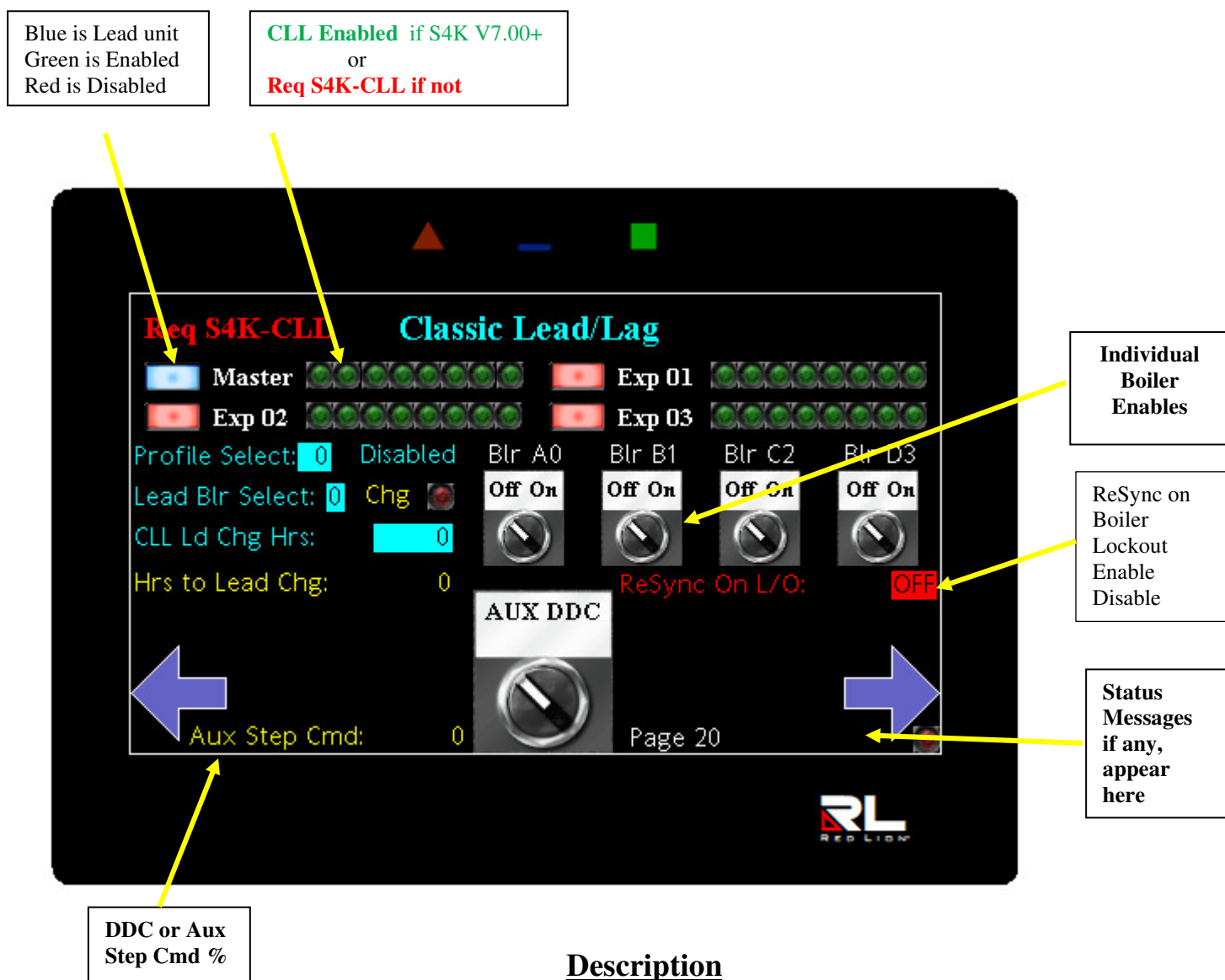

SELECTRONIX, INC.
WOODINVILLE, WA

SUPERSTEP SERIES 4000
SEQUENCING STEP
CONTROLLERS

SLC4075 TECH NOTE 214

Classic Lead/Lag Features and Controls
for Selectronix Building Management Interface

1 Selectronix SLC4000 Classic Lead Lag Features And Controls



Description

Classic Lead/Lag (CLL) control has been added to the Selectronix Building Management Interface (BMI) system, using a special version of the popular SLC4000 (S4K) controller. The CLL provides the more traditional form of Lead/Lag control with a choice of profiles, including a user-defined custom profile. This supplements our Proportional Optimized Progressive Sequencing (POPS) for gas boilers, or Proportional Progressive Sequencing (PPS) for electric boilers. The PPS provides an analog signal to control subordinate Extended Sequencer Chains (ESC) of SLC4000 units,

Features

- **Time-based Lead Stage Rotation**
 - a. The lead boiler may be changed on a programmable periodic time of 0 to 1000 hours (41+ days).
 - b. The hours may be changed via the TSGW or **BMS**
- **Selectable Lead Stage**
 - a. Changeable via the TSGW or **BMS**.
- **Any S4K may be disabled, including the master unit**, by using the 2-pos switch on the CLL page, via the BMS, or a limit string action. *This control is available for all profiles, including when the CLL profiles are disabled, allowing control over standard S4K, or POPS/PPS units!*
- **Indicators show individual S4K Status**
 - a. Blue rectangle indicator is for the lead unit.
 - b. Green rectangle indicator is for an enabled unit.
 - c. Red rectangle indicator is for a disabled unit.
- **Up to 4 boilers** may be controlled directly, or 4 SLC4000-1 units may be used to control an Extended Sequencer Chain each comprised of up to 32 stages, each.
- **2-Position On/Off Boiler Enable/Disable**
 - a. Allows operator or **BMS enable/disable** of the individual boilers.
 - b. The switch is visible for any powered unit, and disappears if power to that unit is disconnected.
- **Automatic re-synchronization on plant configuration change:**
 - a. Lead boiler change
 - b. Boiler being enabled or disabled, either manually or due to a limit string interruption.
 - c. On a plant configuration change, all relays are rapidly sequenced off, and sequenced back on to the proportional command considering the defined lead unit and available quantity of system relays.
- **Staggered and Custom Lead/Lag Modulation Profiles**

Two variables define the switching points, Low Switch Point (LSP) Percent, and High Switch Point (HSP) Percent. The controller calculates the integral quantity of relays for each of the 2 switch points. The sequencing of the relays is as follows:

 1. On the lead boiler (LB), sequence to the HSP.
 2. On the next boiler (LB+1), sequence to the LSP
 3. On the LBr, sequence to all relays for that S4K.
 4. On the LB+1, sequence to the HSP.
 5. On the LB+2, sequence to the LSP.
 6. and so on
 7. The 50/50/100 pattern is a special variation of the standard staggered pattern
 - a. On the lead boiler (LB), sequence to 50% of the relays-in-service..
 - b. On the next boiler (LB+1), sequence to 50% of the relays-in-service.
 - c. On the LBr, sequence to all relays for that S4K.
 - d. On the LB+2, sequence to 50% of the relays-in-service, and so on..
 8. For the Custom profile, the LSP is automatically adjusted to a value that ensures at least one relay is turned on
- **Parallel Modulation Profile**

Parallel modulation adds or removes each stage equally across all enabled boilers, starting from the lead unit.

- **Profile Select** and Pre-defined Profiles (LSP/HSP)
 - a. **Disabled (0)**
 - i. The system relinquishes the control to the master S4K. This enables the native S4K sequencing, *including POPS/PPS units*. For all other profiles, the CLL controls the sequencing.
 - b. **100/0 (1)**
 - i. Provides control with the same sequencing as standard system
 - c. **80/20/100 (2)**
 - i. Provides staggered sequencing as previously defined. This profile might be selected for burners that are most efficient at a high flame rate.
 - d. **50/25/100 (3)**
 - i. Provides staggered sequencing as previously defined.
 - e. **50/50/100 (4)**
 - i. Provides staggered sequencing as previously defined. This profile might be selected for burners that are most efficient at a low flame rate.
 - f. **Parallel (5)**
 - i. Provides equal stages across all available S4Ks.
 - g. **Custom (9)**
 - i. The user defines the LSP and HSP, with HSP 25% higher than LSP. The LSP is automatically adjusted to turn on at least one relay, regardless of the quantity of relays in use on each individual S4K.
 - h. **Proportional or Linear Sequencing**
 - i. CLL uses the setting from the master S4K for independently sequencing either progressively or linearly.
- **Lead Blr Select**
 - a. Select any of the available units
- **Lead Chg Hrs:**
 - a. Select any quantity of hours between 0 and 1000 hours (41+ days)
 - b. Select non-zero profile
- **Hrs to Lead Chg**
 - a. Calculated hours until the lead boiler changes.
- **Shutdown Master Relays on Limit String Input**
 - a. When a limit string trip occurs for the master unit, all contactors are immediately disabled, since the limit string power provides the power to RLYCOM terminal that in-turn, supplies power to the contactors.
- **Expansion Units Using Remote Enable/Disable Contact in Limit String**
 - a. Expansion unit control power may optionally be sourced from the *limit string power*. When a trip occurs, the control power, as well as all relays are shut off, including the Flame Enable relay on the SLC4000-1. The system automatically recognizes the loss of this S4K and re-configures for the dropout of this boiler. On limit string reset, all relays begin OFF. The system automatically recognizes the addition of an S4K and re-configures for the addition of this S4K. *Use this wiring method if a hardware limit-string enable/disable contact is utilized.* Note that a CLL system has the capability to individually enable/disable individual boilers using the touchscreen or the BMS.

- **ReSync On L/O (Lockout)**

Controls the re-sequencing response when a Boiler Lockout condition occurs. *This option is generally useful for multi-boiler, fuel-based systems that must avoid re-sequencing all the burners when a single boiler lockout occurs.* Control power for each of the S4Ks must ***always be provided, while the limit string provides the power to the RLYCOM terminal.***

- a. **When OFF:**

- i. The ***system sequencing logic is not affected by the shutdown.*** The “On/Off” enable switch remains ON, and the associated SLC4000 continues to be sequenced. As the limit string provides the power to RLYCOM, the flame controller is de-energized, as expected. On limit string reset, the flame controller is re-enabled.
 - ii. This is a subtle difference when both control power and RLYCOM are powered from the limit string, On a lockout and/or restoral of a single S4K, the system re-synchronizes all S4Ks.
 - iii. **The GPDI Boiler Lockout is an advisory alarm only with no automatic switching of the boiler’s “On/Off” switch..**
 - iv. *The advantage is that the other online boilers are not affected when a boiler lockout occurs.*

- b. **When ON:**

- i. The CLL “On/Off” boiler enable switches are ***automatically switched to “Off” on a GPDI Boiler Lockout and “On” when the GPDI signal is reset.***
 - ii. **The sequencing logic for ALL boilers are resynchronized whenever an S4K is enabled or disabled, resulting in a momentary shutdown of all the boilers. Any active unit is immediately re-sequenced ON.**
 - iii. This option is similar to the typical wiring of the expansion S4Ks where both control power and RLYCOM are provided power from the end of the limit string.

- c. **OnStartup File:**

- i. This configurable parameter is recommended to be set in the OnStartup file to prevent any inadvertent settings change.

Extended Sequencer Chain (ESC) Configuration

The ESC configuration uses an array of SLC4000-1 units to provide 0-10V outputs to the array of up to 4 boilers with a maximum of 32 steps for each boiler.

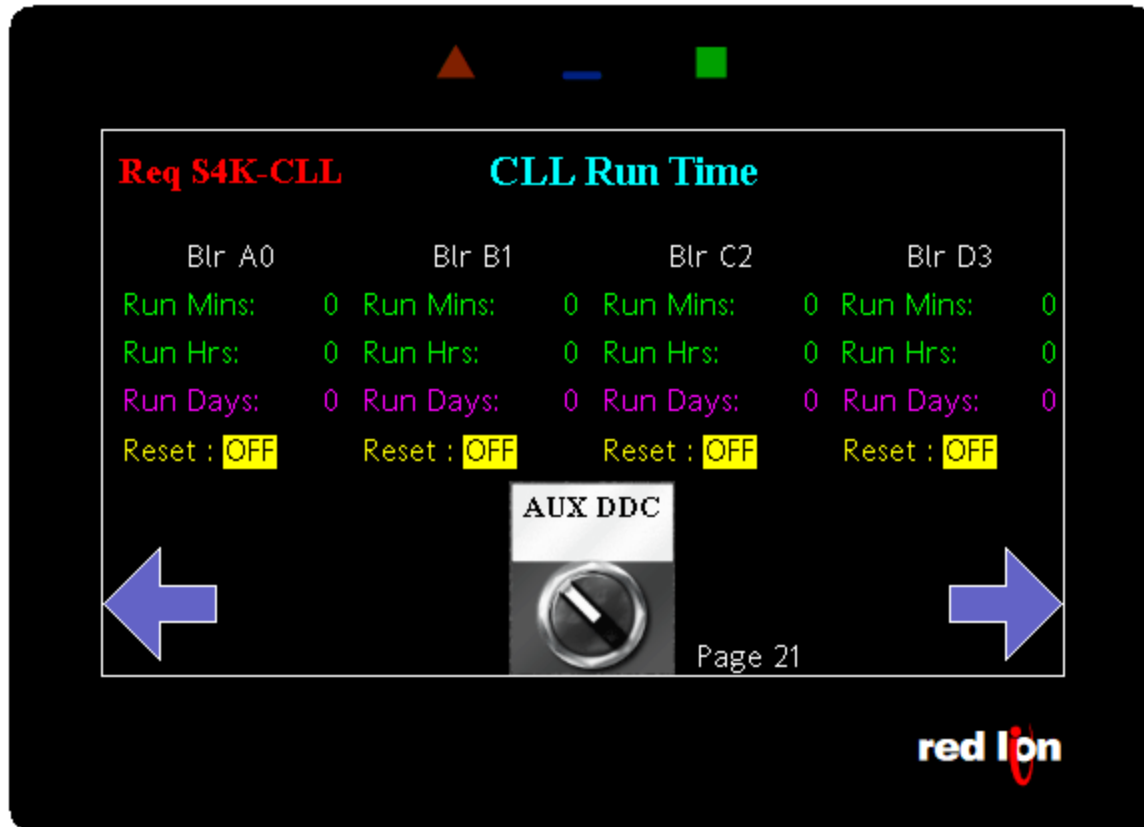
- d. ***This controller configuration enables the ability for independent and autonomous control of each of the boilers.*** A local/remote switch allows switching between a local auxiliary controller and the BMI control. This provides for redundancy, while maintaining the ability for complete autonomous operation.

- **Supervisory Master**

An SLC4000-4 or SLC4000-1 may be configured as a ***0-output supervisory master.*** This mode enables some control benefits for the expansion units.

- a. Allows identical wiring of each of the boilers in an extended sequencer chain.
 - b. When powering the associated SLC4000-1 expansion unit’s L1 and RLYCOM from the associated boiler’s limit string:
 - i. Enables a dry contact to enable/disable the boiler, while removing the unit from the system sequencing logic. This may be useful for systems that are not yet connected to the BMS.

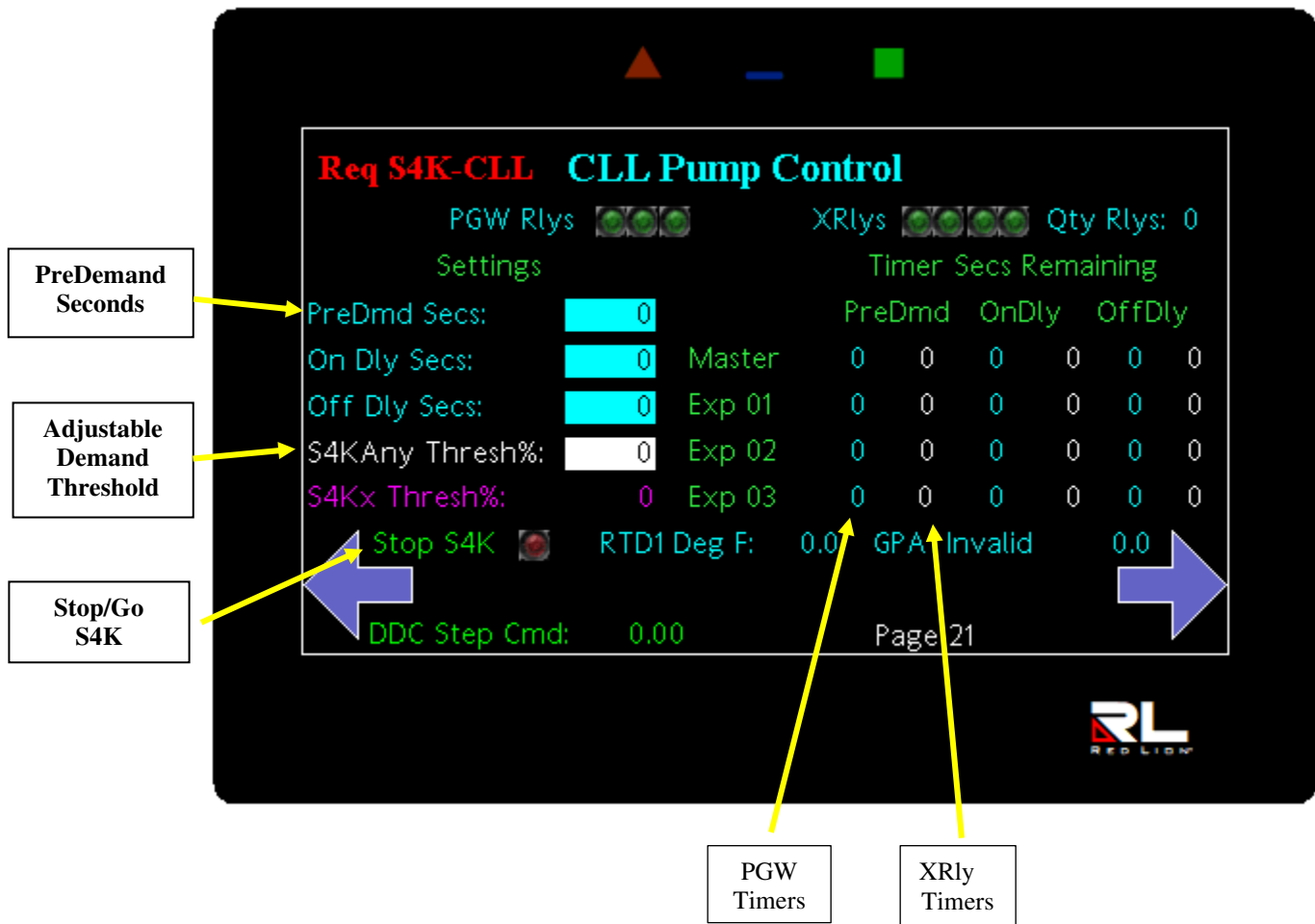
- **CLL Individual Run Time Meters**



- **Classic Lead/Lag Requirements**

- An SLC4000 Building Management Interface system.
- Any model of a standard SLC4000 or SLC4024 equipped with the CLL option, SLC4000-x-CLL. This option is purchased separately at time of order of the standard SLC4000 controller, and is installed at the factory. A CLL firmware version is 7.00 or higher.
- The CLL page in the TSGW displays 'CLL Enabled', otherwise displays 'Req S4K CLL'
- Expansion units may be any standard S4K unit.

2 PGW and XRlys Signaling for Pumps, Fans, or Auxiliary Devices.



- *Requires optional Classic Lead Lag Components*
 - a. SLC4075 V3.04+
 - b. SLC4000 master V5.25+
- Works with all CLL Profiles
- Works with single or multiple boiler configurations
- Programmable constants:
 - a. Set Pre Demand Secs
 - i. This inhibits activating steps for the PreDmdSecs.
 - 1. S4K Inhibit is illuminated whenever the Pump Control is inhibiting application of additional steps
 - ii. Mutually exclusive with OnDly Secs.
 - b. Programmable On Delay Secs
 - c. Programmable Off Delay Secs
 - d. S4K Any Dmd% Threshold
 - i. Programmable DDC Step Cmd threshold for PreDemand to close the applicable relay and initiate timing.

- e. S4Kx Dmd% Threshold
 - i. The derived DDC Step Cmd for PreDemand to close the applicable relay and initiate timing. This threshold is the demand which must be exceeded to turn on relays on the next S4K. The threshold is derived from the demand required for the quantity of relays currently on and the S4K Any threshold.
- **Timer Secs Remaining**
 - a. Realtime display of the countdown timers
- **Go/Stop S4K**
 - a. 'Stop StK' is displayed when the Pump Control is stopping any increase is S4K steps waiting for the DDC Step Cmd to exceed the triggering threshold. 'GO S3K' is displayed whenever there is no conditions to suspend increasing steps
- **PGW Rlys Indicators**
 - a. The indicators show the state of the PGW relays for monitoring the CLL-related relay state.
 - b. On the SLC4060 Relays page "Src Selector" set to either
 - i. CLL S4K Any, where any step ON activates this PGW relay
 - ii. CLL S4Kx, where any step on the corresponding S4K activates this PGW relay.
- **CLL-Related PGW Source Select**
 - a. PGW relay source "CLL S4K ANY".
 - i. The relay is energized whenever any relay is energized on the corresponding SLC4000.
 - b. PGW relay source "CLL S4Kx"
 - i. The relay is energized whenever any relay is on energized on the corresponding SLC4000.
- **XRlys Rlys Indicators**
 - a. The indicators show the state of the XRly relays for monitoring the CLL-related relay state.
- **XRlys CLL Source Selector**
 - a. XRlys relay source "CLL S4Kx" is available using either of the following Source Selections
 - i. The relay is energized whenever any relay is energized on the corresponding SLC4000.
 - b. 5 "CLLS4Kx/XDI
 - c. 6 "CLLS4Kx/DDC
- ***The PGW and XRly relays are pilot duty with a single common. Connect to an appropriate contactor for connection to the actual pump.***

3 How To Order

- a. Order SLC4000-x-CLL in combination with any standard SLC4000 or SLC4024. The CLL version of firmware is installed in this unit. If multiple different SLC4000 units are ordered, specify the target CLL unit.