler CANbus Node Address assignment -- Condensing Boilers start with 11 and are addressed in sequential order up to 20; Non-Condensing Boilers start with 21 and are addressed in sequential order up to 30.		11 - 30	11	
<Boiler Options>	Boiler configuration screen				
- Temp. Input: <RTD> or <4-20mA>	Boiler Inlet/Outlet Temperature Input type -- Hardware/program default is RTD (PT100). (Contact factory for non-standard 4-20mA inputs.)			RTD	
- Inlet Temp?	Boiler Inlet Temperature sensor connected? Inlet Temperature sensor required for Boiler Pump speed control.			No	
- Low Fire Hold	Low Fire Hold Time after initial Boiler Prove --	seconds			
- Max Temp	Maximum allowable operating temperature for boiler -- this temperature limit is used for the HSC's Boiler Outlet Limiting function. This firing rate limiting function prevents nuisance high limit shutdowns where there may be a mismatch between firing rate and water flow rate through the boiler.	deg F		180.0	
- Hold Hyst	Boiler Outlet Limiting hold temperature differential. Boiler Outlet Limiting remains active until the outlet temperature drops to a temperature below Max Temp minus this value.	deg F		10.0	
- FR Dec	Percentage decrease in the boiler's firing rate when the Boiler Outlet Limiting function is activated.	%		25.0	
- Fire Delay	Upon Boiler Start request, Fire Delay is the time allowed for Boiler Prove input. If Boiler Prove is not present within this setting, the Administrator will call the next Lag boiler in the sequence.	seconds		180	
<I/O Config>					
<Digital I/O>	Digital Input status				
- <Digital Outputs>	Switch to Digital Output status screen -- each DO can be momentarily energized to test by pressing the respective output button.				
<Analog Out 1 Config>	Switch to Analog Output 1 screen - Boiler Modulation signal				
- Scale Min	Minimum control output percentage corresponding to Output Min setting	%		0.0	
- Scale Max	Maximum control output percentage corresponding to Output Max setting	%		100.0	
- Output Min	Minimum current output signal corresponding to Scale Min setting -- used for zero value of modulation input signal of boiler (i.e. Low Fire).	mA		4.0	
- Output Max	Maximum current output signal corresponding to Scale Max setting -- used for 100% modulation input signal of boiler. Can be utilized to limit maximum firing rate.	mA		20.0	
<Analog Out 2 Config>	Switch to Analog Output 2 screen - Boiler Pump Modulation signal				
- Scale Min	Minimum control output percentage corresponding to Output Min setting	%		0.0	

HSC BOILER INTERFACE MODULE (BIM) PARAMETER SETTINGS (Continued)

Setup/Configuration Screen or Parameter	Description	Units	Range	Default	User Setting
- Scale Max	Maximum control output percentage corresponding to Output Max setting	%		100.0	
- Output Min	Minimum current output signal corresponding to Scale Min setting -- used for zero value of modulation input signal of VSD boiler pump. Can be utilized to limit minimum pump speed.	mA		4.0	
- Output Max	Maximum current output signal corresponding to Scale Max setting -- used for 100% modulation input signal of VSD boiler pump. Can be utilized to limit maximum pump speed.	mA		20.0	
<PLC Setup>	Switch to hardware utilities screen -- used for utilities such as setting screen contrast, troubleshooting operational status, program version upgrades, etc.				
<Damper & Valve Setup>	Configuration of damper/draft control interlock and connected isolation valve				
<Damper Setup>	Switches to Damper Interlock (combustion air dampers, draft controls, gas boosters, etc.) with Boiler Start configuration screen.				
- Damper control	Is there a damper, draft control, gas booster, etc. Boiler Start interlock required?			No	
- Control: Local or Remote	Select Local for device (e.g. damper) connected directly to Boiler; select Remote for device(s) connected to remote HSC Damper Interface Module (DIM)			Local	
- DIM Module	DIM number assignment for connected Boiler Start interlock device.			DIM1	
- Damper #	Specific Discrete Output assignment for the specified DIM to interlock this Boiler's Start			1	
- Off Delay	Damper request Off Delay time after boiler shutdown. If more than one boiler is assigned to the same DIM output device, all assigned boilers must be off before the specific digital output is de-energized.	seconds		120	
- Time to Prove	Time allowed for device (e.g. damper) Prove input before indicating Boiler Start failure and moving to next Lag Boiler in sequence.	seconds		45	
- Valve control	Is an isolation valve connected to BIM?			No	
- Valve Off Delay	Valve close delay time after boiler shutdown	seconds		600	
- Valve On Delay	Valve open delay upon Boiler Start request	seconds		0	
<Blr Pump/Recirc Valve Setup>	Switches to connected Boiler Pump/Recirc Valve configuration screen				
- Output	Select Constant speed or Modulation speed Boiler Pump				
- Pump Off Delay	Boiler Pump overrun time after boiler shutdown	seconds		600	
- Pump On Delay	Boiler Pump start delay after Boiler Start request	seconds		5	
- Prove Required	Is Pump or Valve Prove required prior to Boiler Start?			No	
- Temp. PID Action	Select control action to match pump or valve action (e.g. for Delta T SP control with VSD pump, select Reverse -- increase pump speed to decrease Delta T)			Reverse	

HSC BOILER INTERFACE MODULE (BIM) PARAMETER SETTINGS (Continued)

Setup/Configuration Screen or Parameter	Description	Units	Range	Default	User Setting
- Process Variable select: Delta T or Temp.	Delta T or Minimum Temp modulation control			Delta T	
<SP & Tuning>					
< Hours and Cycles>					
<Memory Card>	Switches to Memory Card screen for BIM SD Card operations				
- Card On/Off	Enable BIM SD Card operations			Card Off	
- Data On/Off	Enable Data Logging at BIM			Data Off	
- Log Interval	Data log interval time	seconds		60	
- <Backup>	Backup of parameters settings -- press once and wait 30 seconds for indicator to indicate successful Backup				
- <Restore>	Restore of previously backed up parameter settings -- press once and wait 30 seconds for indicator to indicate successful Restore				
- Memory Card capacity	Indicates memory used on card				
<Boiler PID>	Switches to Local Boiler modulation PID tuning screen				
- <P Gain>	Proportional Gain			10	
- <I Gain>	Integral Gain			10	
- <D Gain>	Derivative Gain			0	
- <Auto/Manual>	Switch from Auto to Manual or Manual to Auto			Auto	
- <Out>	Current firing rate (control output) percentage; when in manual, firing rate can be forced	%		0.0	
- <Setpoint>	In the case of loss of communication with Administrator, local Boiler Outlet Temperature Setpoint can established for local boiler modulation control.	deg F		160.0	
<Temp. PID>	Switches to Boiler Pump/Valve modulation PID tuning for Delta T or Minimum Temp control				
- <P Gain>	Proportional Gain			10	
- <I Gain>	Integral Gain			10	
- <D Gain>	Derivative Gain			0	
- <Auto/Manual>	Switch from Auto to Manual or Manual to Auto			Auto	
- <Out>	Current modulation (control output) percentage; when in manual, modulation output can be forced	%		0.0	
- <Setpoint>	Delta T Setpoint for Delta T modulation; Minimum Inlet Temperature Setpoint for Temp. modulation (set at Admin NC Low Limit).	deg F		30.0	

Pump Interface Module

HSC PUMP INTERFACE MODULE (PIM) PARAMETER SETTINGS

Setup/Configuration Screen or Parameter	Description	Units	Range	Default	User Setting
<System Setup>					
<PIM Number>	Pump Interface Module No. -- equates to CANbus node address: #1 = 31 (CANbus); #2 = 32 (CANbus)		1 or 2	1	
<System Options>, Page 1	PIM configuration				
<Number of System Pumps>	Number of pumps connected to PIM.		1 - 4	2	
<Number of Pumps to Run>	Designate number of pumps to run at any time.		1 - 4	1	
<Prove Req.> or <No Prove>	Specify if pump/flow prove is connected for each pump.			Prove Required	
<Control Select>	Select process variable (PV) -- Pressure (DP or Head), Delta T, or single-point Temperature -- for pump speed modulation control			Pressure	
<Temp/Pressure Source>	Local (PIM) analog input or Admin Delta T			Local	
<System Options>, Page 2					
<Modulation Delay>	Time delay before releasing pump speed modulation	minutes		5	
<Hold Speed>	For modulation control, initial pump speed to hold until Modulation Delay is completed	%		75	
- PID Action: <Direct> or <Reverse>	PID modulating output control action			Direct	
- Pump Type: <VSD> or <Constant>	VSD modulating or constant speed pump			VSD	
<NC Start Speed>	Pump speed to hold upon initial Non-Condensing boiler request	%		85	
<NC Start Override Time>	Hold time for pump speed hold upon initial Non-Condensing boiler request	seconds		900	
<On Delay>	Pump on delay upon initial pump run request	seconds		0	
<Off Delay>	Pump off delay upon removal of pump run request	minutes		30	
<Pump Hours>	Elapsed Run Time for each pump				
<P_ ET Reset>	Reset elapsed run time for respective pump to zero.				
<I/O Config>	Switches to Analog and Digital I/O menu screen				
<Analog In Config>	Analog input scaling				
- <Signal Min>	Minimum analog input signal value	mA	0 - 10	4.00	
- <Signal Max>	Maximum analog input signal value	mA	10 - 30	20.00	
- <Scale Min>	Measured value corresponding to Signal Min	psi / degF		0.0	
- <Scale Max>	Measured value corresponding to Signal Max	psi / degF		100.0	
<Analog Out Config>	Analog Output scaling				
- <Scale Min>	Minimum control output percentage corresponding to Output Min setting	%	0 - 10	4.00	
- <Scale Max>	Maximum control output percentage corresponding to Output Max setting	%	10 - 30	20.00	

HSC PUMP INTERFACE MODULE (PIM) PARAMETER SETTINGS (Continued)

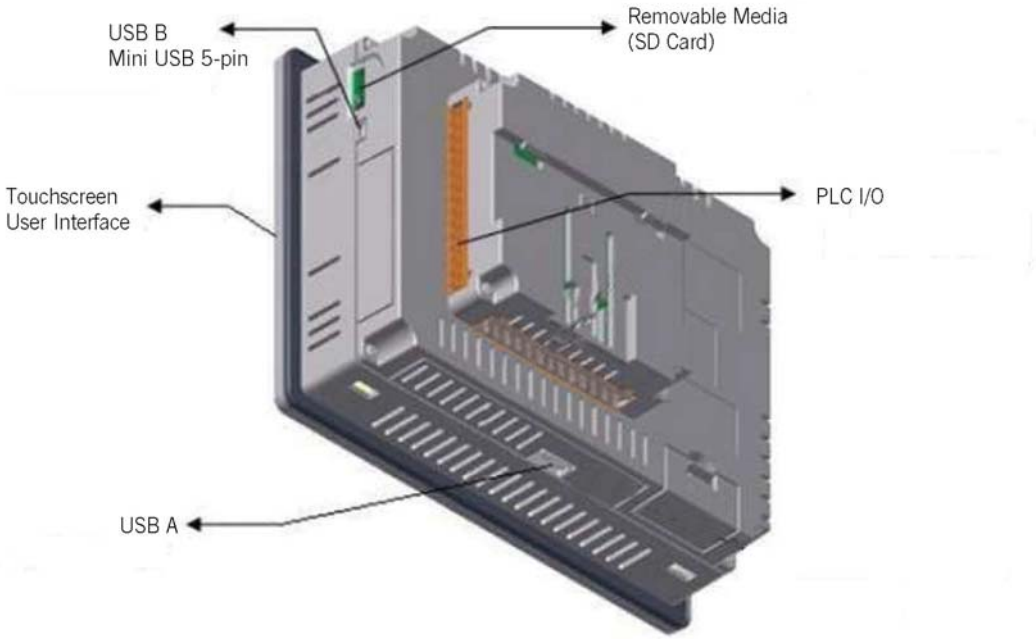
Setup/Configuration Screen or Parameter	Description	Units	Range	Default	User Setting
- <Out Min>	Minimum current output signal corresponding to Scale Min setting -- used for zero value of modulation output signal of VSD system pump. Can be utilized to limit minimum pump speed.	mA		0.0	
- <Out Max>	Maximum current output signal corresponding to Scale Max setting -- used for 100% modulation output signal of VSD system pump. Can be utilized to limit maximum pump speed.	mA		20.0	
<Digital I/O>					
- DI Status	Digital Input status				
- DO Status	Digital Output status -- momentary buttons to test outputs				
- Screen Update	Response time for screen changes relative to touchscreen interface actions. 50 is fastest response rate.	2 - 50		50	
<Memory Card>	Switches to Memory Card screen for PIM SD card operations				
- Card On/Off	Enable BIM SD Card operations			Card Off	
- Data On/Off	Enable Data Logging at BIM			Data Off	
- Log Interval	Data log interval time	seconds		60	
- <Backup>	Backup of parameters settings -- press once and wait 30 seconds for indicator to indicate successful Backup				
- <Restore>	Restore of previously backed up parameter settings -- press once and wait 30 seconds for indicator to indicate successful Restore				
- Memory Card capacity	Indicates memory used on card				
<PID>	Switches to system pump modulation PID tuning screen				
- <P Gain>	Proportional Gain			10	
- <I Gain>	Integral Gain			10	
- <D Gain>	Derivative Gain			0	
- <Auto/Manual>	Switch between Auto and Manual modulation output			Auto	
- <Out>	Current modulation (control output) percentage; when in manual, modulation can be forced	%		0.0	
- <Setpoint>	In the case of loss of communication with Administrator, local PIM Setpoint can established for local pump modulation control.	psi / deg F			
<Seq>	Switches to system pump lead-lag sequence screen -- allows for assignment of sequence order; includes elapsed run time of each connected pump				

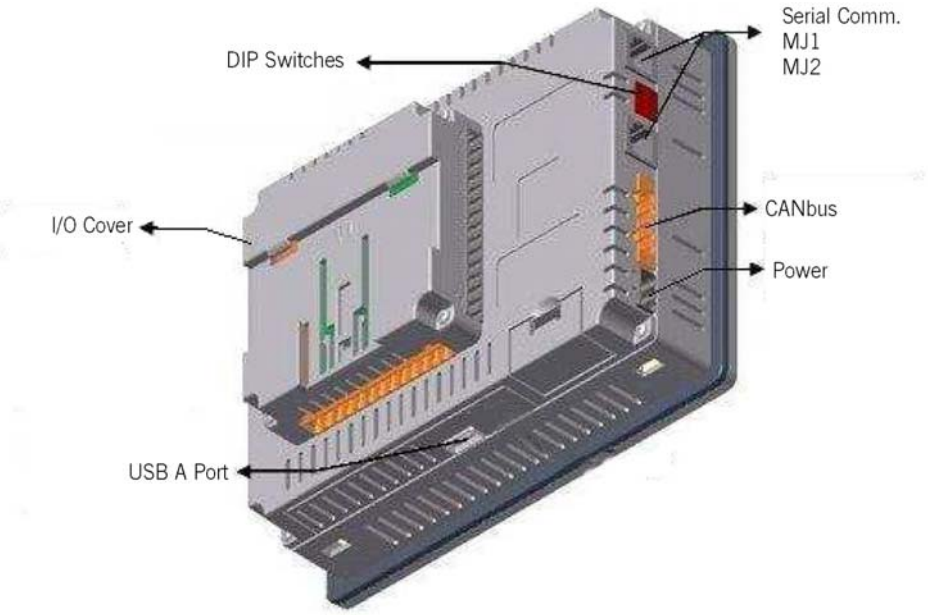
Damper Interface Module

HSC DAMPER INTERFACE MODULE (DIM) PARAMETER SETTINGS

Setup/Configuration Screen or Parameter	Description	Units	Range	Default	User Setting
<Setup>	Password required				
DIM Node	Damper Interface Module No. -- starts with CANbus address 41		41 - 44	41	
# of Dampers	Identify the number of connected devices (dampers, draft control, gas booster, etc.) for boiler start interlock		1 - 6	1	
Boiler Config	Configure number of boilers on network				
- # of Condensing Boilers	Identify the number of Condensing boilers in the network			1	
- # of Non-Condensing Boilers	Identify the number of Non-Condensing boilers in the network			0	
- Off Delays	Set respective Damper Close/Off Delay time following boiler shutdown	seconds	0 - 9999	180	
Damper MOA	Damper Manual-Off-Auto configuration - each device can be forced on or off in Manual mode; Auto means Damper Output enabled by specifically configured boiler(s) run request				
- Auto/Manual	Switch between Auto and Manual device enable/disable			Auto	
- Manual On/Off	When in Manual, force respective Damper Output On or Off			Off	

APPENDIX C - HARDWARE DETAILS





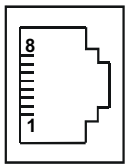
System Administrator controller I/O and communication connections - also see wiring diagrams.

System Admin. communication ports

System Admin. Serial Communications:

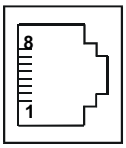
MJ1: (RS-232 / RS-485) Use for Cscape programming and Application-Defined Communications.

MJ2: (RS-232 / RS-485) Use for Application-Defined Communications.



Pin	MJ1 Pins		MJ2 Pins	
	Signal	Direction	Signal	Direction
8	TXD	OUT	TXD	OUT
7	RXD	IN	RXD	IN
6	0 V	Ground	0 V	Ground
5*	+5 60mA	OUT	+5 60mA	OUT
4	RTS	OUT	TX-	OUT
3	CTS	IN	TX+	OUT
2	RX- / TX-	IN / OUT	RX-	IN
1	RX+ / TX+	IN / OUT	RX+	IN

MJ2 Pinouts - Half Duplex Mode



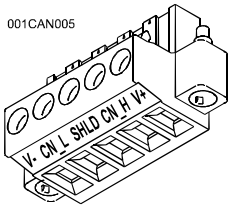
Pin	MJ2 Pins	
	Signal	Direction
8	TXD	OUT
7	RXD	IN
6	0 V	Ground
5*	+5 60mA	OUT
4	TX-	OUT
3	TX+	OUT
2	TX-/RX-	IN/OUT
1	TX+/RX+	IN/OUT

* +5V 60mA Max

MJ2 Half Duplex Mode

Table - Ports and Functions		
Functions	**Port 1 (MJ1)**	**Port 2 (MJ2)**
RS-232	YES	YES
Hardware Handshaking	YES	NO
Programming	YES	NO
Ladder function controlled	YES	YES
Serial Downloable Protocols	YES	YES
RS485 Half duplex	YES	YES

CAN Network Port and Wiring



CAN Connector

Use the CAN Connector when using CsCAN network.

Torque rating 4.5 – 7 Lb-In
(0.50 – 0.78 N-m)

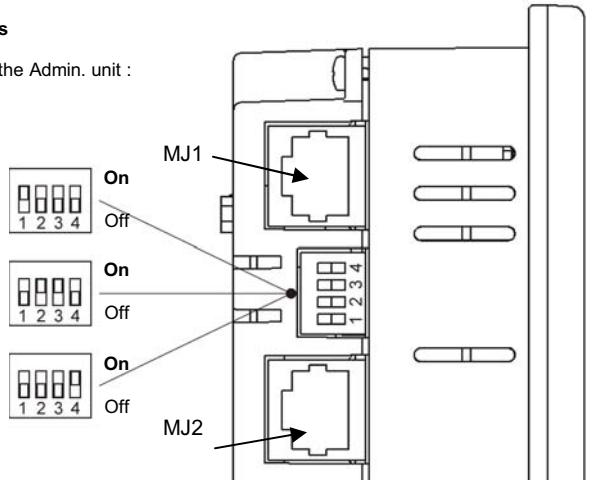
NET1 Port Pin Assignments			
Pin	**Signal**	**Signal Description**	**Direction**
1	V-	CAN Ground	–
2	CN_L	CAN Data Low	In/Out
3	SHLD	Shield Ground	–
4	CN_H	CAN Data High	In/Out
5	NC	No Connect	–

External DIP Switch Settings

As seen when looking at the side of the Admin. unit :

The DIP Switches are used for termination of the RS-485 ports.

To terminate, select one of the DIP Switches and configure it based upon the option that is desired.



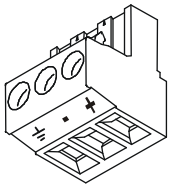
SW1 - ON enables ***MJ2*** RS485 port termination (121 Ohms).
OFF disables ***MJ2*** RS485 port termination.

SW2 & SW3 - ON places ***MJ2*** RS485 port in half-duplex mode.
OFF places ***MJ2*** RS485 port in full-duplex mode.

SW4 - ON enables ***MJ1*** RS485 port termination (121 Ohms).
OFF disables ***MJ1*** RS485 port termination.

Admin. power & wiring

Power Port and Wiring



Power Connector

Power Up:

Connect to Earth Ground.
Apply 10 - 30 VDC.
Screen lights up.

Torque rating 4.5 – 7 Lb-In
(0.50 – 0.78 N-m)

Primary Power Port Pins		
Pin	**Signal**	**Description**
1	Ground	Frame Ground
2	V-	Input Power Supply Ground
3	V+	Input Power Supply Voltage

Wiring and Jumpers

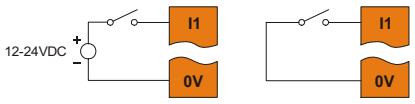
Wire according to the type of inputs / outputs used, and select the appropriate jumper option.

Wiring Specifications

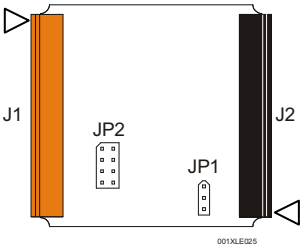
- For I/O wiring (discrete), use the following wire type or equivalent: Belden 9918, 18 AWG (0.8 mm^2) or larger.
- For shielded Analog I/O wiring, use the following wire type or equivalent: Belden 8441, 18 AWG (0.8 mm^2) or larger.
- For CAN wiring, use the following wire type or equivalent: Belden 3084, 24 AWG (0.2 mm^2) or larger.

Use copper conductors in field wiring only, 60/75° C

Positive Logic vs. Negative Logic Wiring
The **HEXL102** can be wired for Positive Logic inputs or Negative Logic inputs.



Positive Logic In Negative Logic In

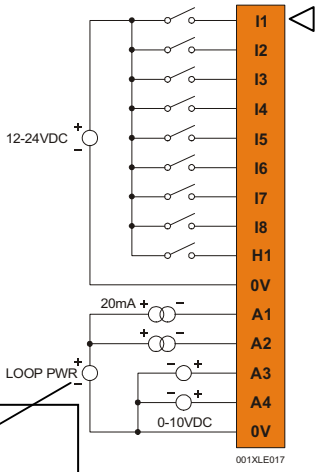


Location of I/O jumpers (**JP2 and JP1**) and wiring connectors
(J1 and J2).

Wiring Examples

J1 Orange Terminal Connector	Name
I1	IN1
I2	IN2
I3	IN3
I4	IN4
I5	IN5
I6	IN6
I7	IN7
I8	IN8
H1	HSC1 /IN9
0V	Ground
A1	Analog IN1
A2	Analog IN2
A3	Analog IN3
A4	Analog IN4
0V	Ground

J1 Orange
Positive Logic In
Digital In / Analog In

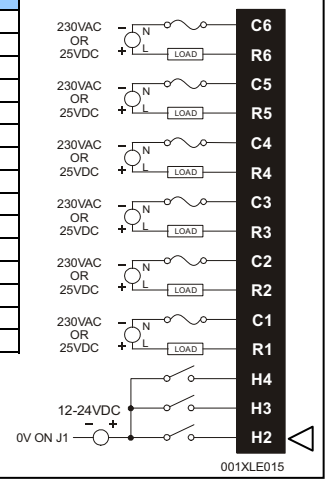


Note:

Loop Power requirements are determined by the transmitter specification.

J2 Black Terminal Connector	Name
C6	Relay 6 COM
R6	Relay 6 NO
C5	Relay 5 COM
R5	Relay 5 NO
C4	Relay 4 COM
R4	Relay 4 NO
C3	Relay 3 COM
R3	Relay 3 NO
C2	Relay 2 COM
R2	Relay 2 NO
C1	Relay 1 COM
R1	Relay 1 NO
H4	HSC4 / IN12
H3	HSC3 / IN11
H2	HSC2 / IN10

J2 Black
Positive Logic
Digital In / Relay Out

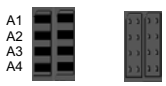


I/O Jumpers Settings (JP1 - JP2)

JP1 Digital DC In / HSC
Positive
Logic

Default

JP2 Analog In (A1 – A4)
Current (20 mA) Voltage (10 V)



Default

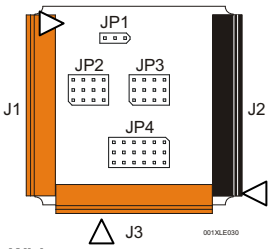
Wiring and Jumpers - Remote Interface Modules

- Wire according to the type of inputs / outputs used and select the appropriate jumper option. Use Copper Conductors in Field Wiring Only, 60/75° C

Wiring Specifications

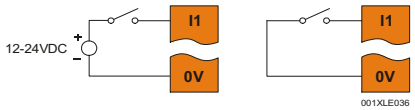
- For I/O wiring (discrete), use the following wire type or equivalent: Belden 9918, 18 AWG (0.8 mm^2) or larger.
- For shielded Analog I/O wiring, use the following wire type or equivalent: Belden 8441, 18 AWG (0.8 mm^2) or larger.
- For CAN wiring, use the following wire type or equivalent: Belden 3084, 24 AWG (0.2 mm^2) or larger.

Location of I/O jumpers (JP) and wiring connectors (J1 – J3).



Positive Logic vs. Negative Logic Wiring

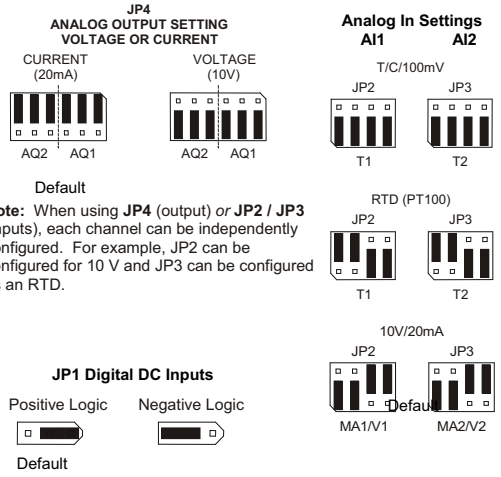
The units can be wired for Positive Logic inputs or Negative Logic inputs.

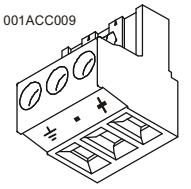


Positive Logic In Negative Logic In

I/O Jumpers Settings (JP1 – JP4)

Note: The Cscape Module Setup configuration must match the selected I/O (JP) jumper settings.

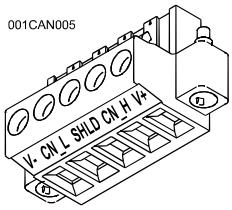




Power Connector

Power Up:
Connect to Earth Ground.
Apply 10 - 30 VDC.
Screen lights up.

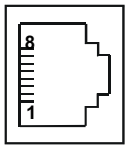
Torque rating 4.5 – 7 Lb-In
(0.50 – 0.78 N-m)



CAN Connector

Use the CAN Connector when using CsCAN network.

Torque Rating 4.5 – 7 Lb-In
(0.50 – 0.78 N-m)

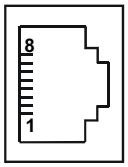


Serial Communications: MJ1 and MJ2 (RS-232 / RS-485)

Pin	MJ1 Pins		MJ2 Pins	
	Signal	Direction	Signal	Direction
8	TXD	OUT	TXD	OUT
7	RXD	IN	RXD	IN
6	0 V	Ground	0 V	Ground
5*	+5 60mA	OUT	+5 60mA	OUT
4	RTS	OUT	TX-	OUT
3	CTS	IN	TX+	OUT
2	RX- / TX-	IN / OUT	TX-/RX-	IN
1	RX+ / TX+	IN / OUT	TX+/RX+	IN

* +5Vdc 60mA Max

MJ2 Pinouts - Half Duplex Mode



Pin	MJ2 Pins	
	Signal	Direction
8	TXD	OUT
7	RXD	IN
6	0 V	Ground
5*	+5 60mA	OUT
4	TX-	OUT
3	TX+	OUT
2	TX-/RX-	IN/OUT
1	TX+/RX+	IN/OUT

Half Duplex

External DIP Switch Settings (or Jumpers Settings)

The External DIP Switches are used for termination of the RS-485 ports.

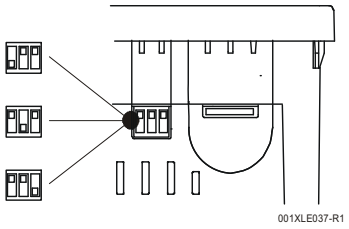
To terminate, select one of the jumpers shipped with the product and insert it based upon the option that is desired or, select the switch and configure based upon the option that is desired.

As seen when looking at the top of the unit: Refer to Section 3 for the location of the External Jumpers.

DIPSW3: FACTORY USE ONLY (tiny bootloader firmware downloading). NOT TO BE USED FOR NORMAL OCS OPERATION.

DIPSW2: MJ2 Termination (default – none)

DIPSW1: MJ1 Termination (default – none)

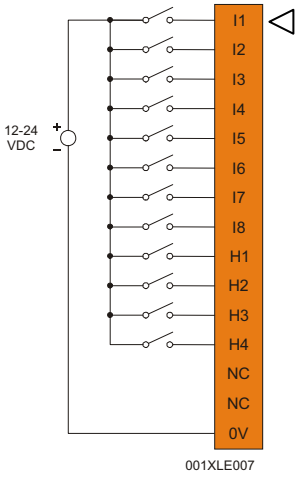


Module Wiring cont'd

Note: The wiring examples show **Positive Logic** input wiring.

J1 Orange	Name
I1	IN1
I2	IN2
I3	IN3
I4	IN4
I5	IN5
I6	IN6
I7	IN7
I8	IN8
H1	HSC1 / IN9
H2	HSC2 / IN10
H3	HSC3 / IN11
H4	HSC4 / IN12
NC	No Connect
NC	No Connect
0V	Ground

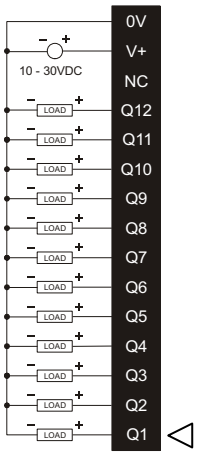
J1 Orange
Positive Logic
Digital In



001XLE007

J2 Black	Name
0V	Ground
V+*	V+*
NC	No Connect
Q12	OUT12
Q11	OUT11
Q10	OUT10
Q9	OUT9
Q8	OUT8
Q7	OUT7
Q6	OUT6
Q5	OUT5
Q4	OUT4
Q3	OUT3
Q2	OUT2 / PWM2
Q1	OUT1 / PWM1
V+* Supply for Sourcing Outputs	

J2 Black
Positive Logic
Digital Outputs



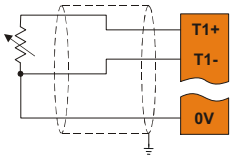
001XLE008

J3 Orange	**Name**
T1+	T/C / RTD IN1+ / 100 mV+
T1-	T/C / RTD IN1- / 100 mV-
T2+	T/C / RTD IN2+ / 100 mV+
T2-	T/C / RTD IN2- / 100 mV-
AQ1	10 V / 20 mA OUT1
AQ2	0 V / 20 mA OUT2
0V	Ground
MA1	20 mA IN1
V1	10 V IN1
0V	Ground
MA2	20 mA IN2
V2	10 V IN2
0V	Ground

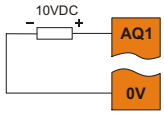
J3 Orange
Analog In / Analog Out

Note: A total of 2 Analog Inputs can be used.

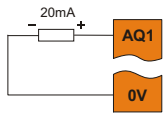
RTD In



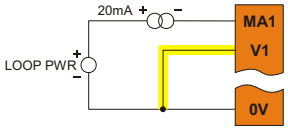
0 -10 V Analog Out



4 - 20 mA Analog Out



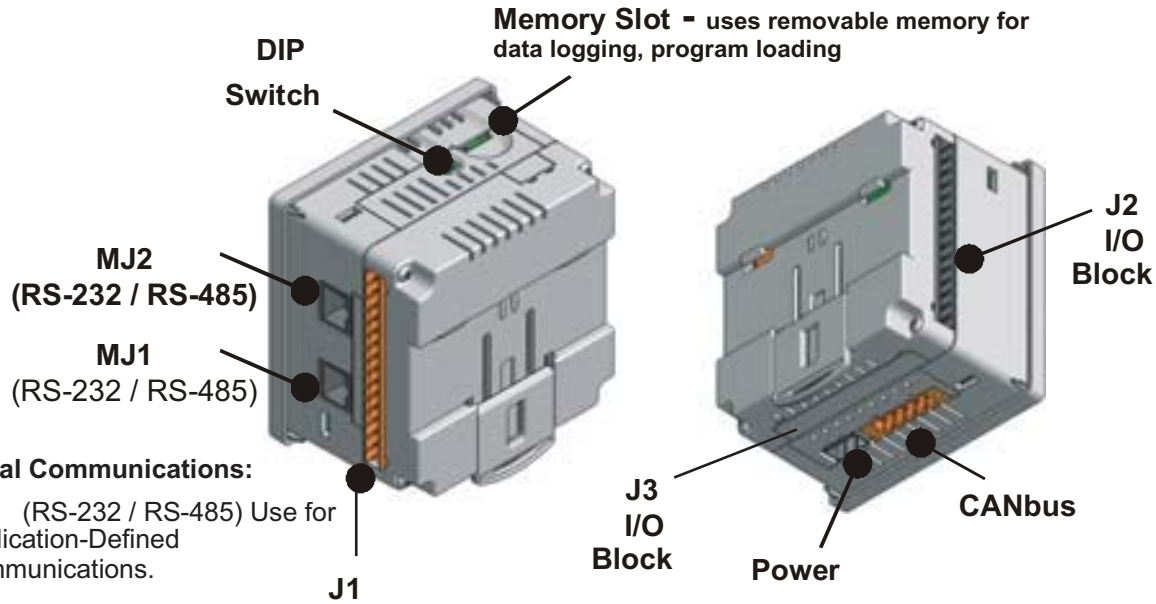
20 mA Analog In



Note: Loop Power (LOOP PWR) requirements are determined by the transmitter specification.

Note: Be sure to wire 0 V to V1 as shown for proper operation.

Ports / Connections - Remote Interface Modules



Serial Communications:

MJ1 (RS-232 / RS-485) Use for Application-Defined Communications.

MJ2 (RS-232 / RS-485) Use for Application-Defined Communications.

I/O Jumpers (Not Shown): I/O Jumpers (JP) are located internally. To access, remove back cover of unit.

To Remove Back Cover:
Unscrew 4 screws located on the back of the unit.

CAUTION:
Do not over tighten screws when replacing the back cover.

BATTERY REPLACEMENT

System Administrator

The System Administrator contains a run-time battery monitor that checks the voltage of the internal lithium battery. This battery is used to run the real-time clock and maintains retentive registers when power is disconnected.

Under normal conditions the battery in the Administrator should last 7 to 10 years. Higher operating temperatures or variations in batteries may reduce this time.

The Administrator indicates the battery is low, failed or missing in a variety of ways. At power-up, an error message is displayed indicating the low or missing battery. The user program can monitor the battery using %SR55.13. This bit will turn on if the battery is low or missing.

Warning: Lithium Batteries may explode or catch fire if mistreated Do not recharge, disassemble, heat above 100 deg.C (212 deg.F) incinerate, or puncture.

Warning: Disposal of lithium batteries must be done in accordance with federal, state, and local regulations. Be sure to consult with the appropriate regulatory agencies before disposing of batteries. Do not re-charge, disassemble, heat or incinerate lithium batteries.

Warning: Do not make substitutions for the battery. Be sure to use only the authorized part number to replace the battery.

To replace the battery.

7. Make sure the user program and any data stored in retentive memory is backed up.
8. Disconnect all power from the unit including I/O power.
9. Remove the battery cover.
10. Note there are two connectors (X1 and X2) in the battery compartment that can accommodate the battery connector.
11. Plug the new battery into the empty connector (X1 or X2) before removal of the old battery.
12. Remove the old battery.
13. Dispose of the old battery properly; see the above warning on disposal regulations.
14. Place the battery cover back on the unit.
15. Apply power to the unit. Check that the battery error is no longer reported. If the unit still reports the error, remove the battery immediately and contact Cleaver-Brooks.

Remote I/O Modules

The units use a CR2450B 'coin style' lithium battery available from a number of manufacturers/retailers. To replace:

1. Make sure the user program and any data stored in retentive memory is backed up. This is most easily done by selecting 'EEPROM Backup' from the 'System Options' screen.
2. Disconnect all power from the unit including I/O power.
3. Unplug the I/O terminal blocks from the unit.
4. Remove the four screws on the back of the unit and remove the back cover.
5. Remove the I/O board by lifting it straight up. It needs to slide off the 2 rows of pins located near the top of the board. You may have to hold the pins in place while lifting the board.
6. Remove the old battery. It may require a small flat blade screwdriver to lift it from the holder.
7. Slide the new battery into the holder. Make sure the battery is inserted with the proper polarity. The top tab of the battery holder should contact the positive (+) terminal of the battery.
8. Place the I/O board back into the case by aligning the pins with the connector and pressing straight down. Be sure to not bend any of the pins-make sure that they are free to slide through the connector before pressing down on the board.
9. Place the back cover back on the unit.
10. Place the screw back into the hole and turn the screw slowly counter clockwise until "clicks" into the threads. This will prevent the screw from being cross threaded. Now turn the screw clockwise until the cover is firmly secured. Repeat this process for all four (4) screws.
11. Replug the I/O terminals.
12. Restore power to the unit.