

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

- Introduction For Specification Writer: This guide specification is for a microprocessor based lead-lag sequencing controller. This controller is generally employed for fire tube steam 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. Plant energy demand is satisfied by the start up and operation of any single boiler to maintain required pressure set point or temperature, 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 or 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 jackshaft 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, menu driven site tunable unit that is preprogrammed for the specific functions delineated. The unit shall have a two-line Vacuum Fluorescent display with 20 alphanumeric 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 and integral loop control capable of full modulating control as specified. CPU failure with auto boiler failure skip and manual transfer capability for modulating control shall be standard.

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 ma. On off and digital outputs shall be through isolation relays.

The process variable shall be continuously displayed by a 1/32nd din Digital Indicator mounted on the panel.

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

The controller shall also have the optional capability of sequencing pumps, positioning combustion make-air louvers, 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 16" H X 16" W X 6 1/2" D (24"X24"x10" for 5810 and depends on options selected). This cabinet shall contain all input and output interface devices, relays, alarm horn (5810, if specified), boiler on-off lamps and Auto-Off-Manual switches for each (all) boilers(s).

An Open Mount (5830-*O-OM) version comprising a panel-mounted faceplate connected via a flexible wiring harness (up to 5ft in length) to a remote mounted electronics sub assembly board shall be available.

Supply Hay Cleaveland Model – 5810 Micro IV or Compact 5830 MICRO IV
(dependant on specification).

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><each boilers existing control system>. Boilers are to be shut down <manually><by the control system>.
3. Auto-Off-Manual switches, boiler status (on) lights and boiler fail lights shall be provided for each boiler. Alarm horn optional (5810 only).
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.

Specification Writer Select One (Optional); 7.a or 7.b.

- 7.a. Supply a gauge pressure transmitter for the plant header steamline with 4-20 ma input to the controller. Pressure transmitter shall be 4-wire type or be furnished with a 24 V loop power supply (C1). 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 ma input to the controller. The temperature sensor shall be 100 ohms Platinum RTD with 4.5-inch insertion length in a SS thermo well. Temperature set point range shall be ___ to ___ deg F.
8. The controller Vacuum Fluorescent panel shall display all inputs, 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.
10. Auto Lead Boiler Changeover shall be front panel programmable for either of the following, accumulated lead boiler run hours, day/hour changeover time.
11. Sequencer shall have the ability to accept universal types/ranges of process transmitters and be configurable from the front keypad.
12. Sequencer must have Master Set Point Tracking of all cut in/out points and modulation parameters.

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 (135 ohm standard or 4-20 ma optional).
- 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 Auto/Manual station shall be Hays Cleveland Model 7200 or equal.

- C. Provide outside air temperature reset control action. Include a temperature transmitter with 4-20 ma 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 ohms Platinum RTD, equipped with a stainless steel weather/sun shield. A dedicated 24 VDC loop power supply (C1) shall be furnished in the cabinet for the transmitter.
- D. Provide automatic sequencing upon boiler failure that 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 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 (available from the front panel display of the controller C1) for each boiler and 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 and a dedicated digital flue gas temp indicator mounted on the cabinet front for each transmitter (option available on 5810 only).
- K. Flue Gas Temperature Monitoring, same as above but with FGT readout and no combustion efficiency readout.