Commissioning Guide

SERIES C-05830-B0 COMPACT MICRO IV™
LEAD LAG SEQUENCER

<<<TABLE OF CONTENTS<<<

CONGRATULATIONS!

On your purchase of the
Hays Cleveland C-05830-B0 Compact Micro IV™
Lead Lag Sequencer. Please turn to the back of this guide to register your product. Thank you!

	Number	Release Date
Instruction Manual	C05830.07	08/113/2015
Commissioning Guide	CG5830.03	08/113/2015

CONVENTIONS USED IN THIS GUIDE

1. This guide pertains to the application of the **C-05830-B0 Compact Micro IV™ Lead Lag Sequencer** to boiler plants. Other applications are possible.

2. Terminology (as defined by ASME CSD-1-2002 “Controls and Safety Devices for Automatically Fired Boilers”) that is used in this manual includes the following:

   a. Control: a device designated to regulate the fuel, air, water, steam, or electrical supply to the controlled equipment. It may be automatic, semiautomatic, or manual.

   b. Control, operating: an automatic control, other than a safety control, to start input, or regulate input upon satisfaction of demand.

   c. Control, primary safety: a control directly responsive to flame properties, sensing the presence of flame and, in event of ignition failure or loss of flame, causing safety shutdown.

   d. Control, safety (also known as limit): a control responsive to changes in liquid level, pressure, or temperature, which is set beyond the operating range to prevent operation beyond designed limits.

SYMBOLS USED IN THIS GUIDE

The following symbols may be used in this guide to denote certain conditions.

DANGER	**Danger** symbol indicates an immanently hazardous situation, which, if not avoided, **will result in death or serious injury.**
WARNING	**Warning** symbol indicates a potentially hazardous situation, which, if not avoided, **could result in death or serious injury.**
CAUTION	**Caution** symbol indicates a potentially hazardous situation, which, if not avoided, **could result in minor or moderate injury.**
CAUTION	**Caution** used without the safety alert symbol indicates a potentially hazardous situation which, if not avoided, **may result in property damage.**

SAFETY WARNINGS

DANGER

Failure to comply in full with the following safety requirements can result in equipment damage and personal injury/death.

1. Read the entire manual to become familiar with the use and operation of this device.

2. Only qualified personnel should attempt to install, wire, commission, startup, service or operate this device.

3. This device is not suitable for use in an explosive ambient atmosphere.

4. Before working on this device, be sure that you understand the processes affected by this device completely.

5. Before working on this device, be sure that any process affected by this device is secure and safe for servicing.

6. Take appropriate precautions to avoid electric shock when working with this device near water.

7. Exercise caution while wiring or working on this device. Multiple voltage sources may be present: take appropriate precautions to avoid electric shock.

8. RFI (radio frequency interference) can affect adversely the operation of this device and devices that are connected together as a system. Do not use radios near this equipment: examples include, but are not limited to; citizen band radios (CB), walkie-talkies, transceivers, and amateur radios (HAM).

WIRING TIPS

1. Wire with extreme caution!

2. All wiring must conform to the National Electrical Code and to local code regulations. Verify all electrical ratings on equipment.

3. Connecting high voltage to the low voltage circuits will damage the circuitry!

4. Mount the unit in such a manner that the wiring cable from the main electronics does not touch or approach any high magnetic source. If mounted near a high magnetic source, electronic interference may cause the display to read incorrectly.

5. Ground shielded cable at one end only.

6. *STORAGE, HANDLING & UNPACKING*

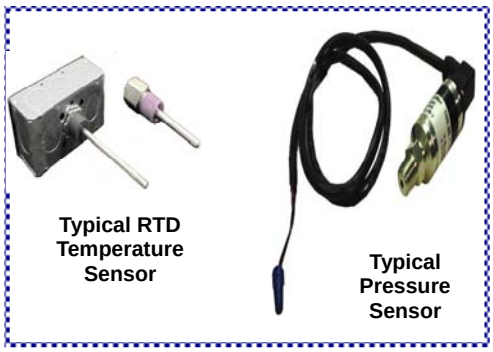
The following components may be shipped individually. Specific purchase orders may include some or all of these items.

- Controller Electronics Unit
- Sensor (either RTD **temperature** sensor or **pressure** sensor).
- Quickstart Guide
- Instruction Manual
- Commissioning Guide

INSTALLATION TIPS

MOUNTING

1. Unpack the **C-05830-B0 Compact Micro IV™ Lead Lag Sequencer** carefully and retain carton and all packaging materials in case the unit needs to be shipped to the factory in the future.
2. Confirm that the **C-05830-B0 Compact Micro IV™ Lead Lag Sequencer** control unit, sensor (either temperature or pressure), and Instruction Manual C-05830.XX are present. Read this Commissioning Guide **and** the Instruction Manual before starting the installation and set up.
3. Mount in a vertical position free from dust, moisture, and vibration.



WIRING

WARNING

1. Wiring should be performed by an **experienced electrician or control/instrumentation technician**.

2. Conform to **local codes and standards**.

3. **Analog inputs** must be **isolated**.

4. **Check for common mode voltage.** There should be less than 5.0 volts DC from C of the analog board to the cabinet ground. There should be less than 5.0 volts DC from O of the analog board to the cabinet ground.

5. **Check for ground.** Verify that there is a ground wire attached to the G terminal of the terminal block. There should be 120 V AC from the H terminal of the terminal block and the cabinet ground. There should be 0 volts from the N terminal of the terminal block to the cabinet ground.

6. **Ground check the RTD (if used).** Remove the RTD wire and check for continuity from the output wires of the RTD to the cabinet ground. There should be an infinite amount of resistance on all three wires except the shield.

7. **Ground shielded cable at one end only.**

INTERFACE CHECKS

1. **Low fire Shutdown (if used):** Confirm that all firing rate modulating actuators have a contact closure at low fire position.

2. **Low fire warm-up and hot stand-by (if used):** Confirm that contacts open on increasing temperature.

3. **135 ohm modulating models** use a Honeywell Series 90 (low current electronic version Modutrol IV) or equivalent with auxiliary low fire switch.

4. **Confirm that any existing temperature switches** (such as low fire hold or hot standby) in the boiler are normally closed when boiler is cold.

The Micro IV™ Operator Interface

CAUTION

Figure 1, below, shows the front panel operator interface with two-line vacuum fluorescent display. **Figure 2** and **Figure 3** show the **Main Menu** (middle of the picture) surrounded by the **Sub-menu**'s typical of a Micro IV™ applied to a four-boiler system. As shown in Figures 2 and 3, the main menu consists of these parameters:

- Header Pressure or Temperature
- Night Set Back
- Modulation
- Boiler Time Delay
- Lead Boiler Select
- Lead Lag Set Point
- Outdoor Temperature Reset (optional on hot water temperature systems).

Figure 2 is a **steam pressure** boiler menu. Figure 3 is a **hot water** boiler menu with the outdoor air temperature reset option included. In either case, the **Main Menu** (**top line** of the front panel operator interface display) is accessed from the operator interface keypad using the right (➔)and left (🡐) arrow keys. Once an item is selected from the **Main Menu**, the tuning parameters can be accessed by selecting the down (🡓)arrow and navigating through each **Sub Menu** (bottom line of the front panel operator interface display) using the right (➔)and left (🡐) arrow keys. Any menu item with a blinking cursor is a **tuning parameter**. To change the value, press the appropriate number key, then press [Enter] to save the value. To return to the **Main Menu**, press the up (🡑) arrow. Repeat this procedure until all parameters are tuned.

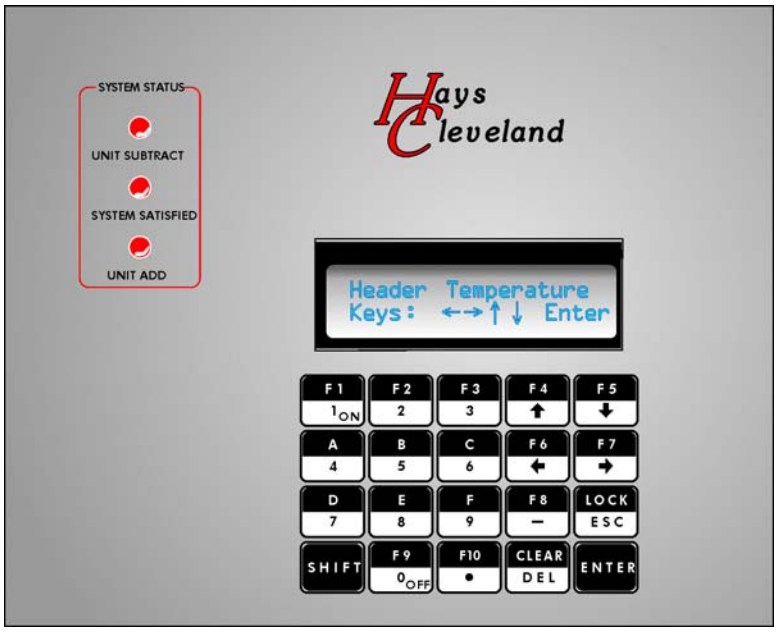


FIGURE 1: MICRO IV™ FRONT PANEL

The keypad includes **Alphanumeric Characters**, plus **Right-Left-Up-Down Arrow Keys**, and several function keys including **ENTER**, **ON**, **OFF**, and **CLEAR/DEL**. Upon initial power-up, the default screen displays "Steam Pressure" or "Header Temperature" on the top line, and the word "Keys" followed by the right, left, up and down arrow characters, and the word **ENTER** on the bottom line. **If the system is password protected**, **ENTER** displays on the bottom line instead of the up/down arrows, indicating that a password must be input on the keypad and the **ENTER** key pressed.

FIGURE 2: MICRO IV™ SAMPLE MENU FOR STEAM BOILERS

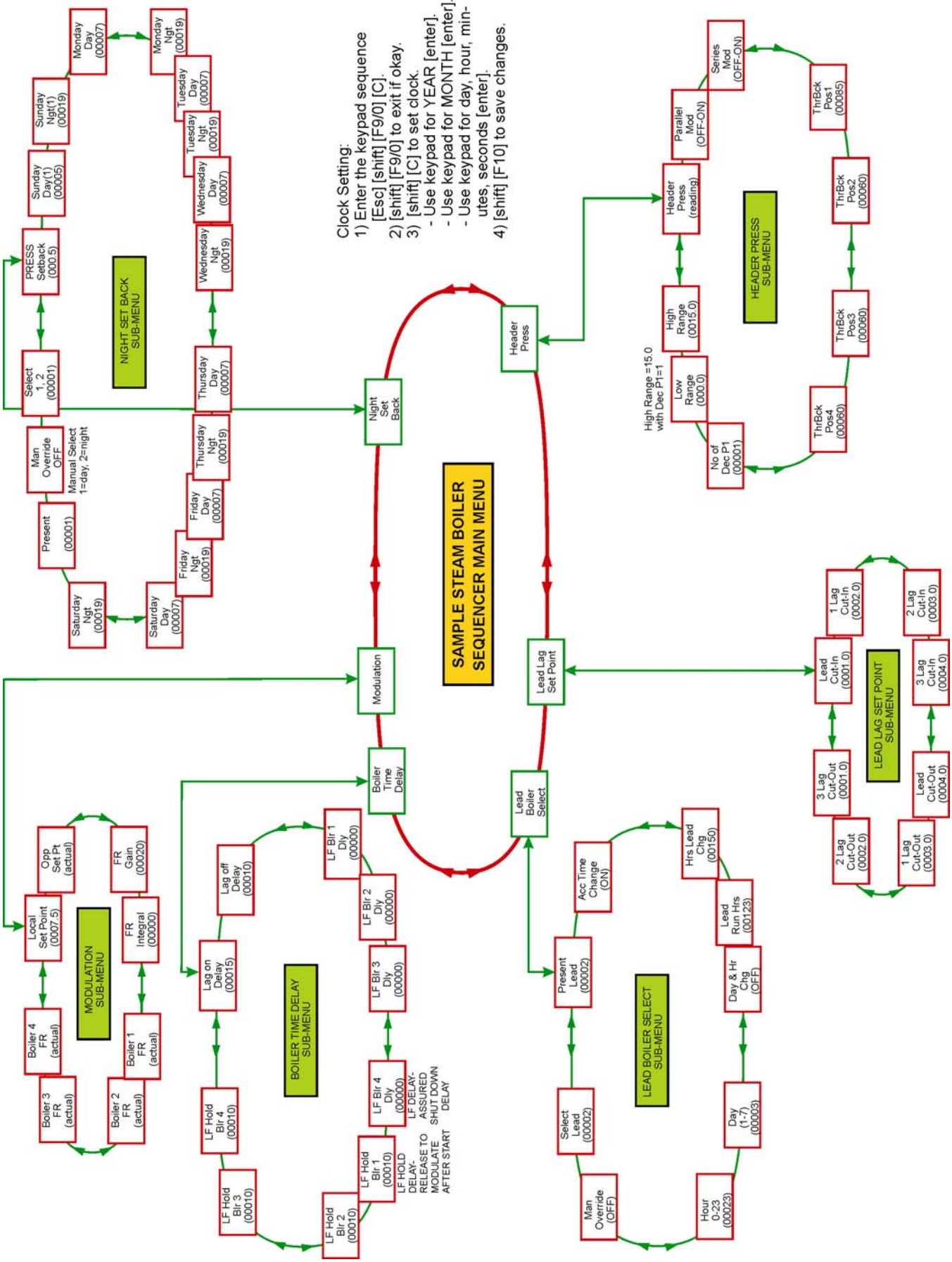
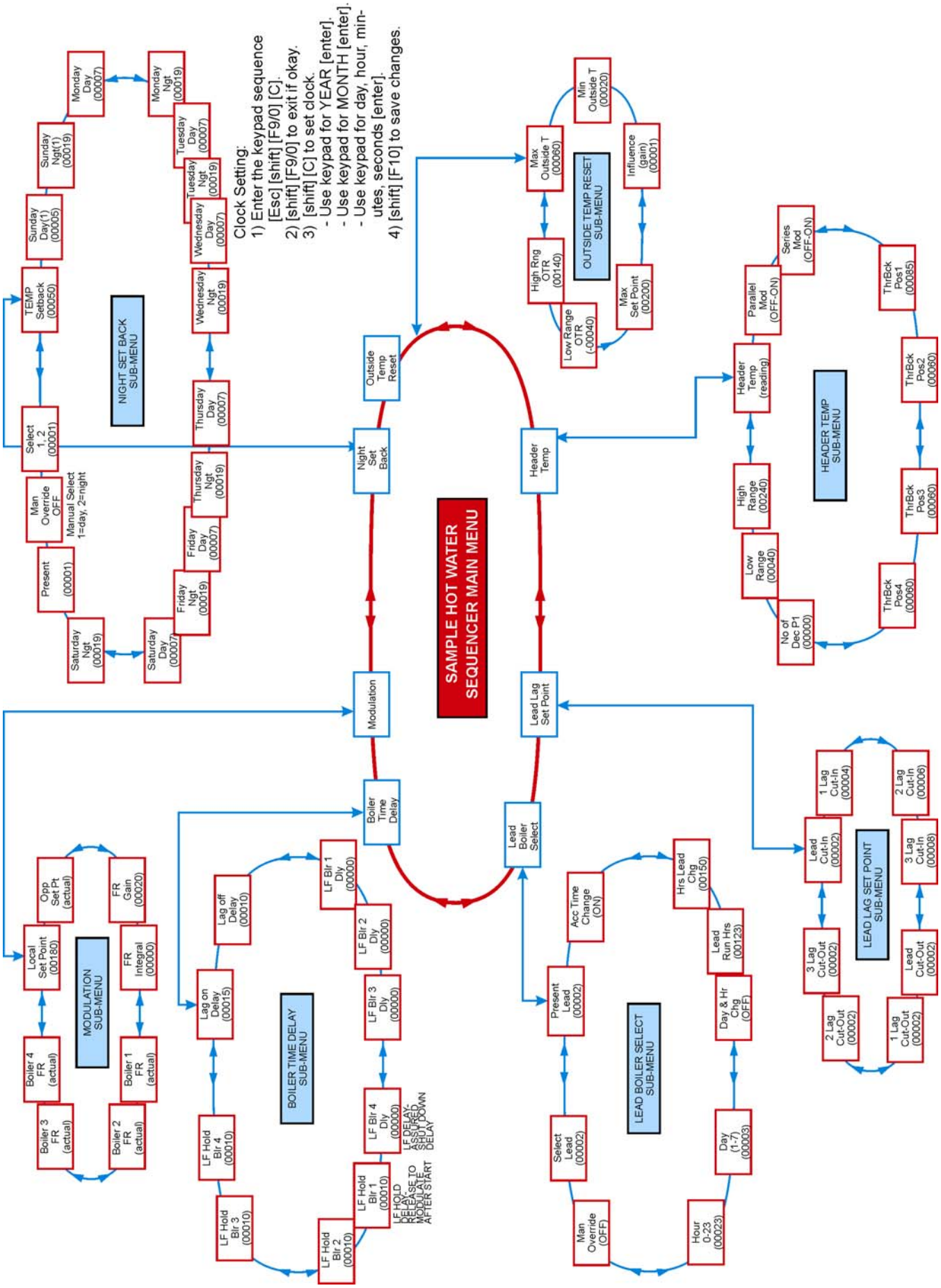


FIGURE 3: MICRO IV™ SAMPLE MENU FOR HOT WATER BOILERS



START-UP TIPS

CAUTION

SET PARAMETERS

The tables in this guide (and in the manual) list the tuning parameters (those requiring field adjustment) in the order in which they display on the front panel operator interface of the **Micro IV™**. Begin the setup process with the default screen shown in Table 1, and then continue through the subsequent screens. While all parameters are factory preset, field configuration is necessary to ensure optimal system performance.

SET CONFIGURATION

Every installation has unique system dynamics which are influenced by the number and size of boilers. System dynamics change as boilers are brought online and offline. For optimal control, the **Micro IV™**'s tuning and scaling parameters must be configured for the specific application.

Adhere to the following procedure to avoid operational problems which can result from an improperly configured system (such as slow response time and nuisance boiler cycling).

1. Reset the “Low Fire Hold Delay” parameters to match the start up cycle time of each boiler. (See Table 2, Low Fire Delay section.)
2. Adjust the **"gain"** and **"integral."** (See Table 5, Modulation Screen Settings.) These parameters influence the **magnitude** and **rate** of control response to deviations from set point. Set the “*gain*” and “*integral*” settings to **optimize** responsiveness over the entire working range of the system. In many cases, the responsiveness of one boiler sequence is sacrificed, in order to provide acceptable response in another sequence. Equal responsiveness throughout the entire range of boiler sequencing may not be possible to achieve. Note: Cut-in and Cut-out parameters for each boiler are values are added to, or subtracted from, the operating set point. (**If you are not familiar with the concept of gain and integral, more detailed information can be found in Instruction Manual C-05830.XX)**
3. Adjust the **Lag ON delay, Lag OFF delay, Cut-in Points, Cut-out Points** (See Tables 2 and 3). These parameters contribute to system response time and control action, so their **interdependence** must be considered. The “Commissioning Tip” column in the tables offers recommendations for each parameter.
4. Check the **Gain** again**.**

TABLE 1: DEFAULT SCREEN (PRESSURE/TEMPERATURE) SETTINGS

Pressure/ Temperature Settings		Range	Factory Preset	Importance	Commissioning Tip
Modulation	Parallel	On/ Off	Off	● ●	Turn “on” for fastest system response to disturbances. Often used for **process applications with wide load swings. "Series" must be turned off.**
	Series	On/ Off	On	● ●	Often used for **heating applications with minimal load swings. "Parallel" must be turned off.**
Throttle Back (% of firing rate)	Boiler #1	0 to 100	60	● ● ●	For **Series Modulation only**: adjust to suit point of optimal firing rate efficiency or to base-load a boiler to minimize next lag boiler nuisance cycling.
	Boiler #2				
	Boiler #3				
	Boiler #4				
	Boiler #5				
	Boiler #6				
Process Variables: Decimal Places		0 or 1	Job Specific	●	Determines **resolution** of process variables: header pressure/temperature, cut-in and cut-out points, throttle back settings etc.
Low Range of Pressure Transmitter (psi)		0		● ●	Must span entire expected operating range of the pressure or temperature sensor. Typically 0.0 to 30.0 or 0 to 30. Note: System will accept inputs between -32000 and +32000.
High Range of Pressure Transmitter (psi)		30 to 999		● ●	
Low Range of Temperature Transmitter (deg F)		0		● ●	Must span entire expected operating range of the pressure or temperature sensor. Typically 32.0 to 240.0 or 32 to 240. Note: System will accept inputs between -32000 and +32000.
High Range of Temperature Transmitter (deg F)		0 to 999		● ●	

The relative importance of field-adjusting a factory preset has been indicated as follows:

● ● ● Very important!
● ● Moderately important.
● Usually not important.

TABLE 2: BOILER TIME DELAY SCREEN SETTINGS

Timer Settings		Range	Factory Preset	Importance	Commissioning Tip
Lag ON Delay		0 to 32,760 sec. = 0 to 546 min.	100	● ● ●	Adjust to allow leading boilers sufficient time to produce heat and reduce demand before additional lag boiler is started. Set delay long enough to minimize nuisance cycling of lag boilers.
Lag OFF Delay			10	● ●	Adjust to allow excess boiler capacity to be removed quickly, but allowing enough time so that needed boilers are not turned off. Set delay long enough for load to settle out after each lag boiler is taken off line in order to minimize nuisance cycling of lag boilers.
Low Fire Delay	Boiler #1		0	● ●	Adjust to allow sufficient time for firing rate actuator to move to low fire position before sequencer takes boiler off-line.
	Boiler #2				
	Boiler #3				
	Boiler #4				
	Boiler #5				
	Boiler #6				
Circulation Pump Delay	Boiler #1		0	● ●	Adjust to allow sufficient time for pump to remove residual heat from the boiler before the sequencer shuts the pump off.
	Boiler #2				
	Boiler #3				
	Boiler #4				
	Boiler #5				
	Boiler #6				

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TABLE 3: BOILER CUT-IN AND CUT-OUT SETTINGS

Lead/Lag Set Point Settings		Range	Preset	Importance	Commissioning Tip
Cut-In	Lead Blr.	0 to 100	5	● ● ●	Cut-in parameter is the acceptable amount of variation in header pressure or temperature **below set point.**: If the process variable drops below a particular cut-in value, the associated boiler is brought on line.
	1st Lag		10		
	2nd Lag		15		
	3rd Lag		20		
	4th Lag		25		
	5th Lag		30		
Cut-Out	Lead Blr.		10	● ● ●	Cut-out parameter is the acceptable amount of variation in header pressure or temperature **above set point**. If the process variable exceeds a particular cut-in value, the associated boiler is taken off line.
	1st Lag				
	2nd Lag				
	3rd Lag				
	4th Lag				
	5th Lag				

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TABLE 4: LEAD BOILER SELECT SCREEN SETTINGS

Lead Boiler Change	Range	Preset	Importance	Commissioning Tip
Accumulated Time Mode	On/Off	**On**	● ●	Disable (set to **OFF**) if runtime-based lead boiler automatic rotation is undesirable.
Hours for Lead Change	0 to 32000 (hours)	100		
Day & Hour Lead Mode	On/Off	**Off**	● ●	Enable (set to **ON**) if day-of-the-week-based lead boiler automatic rotation is desirable.
Day	1 to 7 (days)	7		
Hour	0 to 23 (military hour)	23		
Manual Override Mode	On/Off	**On**	● ● ●	"**ON**" disables all other boiler rotation features (accumulated time mode, day and hour lead mode, and optional remote lead select.)
Select Lead	Job Specific	1	● ●	Selects the lead boiler when manual override is enabled.

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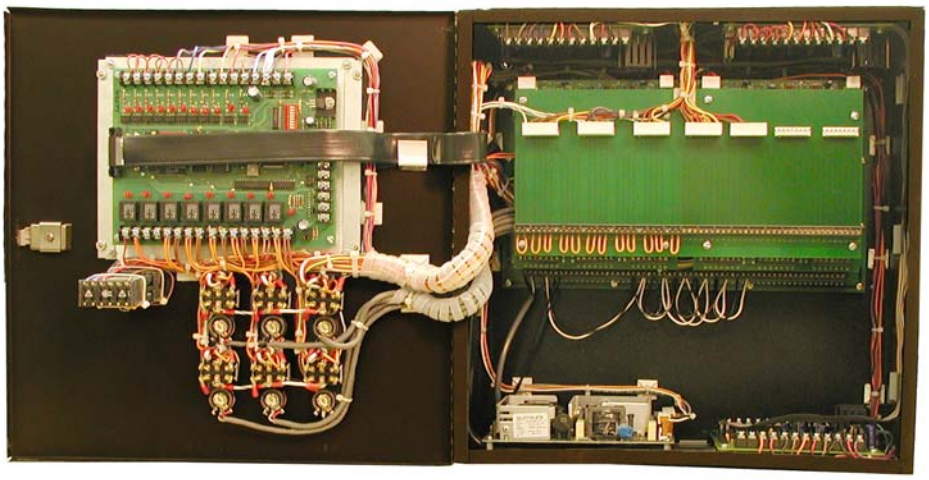
● ● Moderately important.
● Usually not important.

TABLE 5: MODULATION SCREEN SETTINGS

Modulation Settings	Range	Preset	Importance	Commissioning Tip
Local Set Point	Job Specific		● ● ●	Set to desired header set point.
Gain (as per cent of firing rate)	0 to 100	20	● ● ●	Adjust to optimize the response magnitude of the automatic control system to header disturbances. The optimal gain value is a function of the physical dynamics of the system and changes as lead boiler rotation alters the system capacity and physical hardware response times. A balance between quick response time, and nuisance cycling is the goal. Typical gain settings are between 15 and 20.
Integral (repeats per second)	0 to 100	Job Specific	● ●	Adjust to optimize the response time of the automatic control system to header disturbance ("droop").

Interior View of Micro IV™



The relative importance of field-adjusting a factory preset has been indicated as follows:

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● ● Moderately important.
● Usually not important.

TABLE 6: PRESSURE/TEMPERATURE SET BACK SCREEN SETTINGS

Night Setback		Range	Preset	Importance	Commissioning Tip
Pressure/ Temperature Setback		0 to 100 (°F or psi)	10	● ● ●	Select the night set point as a setback from the day set point.
Sunday Monday Tuesday Wednesday Thursday Friday Saturday	Day (1)	0 to 23	7	● ●	Select time (military hours) that night setback ends (day set point restored).
	Night (2)		19		Select time (military hours) that night setback commences.
Manual Override		On/Off	On	● ● ●	Disable if automatic day-time, night setback cycling is desired.
Select (1,2)		1,2	1	● ●	This selection is used to toggle between the primary set point or the night-setback set point, but then **maintain that set point continuously.** A setting of 1 selects the primary set-point 24 hours a day. A setting of 2 selects the night setback set point 24 hours a day.

TABLE 7: MODBUS CONFIGURATION

Card Address	Position					
	1	2	3	4	5	6
00	OFF	OFF	OFF	OFF	OFF	OFF
01	ON	OFF	OFF	OFF	OFF	OFF
02	OFF	ON	OFF	OFF	OFF	OFF
03	ON	ON	OFF	OFF	OFF	OFF
04	OFF	OFF	ON	OFF	OFF	OFF
05	ON	OFF	ON	OFF	OFF	OFF
06	OFF	ON	ON	OFF	OFF	OFF
07	ON	ON	ON	OFF	OFF	OFF
08	OFF	OFF	OFF	ON	OFF	OFF
09	ON	OFF	OFF	ON	OFF	OFF
10	OFF	ON	OFF	ON	OFF	OFF
11	ON	ON	OFF	ON	OFF	OFF
12	OFF	OFF	ON	ON	OFF	OFF
13	ON	OFF	ON	ON	OFF	OFF
14	OFF	ON	ON	ON	OFF	OFF
15	ON	ON	ON	ON	OFF	OFF
16	OFF	OFF	OFF	OFF	ON	OFF
17	ON	OFF	OFF	OFF	ON	OFF
18	OFF	ON	OFF	OFF	ON	OFF
19	ON	ON	OFF	OFF	ON	OFF
20	OFF	OFF	ON	OFF	ON	OFF
21	ON	OFF	ON	OFF	ON	OFF
22	OFF	ON	ON	OFF	ON	OFF
23	ON	ON	ON	OFF	ON	OFF
24	OFF	OFF	OFF	ON	ON	OFF
25	ON	OFF	OFF	ON	ON	OFF
26	OFF	ON	OFF	ON	ON	OFF
27	ON	ON	OFF	ON	ON	OFF
28	OFF	OFF	ON	ON	ON	OFF
29	ON	OFF	ON	ON	ON	OFF
30	OFF	ON	ON	ON	ON	OFF
31	ON	ON	ON	ON	ON	OFF
32	OFF	OFF	OFF	OFF	OFF	ON
33	OFF	OFF	OFF	OFF	OFF	ON
34	OFF	ON	OFF	OFF	OFF	ON
35	ON	ON	OFF	OFF	OFF	ON
36	OFF	OFF	ON	OFF	OFF	ON
37	ON	OFF	ON	OFF	OFF	ON
38	OFF	ON	ON	OFF	OFF	ON
39	ON	ON	ON	OFF	OFF	ON
40	OFF	OFF	OFF	ON	OFF	ON
41	ON	OFF	OFF	ON	OFF	ON
42	OFF	ON	OFF	ON	OFF	ON
43	ON	ON	OFF	ON	OFF	ON
44	OFF	OFF	ON	ON	OFF	ON
45	ON	OFF	ON	ON	OFF	ON
46	OFF	ON	ON	ON	OFF	ON
47	ON	ON	ON	ON	OFF	ON
48	OFF	OFF	OFF	OFF	ON	ON
49	ON	OFF	OFF	OFF	ON	ON
50	OFF	ON	OFF	OFF	ON	ON
51	ON	ON	OFF	OFF	ON	ON
52	OFF	OFF	ON	OFF	ON	ON
53	ON	OFF	ON	OFF	ON	ON
54	OFF	ON	ON	OFF	ON	ON
55	ON	ON	ON	OFF	ON	ON
56	OFF	OFF	OFF	ON	ON	ON
57	ON	OFF	OFF	ON	ON	ON
58	OFF	ON	OFF	ON	ON	ON
59	ON	ON	OFF	ON	ON	ON
60	OFF	OFF	ON	ON	ON	ON
61	ON	OFF	ON	ON	ON	ON
62	OFF	ON	ON	ON	ON	ON
63	ON	ON	ON	ON	ON	ON

TABLE 8: TROUBLESHOOTING

Troubleshooting

Symptom	Possible Cause	Recommended Solution
Boiler will not start, and the associated LED on the Micro IV™ CPU board is lit. (LED 0)	Is the auto/off/man switch in the auto position?	Change switch position to auto.
	Is there a lockout condition?	Correct the lockout condition.
	Is the limit string complete?	Check all limit string devices.
Boiler will not shut off.	Assured low fire contact is not closed at low fire.	Confirm that the low fire end switch is closed at the low fire position.
	The low fire LED is not lit when the actuator is at low fire? The LED is located on the CPU board or the auxiliary input board.	Check low fire shut down circuit for proper termination wiring.
Boiler cycles on and off.	Low fire end switch is used to energize a relay for multiple low fire contact closures. The relay is powered from the blower motor.	Change the relay power source to a terminal that is constantly powered.
Boiler starts and stays at low fire.	Low fire warm up temperature switch is set too high.	Lower the set point of the temperature switch.
	The temperature switch contacts are the incorrect type: they are remaining closed upon temperature increase.	Change to temperature switch contacts that open on temperature increase
	Is the Auto/off/man switch in the auto position?	Change switch position to Auto.
The 135-ohm modulation actuator runs backwards	Actuator is wired backwards.	Swap the B and W wires on the actuator.
The actuator will not reach high-fire or low-fire positions during purge causing a BMS lockout condition.	Actuator is wired incorrectly.	Check actuator wiring.
Micro IV™ is in “unit add” condition, but no boilers are starting up.	Limits In not powered.	Check limit string devices.
	Limits In and Limits Out wiring reversed.	Check actuator wiring.
	No boiler neutral wire connected for limit string power.	Install boiler neutral wire.

Please contact your local Hays Cleveland representative for assistance in commissioning or troubleshooting your Micro-IV™ lead/lag sequencer, or call Hays Cleveland at **(216) 398-4414.**

INSTALLATION CONFIRMATION

INSTALLATION CONFIRMATION FORM

Please help us provide technical support for your installation! Confirm that field installation and parameterization were performed successfully following the procedures in the instruction manual by completing and faxing this page to Hays Cleveland Customer Service at **(216) 398-8558**.

Installation Name:_____

Serial Number:_____

Purchase Order Number:_____

Name (Please Print):_____

Signature:_____

Date:_____