

**GUIDE SPECIFICATION
FOR
LEAD LAG SEQUENCING CONTROLLER
FOR
HOT WATER AND STEAM BOILERS**

- **Introduction For Specification Writer:** This guide specification is for a micro-processor based lead-lag sequencing controller. This controller is generally employed for fire tube or hot water boiler applications where multiple boilers are in service, each with their own steam pressure or temperature controls and not under control of a *master* pressure or temperature controller. Total plant energy demand is satisfied by the start up and operation of any single boiler to nearly-full capacity, followed by the start up and operation of additional boiler(s) as additional energy is required. As the energy demand decreases, boilers are taken off-line in the reverse order sequence from which they were placed on-line.
- This guide specification is given in three parts:
 - Part 1 should be the first paragraphs of the guide specification.
 - Part 2 includes the paragraphs with some options for the lead lag and sequencing descriptions for the final specifications.
 - Part 3 gives the specifier a selection of options for adding features for lead lag and sequencing control and also to add modulation of the fuel/air jack shaft actuator for the burner of each boiler.

Guide Specification

Part 1- Hardware and Control Capability Specifications

The lead lag sequencing controller shall be microprocessor based, programmable unit which is preprogrammed for the specific functions delineated. The unit shall have a two line LCD display with 20 alpha numeric characters per line. This display shall show all input variables, set points, status, alarm messages and prompts for on/off and timers. Operator interface shall be through a front panel alphanumeric keypad with 20 tactile-feedback buttons for entering configuration parameters and for scrolling between display screens. The controller shall exhibit sequential logic as well as proportional, integral and derivative loop control, plus be capable of full modulating control, as specified. CPU failure and manual transfer capability shall be available for modulating control.

As a minimum the controller shall have 22K RAM or 52K EPROM with a 0.5 ms/K scan time and CMOS RAM with battery back-up. The unit shall have as a minimum 11 optically isolated inputs including transmitted or digital inputs, with expansion if the application should require it. Modulating outputs signals to the final elements shall be 135 ohm or 4-20 mADC. On-Off and digital outputs shall be through isolation relays.

Two communications ports shall be available if required as RS-232 or RS-485 with the capability of remote initiation by owner's building management system.

The controller shall also have the capability of sequencing pumps and positioning combustion make-up air louvers. The capability shall also be available for outside air temperature reset, firing rate indication, assured low fire shut down and warm up, and night set back/weekend skip. For full modulating control, separate modulating M/A stations shall be available.

The sequencer shall be supplied in a wall/surface mounting steel cabinet with the approximate dimensions of 24" H X 24" W X 10" D. This cabinet shall contain all input and output interface devices, relays, alarm horn, boiler on/off status lamps, and Auto-Off-Manual switches for each (all) boiler(s).

An Open Mount (5810-CO-OM) version comprising a panel mounted face plate connected via a flexible wiring harness (up to 5ft in length) to a remote mounted master electronics board is available.

Supply Hays Cleveland Model MICRO IV.

Part 2- Specifications for Lead Lag and Sequencing Control

Select <text 1> or <text 2> and add to final specification.

1. Provide panel mounted lead/lag sequencer with features per Paragraph ___ to operate ___ [insert quantity] <steam><hot water> boilers.
2. Boilers are to be taken from cold stand-by to low fire condition <manually><by the control system>. Boilers are to be taken from low to high fire by <the control system><each boilers existing control system>. Boilers are to be shut down <manually><by the control system>.
3. Auto-Off-Manual switches and boiler status (on) lights shall be provided for each boiler along with an alarm horn.
4. The Auto-Off-Manual feature shall provide boiler skip during sequence if switch is in the off position.
5. As the process <pressure><temperature> varies from set point, the controls shall enable additional boilers to be used to satisfy the load/demand, or remove boilers as the load decreases. The sequence for the boilers to come on or off line shall be selectable. An adjustable time delay (0 to 50 minutes) shall be utilized and compared to the process variable before bringing another boiler on or off line.
6. On/Off sequencing shall control the plant master <steam pressure><temperature> set point.
7. Specification Writer Select One; 7.a or 7.b.
 - 7.a. Supply a gauge pressure transmitter for the plant header steam line with 4-20 mADC input to the controller. Pressure transmitter shall be 4-wire type or be furnished with a 24 V loop power supply. It shall sense the steam pressure directly with a capsule that is inside the transmitter enclosure. The Pressure set point range shall be ___ to ___ psig.

- 7.b. Supply a temperature transmitter to sense the supply water temperature with 4-20 mADC input to the controller. The temperature sensor shall be 100 ohm Platinum RTD with 4.5 inch insertion length in a SS thermowell. Temperature set point range shall be ___ to ___ deg F.
8. Controller LCD front panel shall display all inputs and set points and operating parameters.
9. Sequencer shall have retentive memory in case of power failure and shall recall the last operating sequence and number of boilers in service when power is restored.

Part 3- Options For Specification (Select and Add to Final Specification)

- a. Provide full modulating control of each boiler with signals to match the actuators supplied for each boiler.
- b. For full modulating control, provide auxiliary automatic/manual modulating control stations that provide both automatic and manual control of each boiler firing rate that will operate in case of lead/lag sequencer control failure. Provide one per boiler on the front of the panel. The controller shall have a LED display of boiler firing rate actuator position and control capability of ratio, dead band and proportional action. Transfer from the sequencing controls to the auto/manual controls shall be automatic in the event of CPU failure or faults.

The Lead-Lag Sequencer shall be Hays Cleveland Model 7200 or equal.

- c. Provide outside air temperature reset control action. Include a temperature transmitter with 4-20 mADC signal to the controller. The controller will reset the set points based on the variations in the outside air temperature. The outside air temperature sensor shall be 100 ohm Platinum RTD, equipped with a stainless steel weather/sun shield. A dedicated 24 VDC loop power supply shall be furnished in the cabinet for the transmitter.
- d. Provide automatic sequencing upon boiler failure which shall enable another boiler to be brought into sequence in the event of flame failure of an on-line boiler.
- e. Provide set point scheduling of all on and off set points at a selectable time of day/week/month to implement night set back and weekend skip.
- f. Provide output from the controller to enable hot water circulating pumps to be staged with the sequence of the boiler. Pumps are to remain on for a time adjustable period after the boiler is turned off.
- g. Provide assured low fire warm up and low fire shut shutdown from proof of position contacts that are required on the firing rate actuators.
- h. For boilers with non-modulating outlet draft dampers, provide outputs to fully open and fully close the outlet dampers in response to the sequence of bringing a boiler on or off.

- I. Provide the RS-485 output and programming of the controller to permit remote changes of control commands from the building management system.
- j. Provide combustion efficiency reading on the front panel display of the controller for each boiler, which is based upon boiler flue gas temperature. For this, provide one flue gas temperature transmitter for each boiler, with a stainless steel protected 18-inch insertion 100 ohm platinum RTD. A dedicated 24 VDC loop power supply shall be furnished in the cabinet for each transmitter.