



## Section 16

# *LSC - C Control Systems...*

**This section provides information on all the products in the LSC - C product line including the following:**

- *Lift Station Constant Speed Control System (LSC-C)*
  - *LSC-C 200 for a two pump, constant speed lift station application*
  - *LSC-C 300 for a three pump, constant speed lift station application*

**In this section, you will find:**

***\*\*Files noted below can be downloaded from the Reps Only section under the "LSC - C Product Information Center".***

- *LSC Series Background Information*
- *LSC/BSC Brochure (available online)*
- *LSC - C Screen Guide (available online)*
- *LSC - C Standard Specifications (available online)*

***For further assistance...***

Please call 904-292-0110 or [sales@egcontrols.com](mailto:sales@egcontrols.com)





## ***LSC Series Background Information...***

The **LSC Series** uses a PLC and Soft Touch Screen with Graphical software to provide a consistent approach to using a PLC for level control applications. The **LSC - C** model is used for constant speed and the **LSC - V** model is used for variable speed.

The **LSC Series** base system is available on a RFQ basis only and includes the following standard key features: *Note: All systems are UL listed and SCADA Ready.*

- See all operating information graphically and digitally on full color touch screens
- Customize pump operations through intuitive touch screen entries
- View critical data on pump operating trends, alarm history, pump fail replacement, data logging and multiple alternation strategies via user friendly screens
- Set pump speed settings using the minimum and maximum speed levels and the percent speed for each pump (LSC-V variable speed models only...)
- Evaluate all operating functions quickly and easily using a unique System Test Screen
- Access all system parameters including but not limited to alarm setpoints, timers and transmitter ranges through password protected touch screens.

## ***BSC Series Background Information...***

The **BSC Series** utilizes a PLC and Soft Touch Screen with Graphical software to provide a consistent approach to using a PLC for level control applications. The BSC is specifically designed for pump up applications.

The **BSC Series** base system is available on a RFQ basis only and includes the following standard key features: *Note: All systems are UL listed and SCADA Ready.*

- See all operating information graphically and digitally on full color touch screens
- Customize pump operations through intuitive touch screen entries
- View critical data on pump operating trends, alarm history, pump fail replacement, data logging and multiple alternation strategies via user friendly screens
- Pre-configure the system for tank fill or water distribution applications
- Set pump minimum and maximum speeds and select automatic or manual operation.
- Access all system parameters including but not limited to alarm setpoints, timers and transmitter ranges through password protected touch screens.

Contact EG Controls at 904-292-0110 or [sales@egcontrols](mailto:sales@egcontrols) to view samples of the BSC screens or to request a quotation.



# LIFT STATION CONSTANT SPEED CONTROL SYSTEM (LSC - C SERIES)

## OPERATIONAL SCREEN GUIDE

*INCLUDING STEP BY STEP INSTRUCTIONS FOR  
OPERATING ALL OF THE LSC - C 200/300 SCREENS*



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### INTRODUCTION

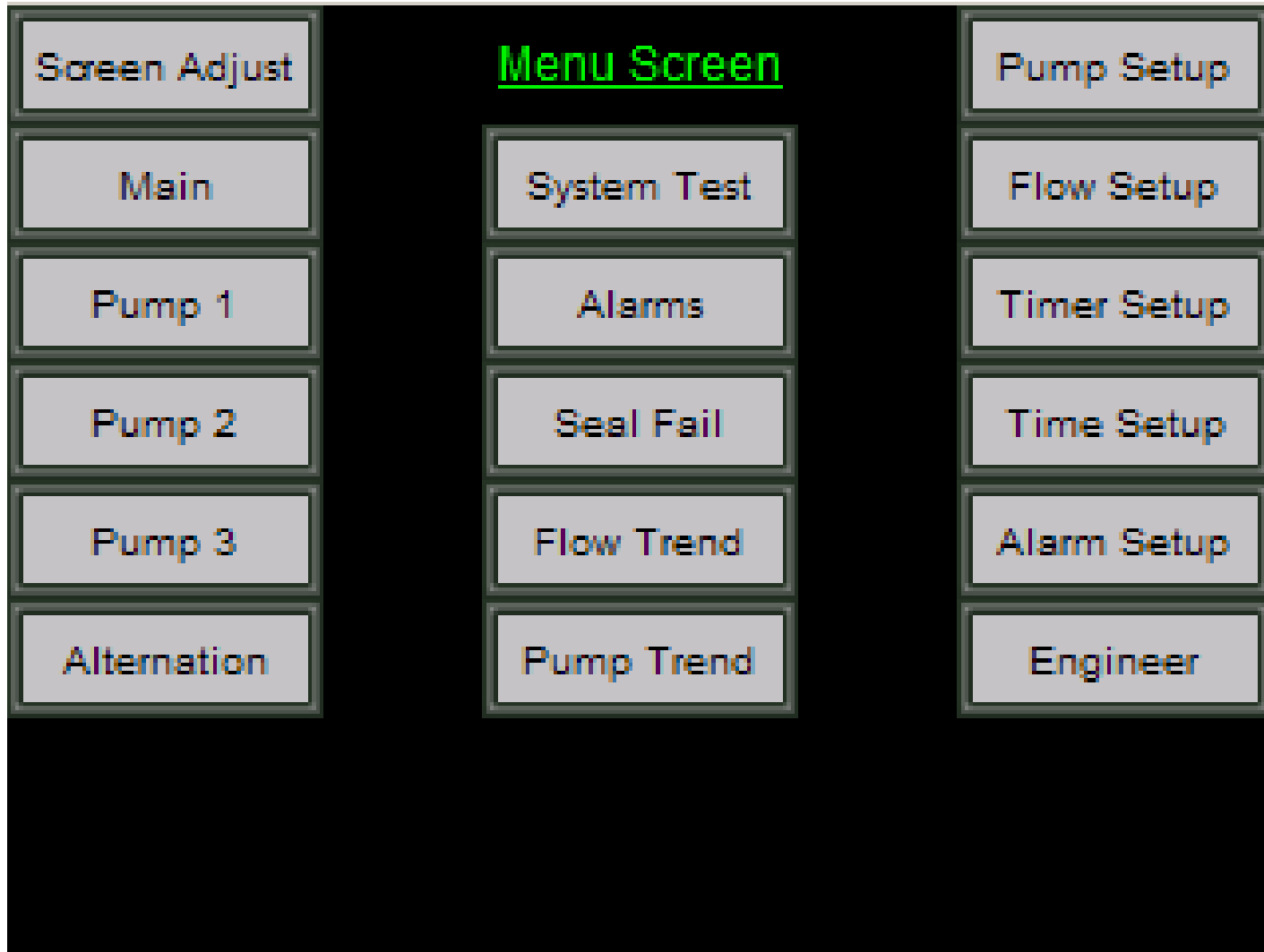
The LSC - C series has two different models: the LSC - C 200 for a two pump, constant speed, waste lift application and the LSC - C 300 for a similar three pump system. There are 30 color soft touch information and control screens within the system.

The screens graphically and digitally display all of the operating information for a pump station. The screen also allows the operation to be customized via feature selections and setpoint entries. Each LSC - C includes graphical trend screens that help you get “inside” your system, detailed pump information screens and a unique System Test screen that allows you to evaluate all operational functions quickly and easily.

The system is designed with the operator’s needs in mind and is able to run smoothly and efficiently once the appropriate setpoints have been designated. In the automatic mode, when three pumps are in automatic, the Lead, Lag 1 and 2 pumps will start and stop at their designated levels and alternate per the scheme selected by the operator. When one pump is operating and a failure occurs, the next pump in the operation sequence will be called in to service.

The actual screens contained in this book “walk the user through the LSC - C system”. Ninety percent of the features can be used without referring to this guide or attending any special training. This guide will help explain the application and functionality of each screen and is a ready reference tool for specific questions that may develop as you use the screens.

MENU SCREEN



The **MENU Screen** is your road map to the various displays within your system. Touch the appropriate button to take you to any of the different screens indicated.

Menu Buttons are organized into three columns.

**Informational and Operating Screens (left column) - These screens will be the screens most frequently used by operators.**

Screen Adjustment	Allows adjustment of screen brightness
Main Screen	Provides an overview.
Pump 1, 2 and 3 screens	Gives detailed information about the operating conditions of each pump.
Alternation	Allows the user to view or change the current alternating condition.

**Informational and Operating Screens (center column)**

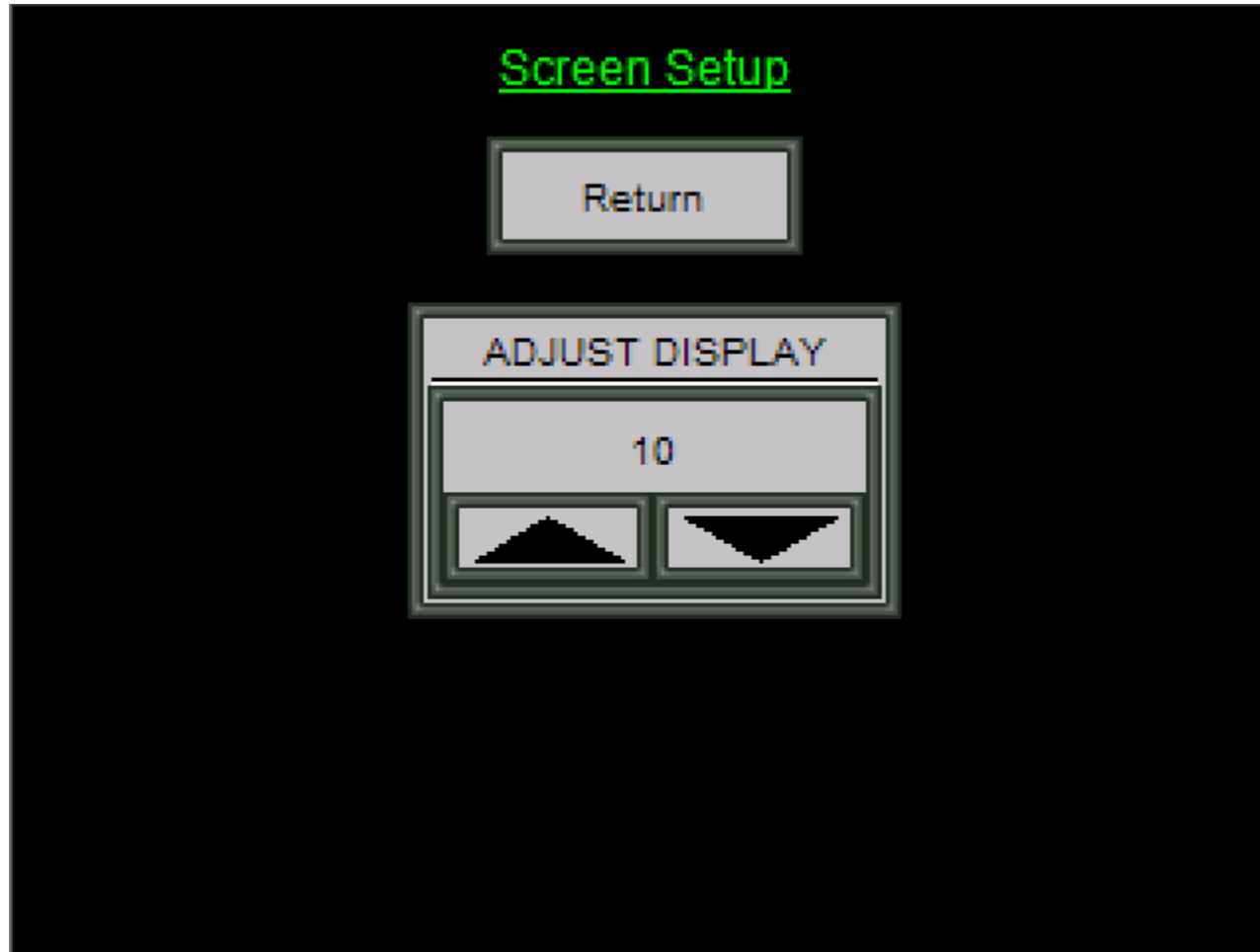
System Test	Provides an easy way to simulate conditions and test your system
Alarms	Shows current and historical alarm conditions
Seal Fail	Select seal fail actions
Flow Trend	Displays real time trend for inflow and outflow
Pump Trend	Displays real time trend for pump performance

**Set Up/Data Entry Screens (right column)**

Pump Set Up	Defines the level parameters for pumps turning ON or OFF
Flow Set Up	Information required for flow calculations
Timer Set Up	Timer adjustment to custom tune your system
Time Set Up	Allows date and time changes
Alarm Set Up	Enter alarm setpoints
Engineer	Allows field transmitter scaling

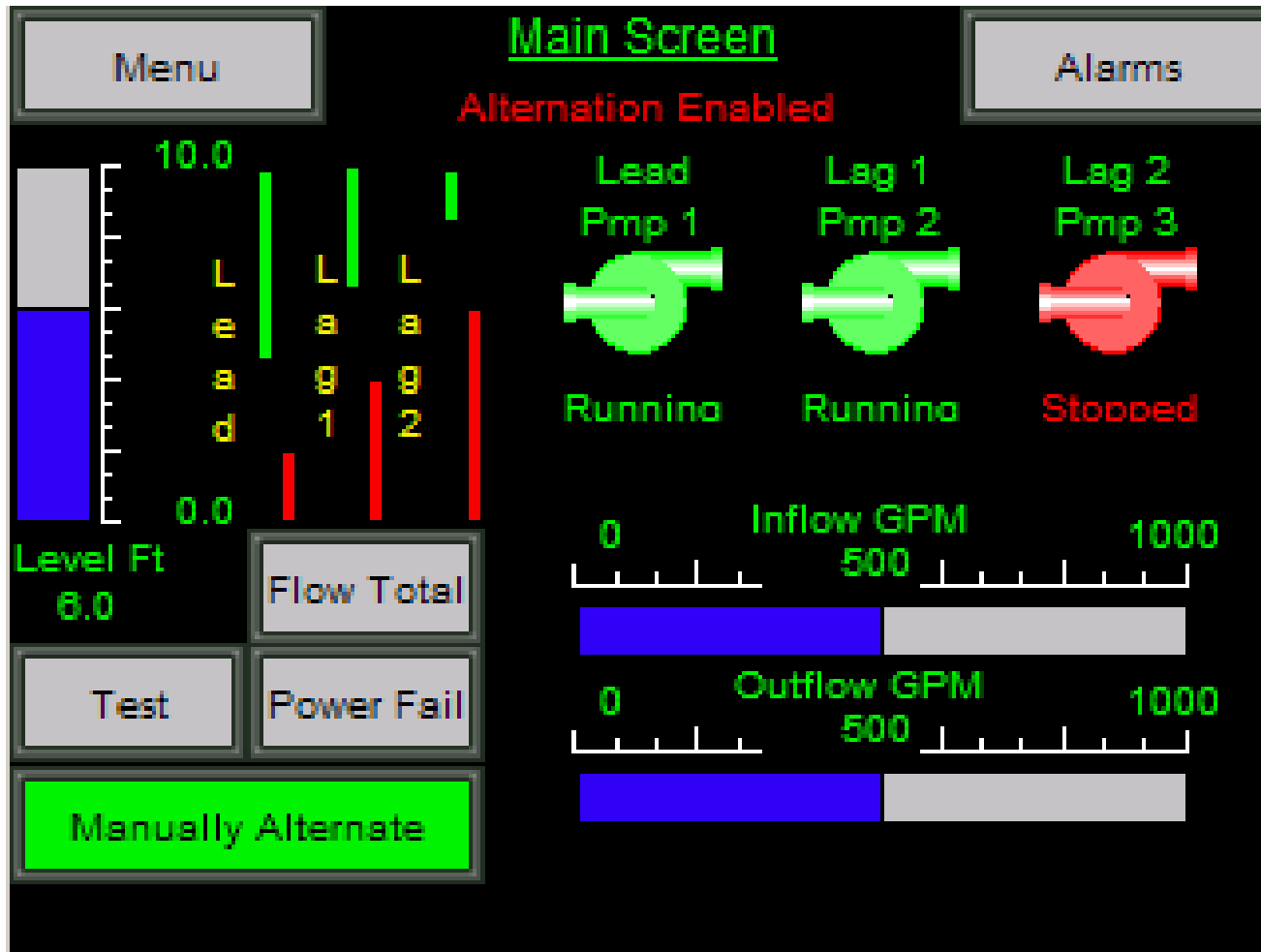


SCREEN SET UP



The Screen Set Up Screen allows the operator to adjust the contrast on the screen for better viewability.

MAIN SCREEN



The **Main Screen** is an informational screen designed to give you an overview of your pump station operations. Changes in pump operating conditions cannot be made from this screen. It constantly displays and updates the following information:

- |     |                                       |   |
|-----|---------------------------------------|---|
| 1)  | Wet Well Level (in feet)              | Displayed as a digital readout with vertical bargraph   |
| 2)  | Wet Well Transmitter Range            | Displayed as a digital readout at bottom right and top right of Level bargraph  |
| 3)  | Lead, Lag 1 or 2 Start/Stop Setpoints | Displayed as a vertical bargraph beside the level. The bottom of the green bar indicates the start setpoint and the top of the red bar indicates the stop setpoint. |
| 4)  | Alternation Type                      | Displayed in text below the Screen Title  |
| 5)  | Pump Line Up (Lead, Lag 1, Lag 2)     | Displayed in text above each pump graphic   |
| 6)  | Pump Run Status                       | Each pump graphic is RED for stopped or GREEN for run.  |
| 7)  | Pump Status                           | Displayed as text below each pump graphic (Running/Stopped/Fail)  |
| 8)  | Demand Charge Avoidance               | Displayed as text below the Pump Status Text - Pump Status will be "Fail" and DCA indication will be "Temporary"  |
| 9)  | Station Inflow (in GPM)               | Displayed as a digital readout with bargraph -- scaling is indicated at the top left and right above the bargraph   |
| 10) | Station Outflow (in GPM)              | Displayed as a digital readout with bargraph - scaling is indicated   |
| 11) | Manual Alternate Button               | When alternation is enabled, this button will allow the operator to alternate pumps at any time   |

*Easy to use navigation buttons will help you move throughout the LSC - C system, as follows:*

Touch the MENU button to go to the Menu Screen.

Touch the ALARM button to go to the Alarm History Screen.

Touch the TEST button to go to the Test(Simulate) Screen.

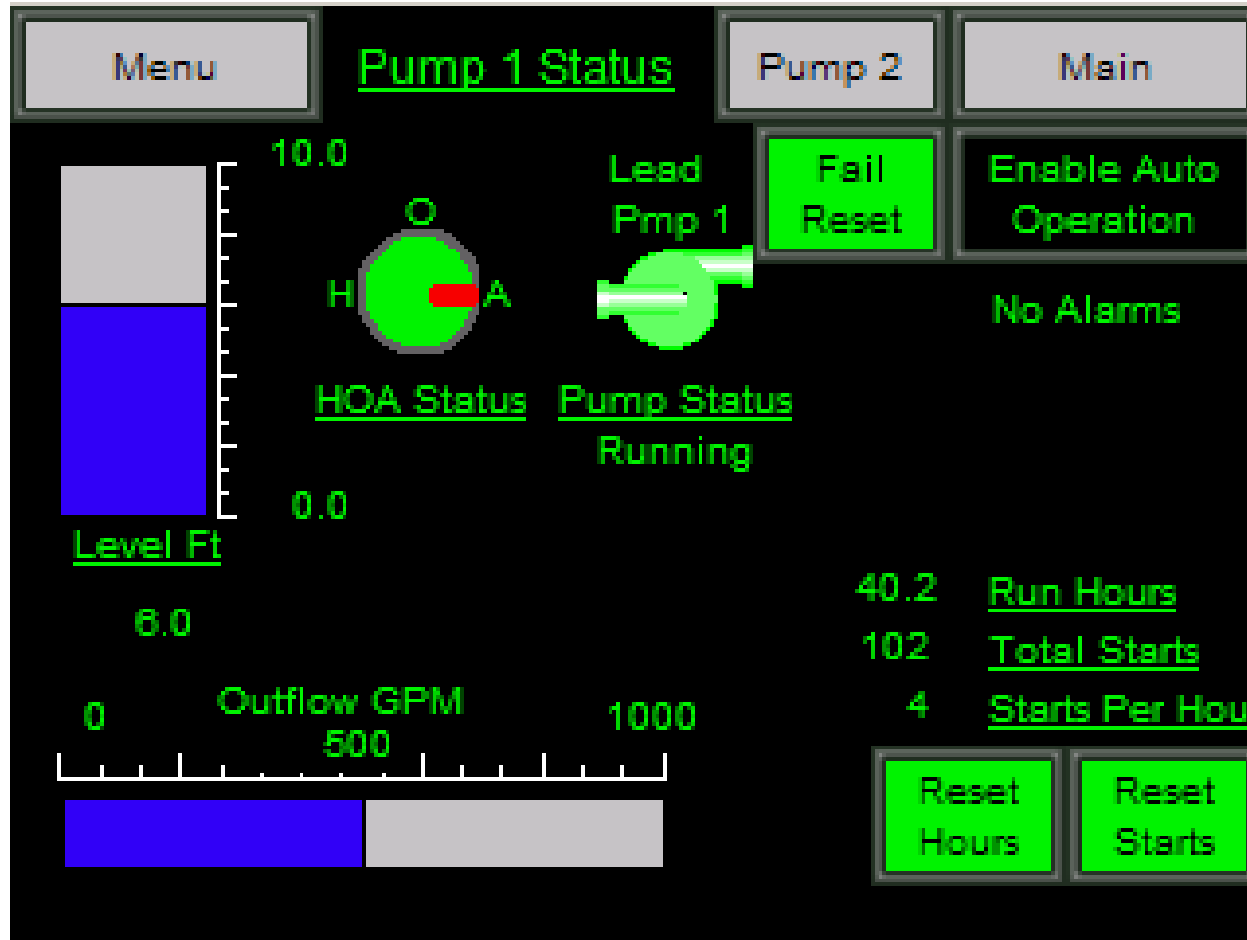
Touch the POWER FAIL button to go to the Power Fail and Restore Times Screen.

Touch the PUMP 1, 2 or 3 pump icon to go to the appropriate Pump Status Screen.

Touch the LEAD/LAG 1/LAG 2 Setpoint bargraph to go to the Pump Set Up Screen 1.

Touch the FLOW bargraph to go to the Wet Well Inflow/Outflow Real Time Trend Screen.

PUMP STATUS SCREEN



^ Pump Status Screen with no Active Alarms



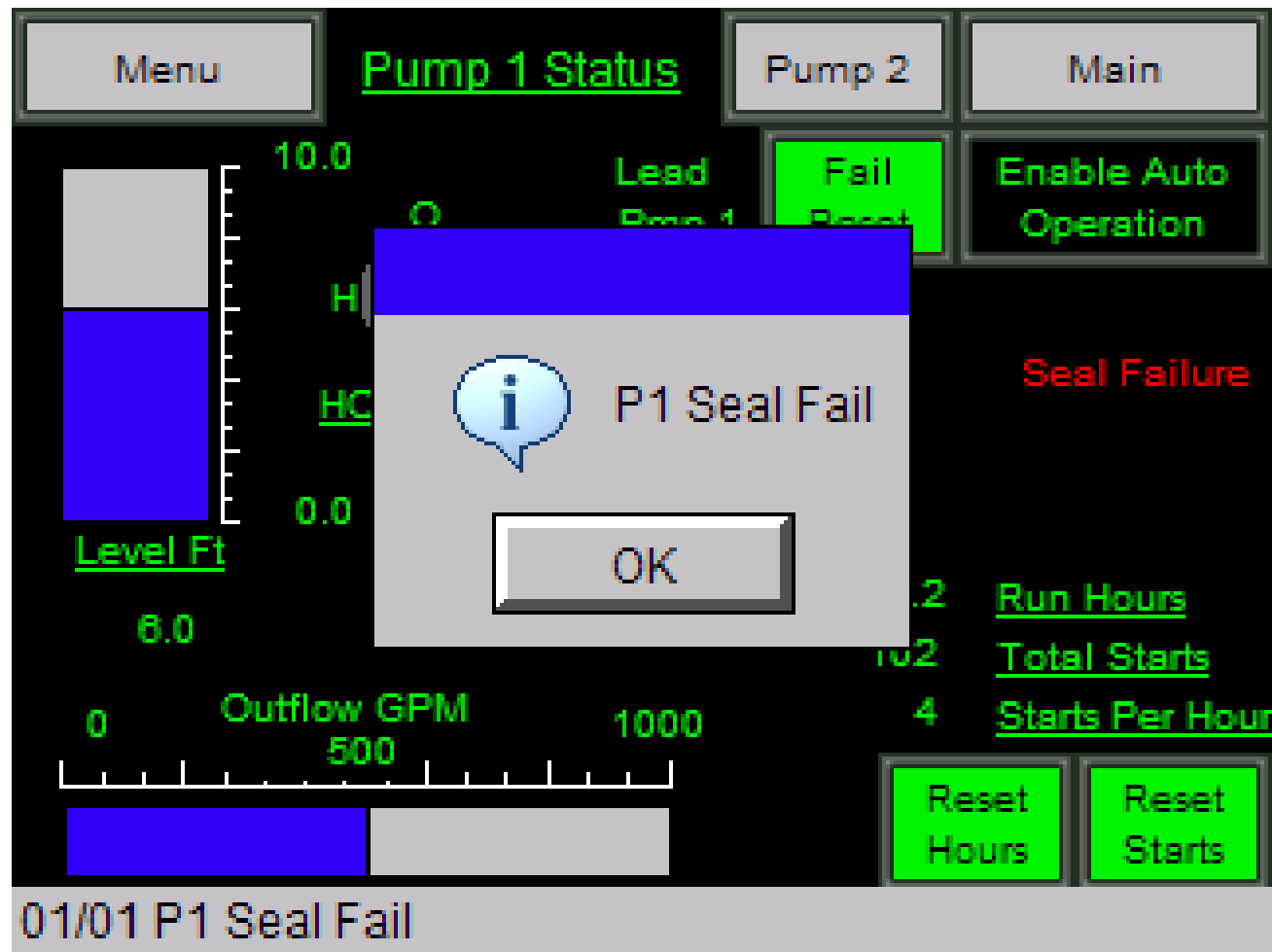
The **Pump Status Screen** is designed to give you a complete and up-to date status for each pump in your system. Each Pump Information Screen uses pump icons, vertical and horizontal bargraphs , digital readouts and display buttons to provide and update the following information.

- |     |                                 |  |
|-----|---------------------------------|--|
| 1)  | Wet Well Level (in feet)        | Displayed as a digital readout with vertical bargraph  |
| 2)  | Wet Well Transmitter Range      | Displayed as a digital readout at bottom right and top right of Level bargraph   |
| 3)  | HOA Status                      | Indicates the position of the panel mounted HAND/OFF/AUTO switch   |
| 4)  | Pump Line Up (Lead, Lag 1 or 2) | Lead, Lag 1 or 2 shown above the pump graphic  |
| 5)  | Pump Run Status                 | Each pump graphic is RED for stopped or GREEN for run  |
| 6)  | Pump Status                     | Displayed as text below the pump graphic (Running/Stopped/Fail)  |
| 7)  | Fail Reset                      | Used to reset a pump "Fail to Start" alarm   |
| 8)  | LOCK OUT button                 | "Locks out" a pump from automatic operation or allows normal operations.<br><i><b>IMPORTANT - Please note that it does not prevent the pump from manual operation from the HOA switch.</b></i> |
| 9)  | Alarm Text                      | Each text pump alarm will describe the alarm and flash RED when the alarm is active  |
| 10) | Run Hours                       | Displays a running total of the pump operating hours   |
| 11) | Total Starts                    | Displays a running total of the pump starts  |
| 12) | Starts per Hour                 | Displays the number of pump starts per hour  |
| 13) | Reset Hours Pushbutton          | Resets the RUN hours to 0  |
| 14) | Reset Starts Pushbutton         | Resets the Total Starts to 0   |
| 10) | Station Outflow (in GPM)        | Displayed as a digital readout with bargraph - scaling is indicated  |

### Pump Operation

The Pump Status Screen allows the operator to reset at "Fail to Start" alarm and to lock out a pump from automatic operation.

*Menu, Main and Pump 1, 2 or 3 buttons appear at the top of this screen for easy navigation to other screens. Touch the Main button to move to the Main Screen or any of the Pump button to move to any other Pump Status Screen that you wish to view.*



Pump Status Screen with an active alarm

*Note: The active alarm icon will display on any screen that the operator is viewing.*

The **Pump Status Screen in an Alarm Condition** will have a pop up window in the center of the screen with the alarm with a box for the operator to acknowledge the alarm by touching OK.

The standard pump related alarms included on the Pump Status Screen are, as follows:

- Start Fail Alarm**            A "Start Fail" alarm indicates that the Automated System attempted to start a pump but never received a run confirmation. Pushing "Fail Reset" will attempt another start.
- Seal Fail Alarm**            This alarm indicates a pump seal problem. When setting up this alarm, select from two options:  
1) Allow the pump to continue to operate    2) Stop on Seal Failure
- Overtemp Alarm**            This alarm indicates an overtemperature condition exists. The pump cannot be restarted until the condition is corrected.
- Overload Alarm**            This alarm indicates an overload condition. The pump cannot be restarted until the condition is corrected.
- Starts per Hour Alarm**    This alarm indicates that the pump has exceeded the allowed number of starts per hour. The number of starts to be allowed is determined during the set up process and is based on the manufacturer's recommendations. The action that results when a pump exceeds the maximum number of starts per hour depends on whether the pump is serving as the Lead, Lag 1 or 2 Pump. If the Lead Pump exceeds the maximum number of starts per hour and a Lag Pump is not required, it will be automatically stopped and one of the Lag Pumps will be forced into service. If the level continues to rise and either Lag pump is required, the Lead Pump will be forced into service.

*Menu, Main and Pump 1, 2 or 3 buttons appear at the top of this screen for easy navigation to other screens. Touch the Main button to move to the Main Screen or any of the Pump button to move to any other Pump Status Screen that you wish to view.*

PUMP ALTERNATION SET UP SCREENS

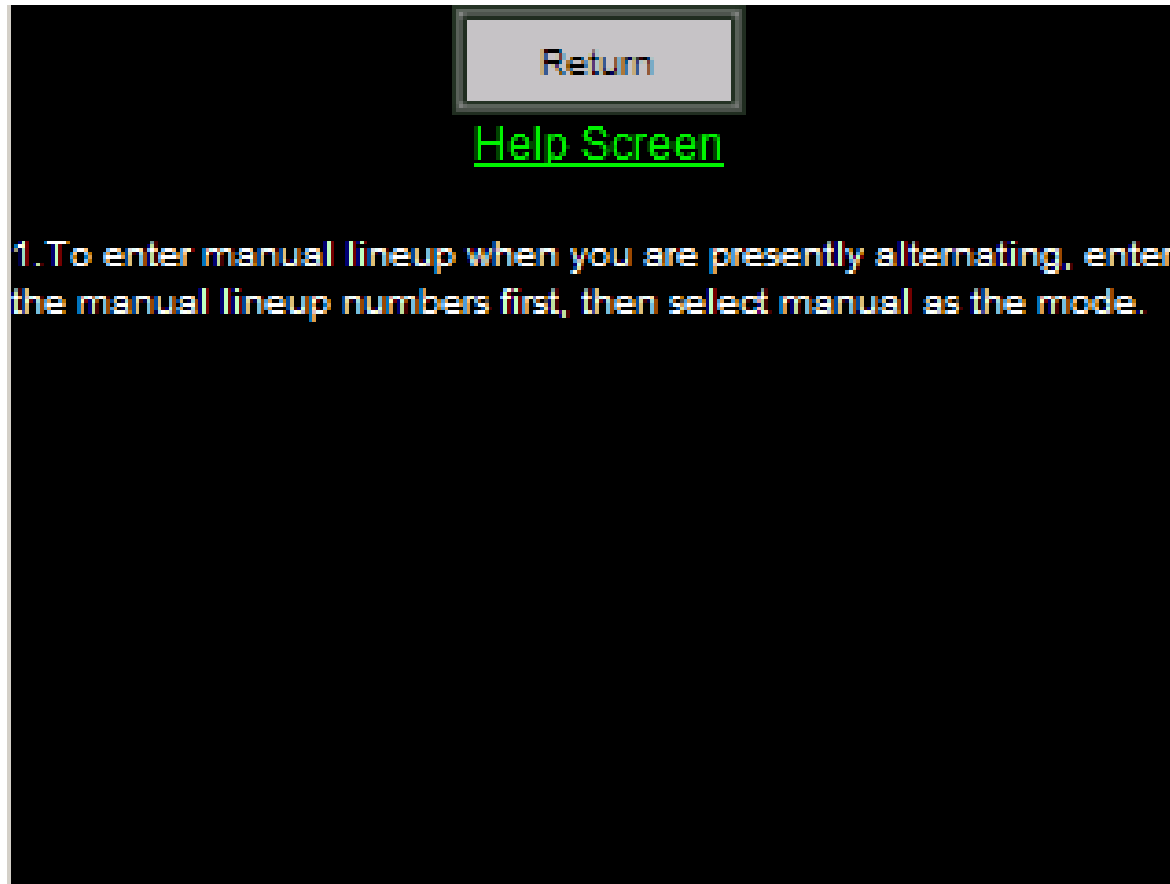
The Pump Alternation Set up Screen was designed to allow you to select the desired type of alternation considered most suitable for your pump station.

Set Up Screen #1 offers a choice between Manual Line Up and Automatic Alternation, as well as FOFO (First On, First Off) or LOFO (Last On, First Off). Should you choose Manual, you can also specify the Manual Line Up Order.

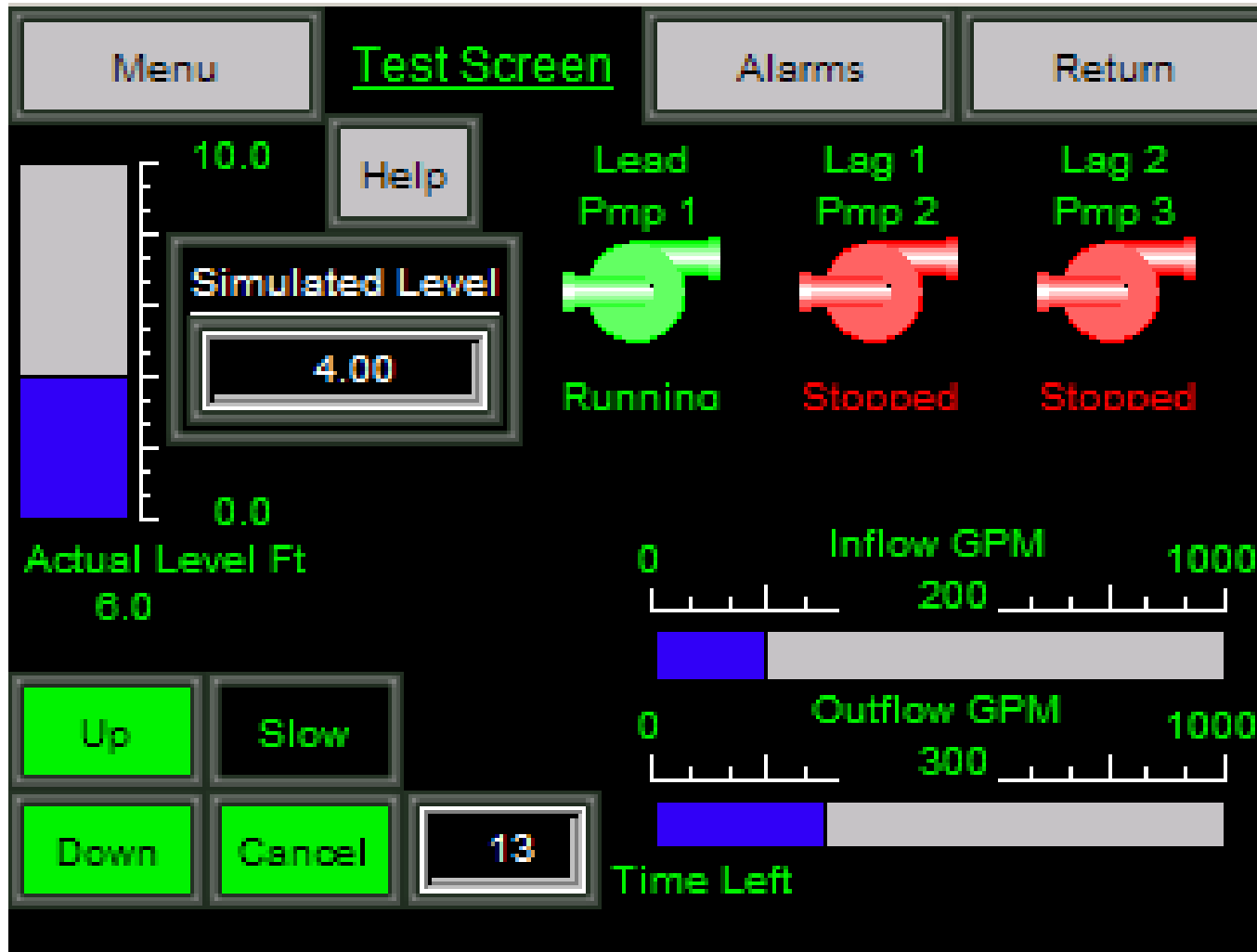
Set Up Screen #2 is only used if you have selected Automatic Alternation. On this screen, you must indicate alternation sequence and times. You can specify an exact time for alternation or have the system alternate after a certain number of hours.

*MENU, MAIN, ALARMS or RETURN (go back to prior screen) appear at the top of the screen for easy navigation to other screens. HELP will take you to the Help Screens.*

ALTERNATION HELP SCREEN



SYSTEM TEST SCREEN



The **System Test Screen** simulates a well level to test pumps and alarms in minutes. All of the data that you need for a complete operations test of your system is found on one screen.

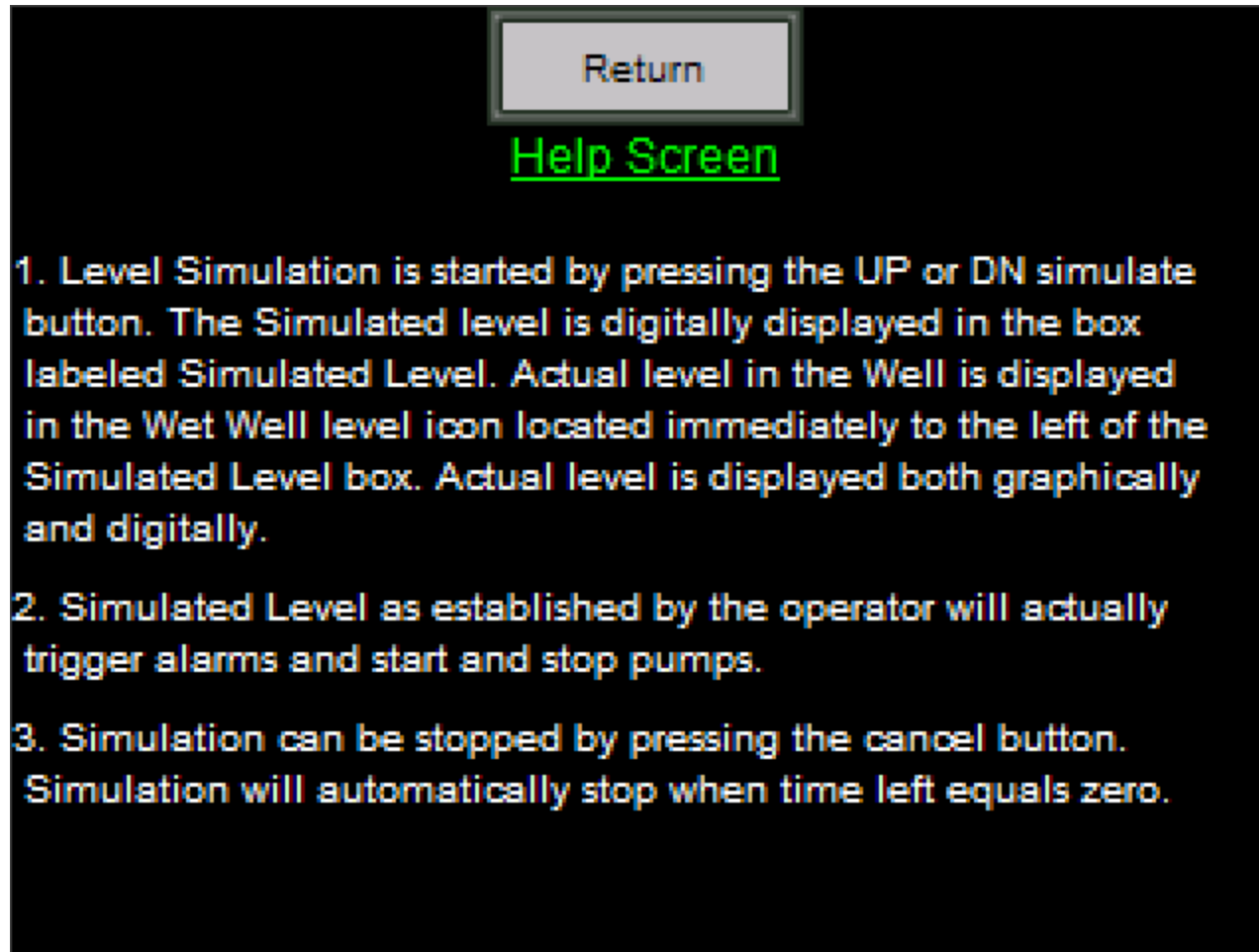
The System Test Screen displays and updates the following information during your system test:

- |   |   |
|---|---|
| 1) Wet Well Level (Simulated)                 | Displayed in digital readout box  |
| 2) Wet Well Level (Actual)                    | Displayed in vertical bargraph and digitally on the bottom of the graph |
| 3) Pump Line Up, Pump Run Status, Pump Status | Displayed by pump icons as on the Main Screen                           |
| 4) Station Outflow (in GPM)                   | Displayed in digital readout and in a bargraph                          |
| 5) Alarms                                     | Displayed in text form (pop ups) as they occur                          |

### Testing

- 1) Touch the UP or DOWN button to activate your simulate test . You can terminate the test and revert to normal operation at any time by touching the CANCEL button.
- 2) If the CANCEL button is not touched, the system will automatically return to normal operation after the "Time Left" returns to zero. (Duration is configured on the Set Up Screens.)
- 3) The FAST/SLOW toggle button determines the ramping speed for the UP and DOWN buttons.
- 4) The UP button will ramp up the simulated level and the DOWN button will ramp the level down.
- 5) During simulation, the pumps will actually START and STOP and alarms will occur.
- 6) Touching the HELP button will take you to a Simulation Help Screen.

*MENU, ALARMS or RETURN (go back to prior screen) appear at the top of the screen for easy navigation to other screens. HELP will take you to the Help Screens.*

SIMULATION HELP SCREEN

The Simulation Help Screen provides instructions on how to implement the System Test feature of the LSC - C system.



ALARM HISTORY SCREEN

Alarm History		Total of 2 Alarms	
Entry No	Alarm No	Message	Confirm
<b>1</b>	<b>15</b>	<b>P2 Overtemp</b>	<b>Required</b>
2	10	P1 Seal Fail	

Alarm Coun	Page Up	Page Down	Line Up	Line Down	Detail s	Clear All	Exit
---------------	------------	--------------	------------	--------------	-------------	--------------	------

The Alarm History Screen shows all alarms as an overview. By using the scrolling buttons at the bottom of the screen, you can select a specific alarm and go to the Alarm History Details Screen (see next page).

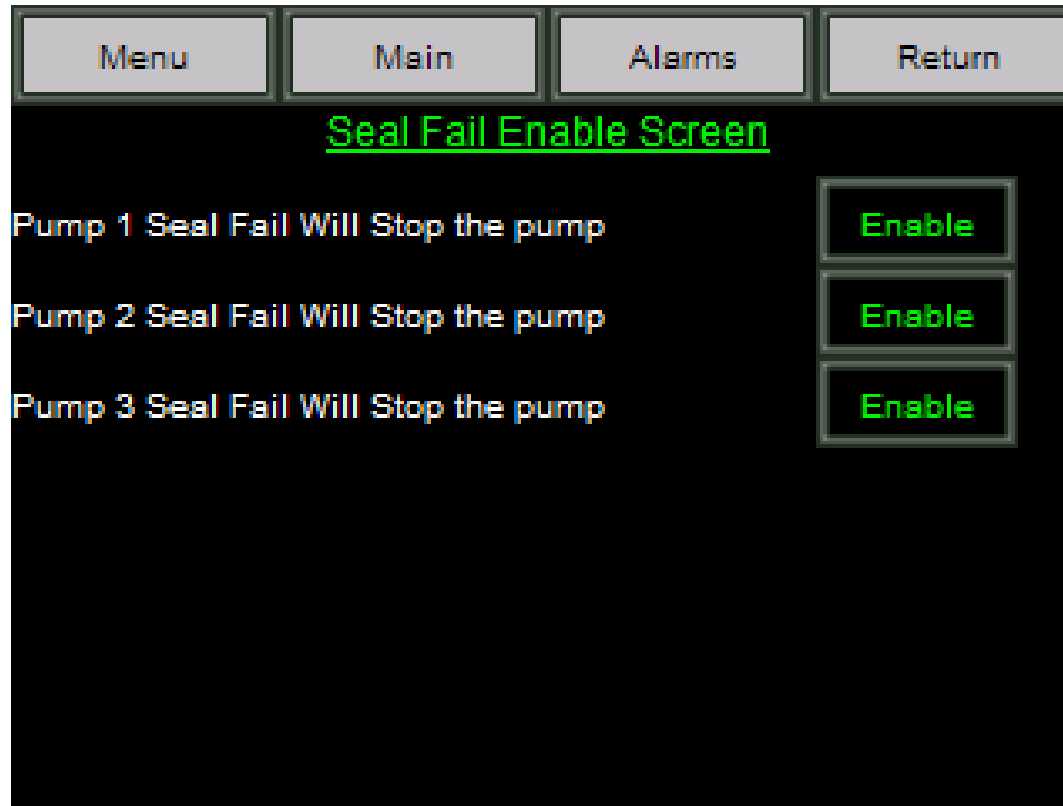
ALARM HISTORY DETAIL SCREEN

Alarm History Details

Entry No:	2
Message:	P1 Seal Fail
Activated:	05-SEP-2007 15:45:28
Cleared:	05-SEP-2007 15:46:11
Actual Value:	On
High/Low/Dis:	Discrete
Low:	
High:	
Confirm Cleared:	05-SEP-2007 15:45:59

The Alarm History Details Screen displays one specific alarm with complete information about when the alarm occurred, when it was cleared and when it was acknowledged.

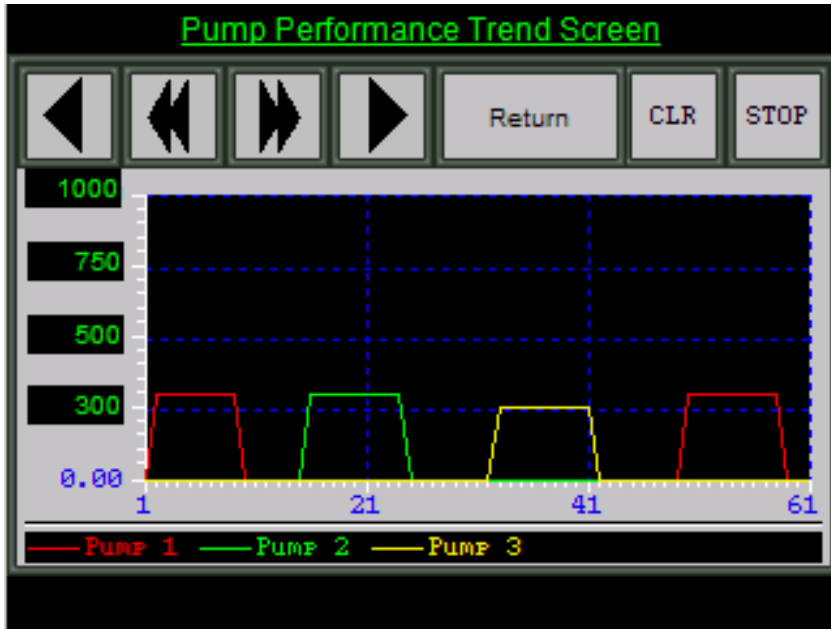
*Navigation buttons at the bottom of the screen enable the user to move to other alarms (via PREV for Previous or NEXT), confirm alarms or exit the details section.*

SEAL FAIL ENABLE SCREEN

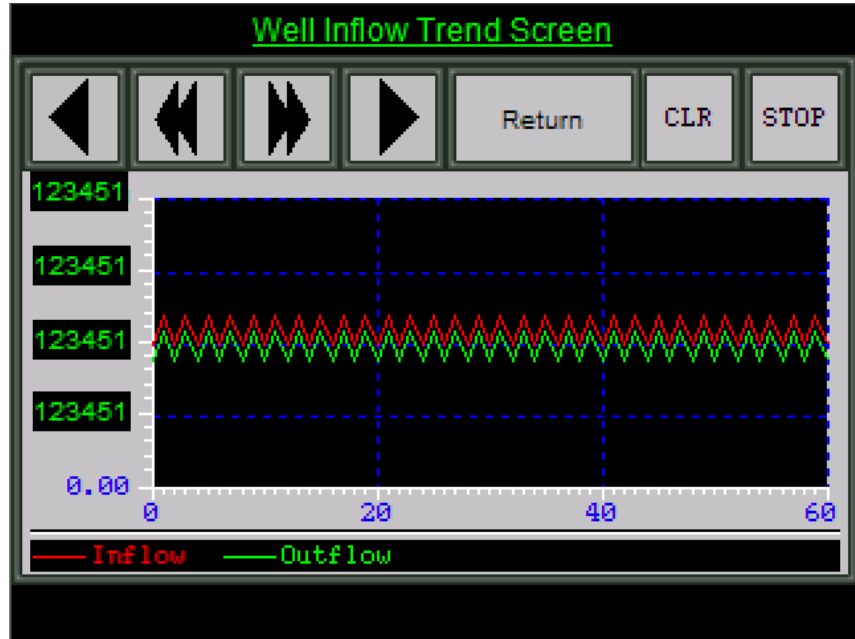
The **Seal Failure Enable Screen** allows the operator to determine the action taken under Seal Fail conditions. When the “Seal Fail Enabled” is selected, a Seal Failure will stop the pump. If Seal Fail disabled is selected, the alarm will occur but the pump will continue to run.

*MENU, MAIN, ALARMS or RETURN (go back to prior screen) appear at the top of the screen for easy navigation to other screens.*

TRENDS SCREENS



Pump Performance Trend Screen



Well Inflow Trend Screen

## PUMP PERFORMANCE TRENDS SCREEN

The Pump Performance Trends Screen is designed to help you compare and evaluate your pump performance. When the Trend is initiated, it will show the calculated pump discharge flow for the pump currently running. For example, it will show the discharge flow for that specific pump is running. It will show the flow for either Pump 1, 2 or 3 but will not show flow when more than one pump is running.

This screen is designed to show which pump is degrading in performance. If two pumps are pumping roughly the same GPM, two pumps are performing well. If one pump begins to show significantly less flow, this is an indication of a potential pumping problem that needs attention. This screen does **not** show the total outflow.

*IMPORTANT - The trends on this screen are real-time trends and not historical trends. Each trend screen represents a 60 minute time segment. Time 0 is the line where the trend was started and Time 60 is sixty minutes later. If you started the trend at noon on one day and examined it again at 6 PM, you would see Time 360 in the lower right hand corner based on 6 hours at 60 minutes. You can scroll back through time to look at values until you reach Time 0.*

*Continuous capacity is based on the size of the flash drive. The flash drive supplied is 128 MB which would allow you to save data for approximately 116 days.*

*Touch Return to go back to the prior screen.*

## WELL INFLOW TRENDS SCREEN

The Well Inflow Trend Screen trends the well inflow and well outflow. The timing and operation is similar to the Pump Performance procedures described above.

PUMP SETPOINT SCREENS

Menu	Main	Alarms	Return
<u>Pump Setpoint Screen 1 of 2</u>			
Lead (1 Pump) Start Level (FT)	4.50		
Lead (1 Pump) Stop Level (FT)	2.00		
Lag1 (2 Pumps) Start Level (FT)	6.50		
Lag1 (2 Pumps) Stop Level (FT)	4.00		
			Page 2

Menu	Main	Page 1	Return
<u>Pump Setpoint Screen 2 of 2</u>			
Lag2 (3 Pumps) Start Level (FT)	8.50		
Lag2 (3 Pumps) Stop Level (FT)	6.00		
Pump 1 Max Starts Per Hour for Alarm	6		
Pump 2 Max Starts Per Hour for Alarm	6		
Pump 3 Max Starts Per Hour for Alarm	6		

The **Pump Setpoint Screens** enable the operator to establish setpoints for two pumps through two different screens: Set Up Screen #1 allows you to set the levels for the LEAD, LAG 1 or LAG 2 pumps to START or STOP. Set Up Screen #2 allows you to establish the number of starts per hour that each pump can have BEFORE an alarm is triggered.

*MENU, MAIN, ALARMS or RETURN (go back to prior screen) appear at the top of the screen for easy navigation to other screens.*

CALCULATED FLOW SET UP SCREEN

Menu	Main	Alarms	Return
<u>Calculated Flow Setup Screen</u>			
Select Circular or Rectangular Wet Well			Rectangul
If Circular, enter diameter in Feet			0.00
If Rectangular, enter Length in Feet			8.00
If Rectangular, enter Width in Feet			4.00
Flow Bargraph/ Trend Minimum GPM Scale			0.0
Flow Bargraph/ Trend Maximum GPM Scale			1000.0

The **Calculated Flow Set Up Screen** enables the operator to specify the dimensions of the wet well which affect flow calculations. Enter all dimensions in feet. By entering the Flow Bargraph/Trend MIN and MAX GPM scale, you establish the minimum and maximum values that are displayed. It is suggested that the maximum be set at twice the normal outflow.

*MENU, MAIN, ALARMS or RETURN (go back to prior screen) appear at the top of the screen for easy navigation to other screens.*

TIMER SET UP SCREENS (1 THROUGH 5)

Menu	Main	Alarms	Return
<b>Timer Setup Screen 1 of 5</b>			
Pump 1 time to wait for Run Feedback (Sec)			3
Pump 2 time to wait for Run Feedback (Sec)			3
Pump 3 time to wait for Run Feedback (Sec)			3
Page 2 of 5			

The **Timer Set Up Screen #1** allows the operator to indicate the specific time delay for Run Feedback or Pump Start. Times must be entered in seconds.

*MENU, MAIN, ALARMS or RETURN (go back to prior screen) appear at the top of the screen for easy navigation to other screens.*



Menu	Main	Alarms	Return
<u>Timer Setup Screen 2 of 5</u>			
Lead Start delay after lead start level is reached (Sec)			1
Lag1 Start delay after lag1 start level is reached (Sec)			1
Lag2 Start delay after lag2 start level is reached (Sec)			1
Delay between Lead and Lag1 Calls (Sec)			5
Delay between Lag1 and Lag2 Calls (Sec)			5
Page 3 of 5			

The Timer Set Up Screen #2 allows the operator to specify a minimum time delay between Lead and Lag pump (either LAG 1 or 2) calls. Enter time in seconds.

*MENU, MAIN, ALARMS or RETURN (go back to prior screen) appear at the top of the screen for easy navigation to other screens.*

Menu	Main	Alarms	Return
<u>Timer Setup Screen 3 of 5</u>			
High Level Alarm Delay (Sec)		1	
High Level Alarm Reset Delay (Sec)		1	
Low Level Alarm Delay (Sec)		1	
Low Level Alarm Reset Delay (Sec)		1	
Level Transmitter Low Failure Delay (Sec)		3	
Level Transmitter Low Failure Reset Delay (Sec)		3	
Page 4 of 5			

The **Timer Set Up Screen #3** enables the operator to specify the time delay before triggering Alarms for High and Low Level or Transmitter Low Failure. All times are entered in seconds.

*MENU, MAIN, ALARMS or RETURN (go back to prior screen) appear at the top of the screen for easy navigation to other screens.*

Navigation	Menu	Main	Alarms	Return
<b>Timer Setup Screen 4 of 5</b>				
Pump 1 Seal Fail Alarm Delay (Sec)			1	
Pump 2 Seal Fail Alarm Delay (Sec)			1	
Pump 3 Seal Fail Alarm Delay (Sec)			1	
Page 5 of 5				

The **Timer Set Up Screen #4** allows the operator to specify time delays before triggering the Alarms for Seal Failure or Overtemperature. All times are entered in seconds.

*MENU, MAIN, ALARMS or RETURN (go back to prior screen) appear at the top of the screen for easy navigation to other screens.*

Menu	Main	Alarms	Return
<u>Timer Setup Screen 5 of 5</u>			
Pump 1 Overtemp Alarm Delay (Sec)			1
Pump 2 Overtemp Alarm Delay (Sec)			1
Pump 3 Overtemp Alarm Delay (Sec)			1
Phase Fail Alarm Delay (Sec)			1
Duration for Simulation Auto Cancel (Sec)			30
Page 1			

The Timer Set Up Screen #5 enables the operator to specify time delay for the Phase Fail Alarm and to determine the time allowed for the Simulation Test. All times are entered in seconds.

*MENU, MAIN, ALARMS or RETURN (go back to prior screen) appear at the top of the screen for easy navigation to other screens.*

TIME SET UP SCREENS

Menu Main Alarms Return

**PLC Time Clock Setup Screen 1 of 2**

15:01:35 09/05/07 Panel Time Enter

Note: Panel time updates to PLC time at 1:00 AM each day.  
 Note: You Must enter all 3 values and then press ENTER.

Actual PLC Time		New PLC Entry Values
15	Hour	15
1	Minute	1
33	Second	33

Page 2 of 2

The Time Set Up Screen #1 is designed to allow the operator to communicate with the PLC to specify the time and date. The time must be set in hours, minutes and seconds. Enter the desired values in the blue box and touch the red ENTER button to confirm. You must enter all three values before you press ENTER because the three values are simultaneously written to the PLC. The Panel Real Time Clock (shown in the gray box) will synchronize with the PLC at 1:00 a.m. each day.

*MENU, MAIN, ALARMS or RETURN (go back to prior screen) appear at the top of the screen for easy navigation to other screens.*

Menu Main Page 1 Return

PLC Time Clock Setup Screen 2 of 2

Actual

2007 Year

9 Month

5 Day of Month

Enter

New Entry

2007

9

5

The Time Set Up Screen #2 enables the operator to set the year, month and day. Operation is the same as in Set Up Screen #1.

*MENU, MAIN, ALARMS or RETURN (go back to prior screen) appear at the top of the screen for easy navigation to other screens.*

ALARM SET UP SCREENS

Menu	Main	Alarms	Return
<u>Alarm Setup Screen</u>			
<b>Alarm Point</b>		<b>Reset Point</b>	
9.00	High Level Alarm (FT)	8.80	
1.00	Low Level Alarm (FT)	1.30	
-0.20	Level Xmtr Fail (FT)	0.00	

On the **Alarm Set Up Screen**, you can indicate the desired level setpoints for the following alarm conditions:  
1) HIGH and LOW level alarms 2) Level Transmitter Failure

These setpoints include both the level at which the alarm should be triggered, as well as a reset point.

*Menu, Main and Return buttons appear at the top of this screen for easy navigation to other screens.*

ENGINEER SET UP SCREEN 1

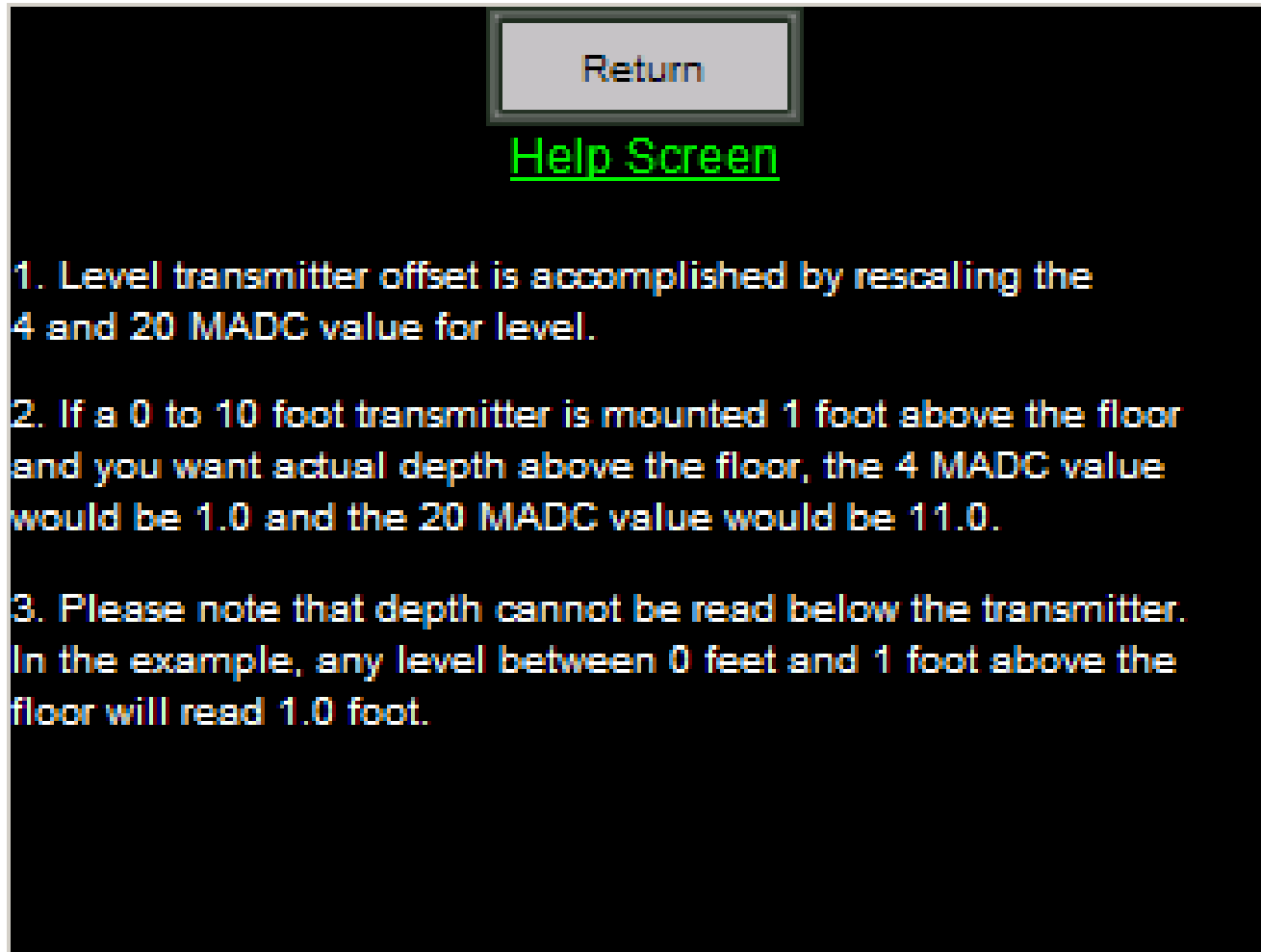
The screenshot displays the 'Engineer Setup Screen' with a black background and green text. At the top, there are four navigation buttons: 'Menu', 'Main', 'Help', and 'Return'. The title 'Engineer Setup Screen' is centered in green. Below the title, there are two rows of text, each followed by a blue input field. The first row is 'Level Transmitter 4 MADC value (FT)' with a value of '0.00'. The second row is 'Level Transmitter 20 MADC value (FT)' with a value of '10.00'.

Parameter	Value
Level Transmitter 4 MADC value (FT)	0.00
Level Transmitter 20 MADC value (FT)	10.00

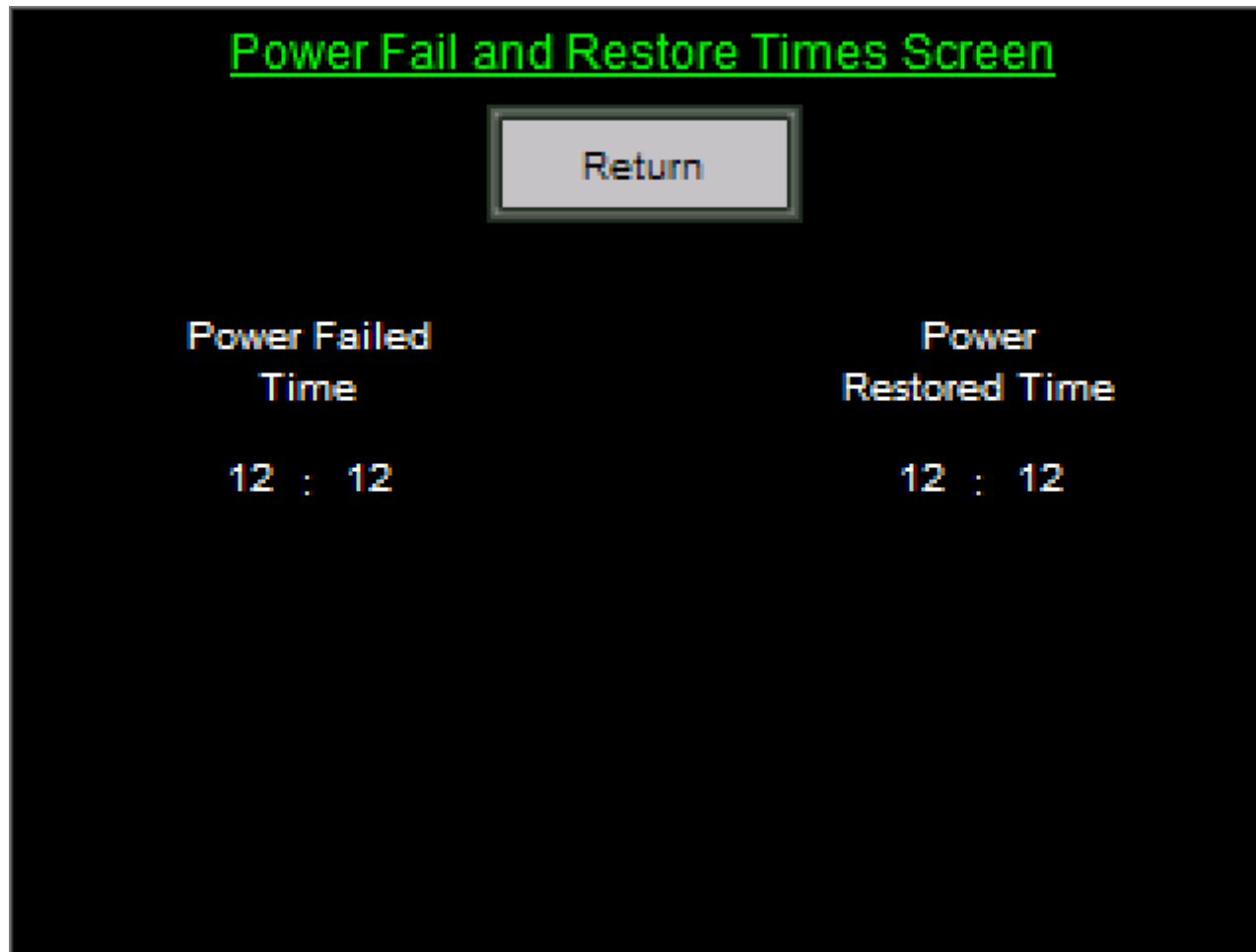
The Engineer Set up Screen is designed to allow entry of transmitter range values. Enter the desired value in feet.

*MENU, MAIN or RETURN (go back to prior screen) appear at the top of the screen for easy navigation to other screens. HELP will take you to the Help Screens.*



ENGINEER HELP SCREEN

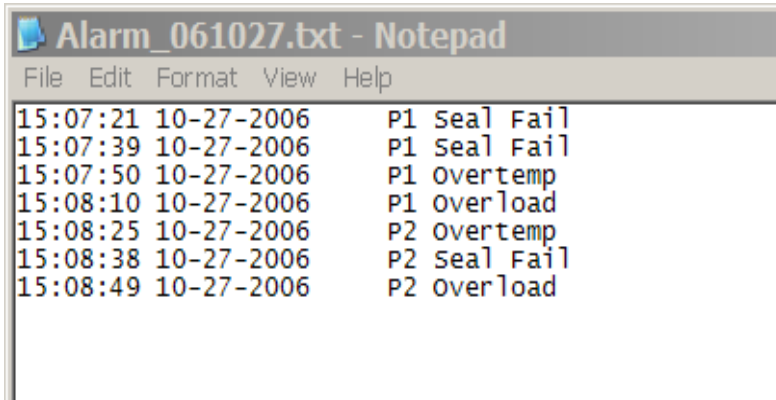
*Touch RETURN to go back to the prior screen.*

POWER FAIL SCREEN

The Power Fail and Restore Times Screen is used in the event of a power failure to be able to determine the time of failure and the time of restoration.

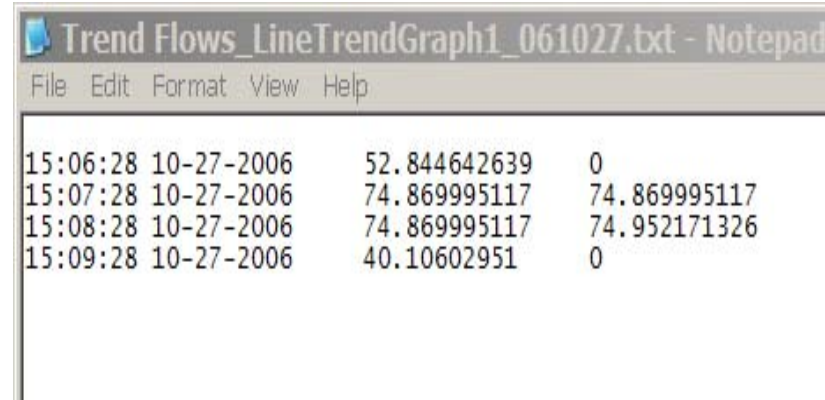
*Touch RETURN to go back to the prior screen.*

## DATA LOGGING SCREENS



Alarm\_061027.txt - Notepad

```
File Edit Format View Help
15:07:21 10-27-2006 P1 Seal Fail
15:07:39 10-27-2006 P1 Seal Fail
15:07:50 10-27-2006 P1 Overtemp
15:08:10 10-27-2006 P1 Overload
15:08:25 10-27-2006 P2 Overtemp
15:08:38 10-27-2006 P2 Seal Fail
15:08:49 10-27-2006 P2 Overload
```



Trend Flows\_LineTrendGraph1\_061027.txt - Notepad

```
File Edit Format View Help
15:06:28 10-27-2006 52.844642639 0
15:07:28 10-27-2006 74.869995117 74.869995117
15:08:28 10-27-2006 74.869995117 74.952171326
15:09:28 10-27-2006 40.10602951 0
```

These Data Logging Screens log two types of data: Alarms and Trends (in Flow). You can use this function to download this data to your computer for your use or record keeping.

## SUMMARY

These unique screens not only provide important operating data but they also make it easy to make changes and customize your system. The LSC - C is designed to make it easier for you to observe the constantly changing conditions of your pump station and head off problems before they become costly failures.

You can also learn more about how your pump station really works. The easy to follow screens make it easy to experiment and try different settings. The simulation feature allows you to create conditions that you might otherwise never see. Consider the LSC - C your own personal training tool and improve both your system's performance and your professional skills.

Please consult the factory if you have additional questions not answered in this Guide. We are confident that you will see a significant improvement in how you operate your system after you have installed and used the LSC - C by EG Controls.

**LSC-C 200 CONSTANT SPEED  
PUMP CONTROL  
SPECIFICATION  
for**

**STANDARD SPECIFICATION**

**Produced by: EG Controls  
11790 Philips Highway  
Jacksonville, FL 32256**

**Date Prepared : June 14, 2007**

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# 1. GENERAL

## 1.1 Scope

This document examines the specifications for a Pump Control System used to control and monitor the performance of constant speed pumps that will be used to control the wet well level at a Pump Station Facility in the USA.

The purpose of this section is to specify a complete Pump Control System as follows:

The control system shall be comprised of a standard off the shelf microprocessor with user friendly developed standard PLC and Graphical software. The controller shall have a bright color display with active text and graphics, and operate with any type of compatible analog level transmitter. The controller shall be 100% digital. Control adjustments shall be accomplished through color soft touch screen graphical entry points (potentiometers or other analog adjustments shall not be acceptable ). The controller shall allow for setpoint changes from the color soft touch screen graphical interface. All of the above shall be accomplished from the microprocessor display without special codes. An integral float backup program, shall be initiated in case of a primary level transmitter failure. Pump alternation sequencing, shall operate in both primary and float back up operation. Pump run times shall be displayed. Both station inflow and outflow, in gallons per minute, shall be calculated and displayed. All operator adjustable setpoints and feature selections shall be accessible through user friendly color soft touch screen graphical displays. All digital outputs from the controller shall be normally open relay contacts rated for 120 VAC. The unit shall meet all the requirements described in the section of this specification labeled " Components "- Pump Controller.

The manufacturer of the system shall take responsibility for the proper operation / sequencing of the total pump control system.

The manufacturer of the system shall take single source, unit responsibility for every component contained within the manufacturer's pump control system.

The system shall be the LSC-C 200 control system as manufactured by EG Controls, Jacksonville, FL or pre-approved equal.

## 1.2 Codes And Standards

Electrical equipment, materials and workmanship shall comply with all applicable codes, safety and fire law regulations at the location of the work and shall conform to applicable codes and standards of the organizations listed below.

- A. Institute of Electrical and Electronic Engineers. (IEEE)
- B. National Electric Code. (NEC)
- C. National Electrical Manufacturers Association (NEMA)



D. American National Standards Institute. (ANSI)

E. Underwriters Laboratories 508. (UL-508)

## **2. OPERATIONAL CHARACTERISTICS**

Operation of the Pump Station Controller shall be as described in the following paragraphs.

### **2.1 Design Data**

The pump control system shall be capable of operating X, XX HP, XX full load amp (FLA), XXXX RPM Pumps in a constant speed mode in order to convey sewage to the next Pump Station without causing a sewage over-flow, regardless of system demands.

The available input power is XXX VAC, 3 phase, X wire, 60 HZ and is supplied from a \_\_\_ KVA, \_\_\_ % impedance transformer with a {Delta} {Wye} {WyEGrounded} {Other} secondary winding configuration.

The pumping system shall be capable of operating in the simplex or duplex mode.

The system controller shall supervise all sequencing, pump combinations, non critical annunciation, system testing, system monitoring and back-up systems, and overall system status and control.

The complete system shall be equal to the LSC-C 200 system as manufactured by EG Controls, Jacksonville, Florida.

#### **A. Sequence Of Operation**

At low wet well levels, the lead pump operates alone and maintains adequate flow. As the wet well level continues to rise and reaches the lag pump start level the lag pump will start and work with the lead pump in gaining control of the wet well. If the wet well continues to rise a high level alarm will be activated.

On decreasing wet well level, the pump sequence will reverse and the pumps will shut off in reverse starting order. As the wet well level decreases and the stop lag pump level is reached the lag pump will be stopped. The lead pump will continue to run until the level decreases sufficiently to reach the stop lead pump level. Once the lead stop pump level has been reached the lead pump will be stopped and the pumps shall alternate.

### **2.2 Primary System Operation**

The system shall be designed to produce an outflow from the wet well, in an efficient manner, to prevent the wet well from overflowing.

## **2.3 Back-Up System and Redundancy:**

### **a) Float Backup System**

Failure of the pump controller transducer will cause the wet well level to rise to the Standby-Float-System on level. The standby float system will lock out all other control and start the pumps as required based on four float switches (1) for high level float, (1) for start lag float pump, (1) for start lead float pump and (1) for stop pumps.

- The pumps shall sequence on in a selected time delay manner.
- The pumps will stop when the wet-well level reaches the "stop" pump float level and the pumps shall then alternate.

### **b) Hand Off Automatic (HOA) Switch for each pump**

## **3. EQUIPMENT DESCRIPTION**

### **3.1 Circuit Breakers**

Circuit breakers shall have a quick make and break operator mechanism.

The handle position shall indicate on, off, or tripped.

A padlock provisions shall be provided to lock the circuit breaker in the Off position.

All motor three phase short circuit protection shall have a minimum rating of 14KAIC .

Breakers shall be as manufactured by EATON.

### **3.2 Motor Control (Starters, Contactors)**

Motor control components shall meet the following criteria:

All contactors shall be NEMA, HP rated and bear a U.L. listed label.

IEC control will not be accepted due to reduced life expectancy

Mechanical and electrical interlocks will be provided whenever two contactors are connected to any electrical component or motor and the possibility exists for equipment damage or personnel injury.

A minimum of 1N.O. and 1N.C. auxiliary contacts shall be provided for each starter or contactor.

Overload heaters must be of the bimetallic type and shall be ambient compensated.

Unit shall be manufactured by EATON Corporation.

### **3.3 Alarm Horn & Beacon**

The panel shall have a red/amber alarm beacon and audible horn. The beacon shall be mounted on top of the panel. The alarm beacon shall be rated 120 VAC, 40/60W, and shall illuminate/flash and the audible alarm shall sound to indicate an alarm condition exists.

### **3.4 Relays**

Relays shall be of the plug-in design and have a transparent, polycarbonate dust cover to protect the contact surfaces from airborne dust and other contaminants. All relays shall have a minimum of 2PDT contacts and a molded nylon coil rated for continuous duty operation on 24 and 120VAC. Relay contacts shall be rated for 10A at 300VAC with .187 quick connect terminals.

Relay sockets shall be of the (.187) eleven (11) blade design and have screw terminals with self-lifting clamps. Terminal identification numbers shall be visible on the sockets

### **3.5 Intrinsic Safe Relay (ISR) for Float Back-Up System**

The ISR shall be UL listed and designed to interface with devices in hazardous locations. The ISR shall operate from 24 DC and accept a minimum of four (4) inputs from a hazardous area.

### **3.6 Seal Failure Relays**

Seal Failure relays providing adjustable resistance sensing circuitry from 0 to 250,000 ohms for each pump shall be supplied. Upon activation, the seal failure relay shall not shut down the pump but shall activate an alarm that shall be displayed on the graphical screen display. The moisture sensing probes shall be supplied and installed in the pumps by the pump manufacturer.

### **3.7 Over Temperature Sensing Relays**

Pump over temperature (manual reset) sensors located in the pump motor shall be supplied for each pump. When activated, the alarm shall be displayed on the graphical screen display.

### **3.8 Dry Contacts**

Form "C" Dry contacts shall be supplied for power failure, high level alarm and float backup enabled conditions.

### **3.9 Phase Monitor Relay**

A three phase monitoring relay shall be connected to the incoming side of the power input terminals. The unit shall annunciate the status of incoming power and monitor loss of phase, phase reversal, under voltage. A special user-friendly adjustment panel allows the operator to make adjustments to phase imbalance, low and high voltage trip points, individually adjustable trip and restart delays and offers a selectable restart setting.

### **3.10 Convenience Receptacle**

A GFCI convenience receptacle shall be provided. The unit shall have polarized blades for two (2) or three (3) wire receptacles. The unit shall require a reset after any ground fault interruption.

### **3.11 Heater with Thermostat**

The control panel shall be equipped with a panel heater to minimize the effects of humidity and condensation. The heater shall include a thermostat.

### **3.12 Control Circuit Transformer**

Nominal control voltage not to exceed 120V.

Control power transformers (CPT) shall be mounted inside the enclosure.

Overcurrent protection shall be supplied on both the line and load sides. Line protection for all step-down transformers shall be provided.

Transformers to be sized for a minimum of 25% extra capacity under full load conditions.

One secondary line shall be grounded for operator safety.

Transformers shall be manufactured by Eaton.

### **3.13 Surge Protection**

Line-to-line and line-to-ground protection shall be provided. This protection shall exceed the requirements of ANSI / IEEE standard C62.1-1984 section 8.6.1. and 8.7.3 by a factor of at least 300%.

Voltage clamping time shall be less than 5 nanoseconds with a maximum surge current of 30,000A RMS at a clamping voltage 552VAC.

Clamping voltage levels shall be specifically sized for the applied system voltage as well as the winding and grounding configuration of the supply transformer. These voltage levels will be chosen to assure minimizing system voltage excursion.

One surge arrester shall be supplied at the incoming service to the control panel.

### **3.14 Pump Controller**

1. The pump controller shall utilize a microprocessor with a graphical screen display to program and alternate up to two (2) pumps in a constant speed mode with high level alarm. All operator adjustable setpoints and features shall be accessible from the face of the microprocessor through the use of user friendly graphical screen displays.
2. Accurate measurement of the liquid level in the sump shall be made by a compatible analog level transmitter. The transmitter range shall be entered through the graphical screen display.

3. The controller shall automatically alternate up to two (2) pumps in the automatic operation mode. The alternation scheme shall include the capability of selecting either pump 1 or 2 in the lead position without alternation.
4. A lag pump start time delay shall be provided to prevent simultaneous pump starts on power up or the restoring of power after a power outage. The lag pump time delay shall be adjustable from a graphical screen display.
5. The controller shall be capable of calculating both input and output flows and shall dynamically display both flows in gallons per minute(GPM). Inflow and outflow shall be calculated at 15 second intervals.
6. The controller shall display the run time hours for both pumps 1 & 2. The timers shall be re-settable, if desired, from the graphical display screen.
7. The controller shall allow for the entry of wet well geometry, through the graphical display screen, for use in the controller's flow calculations.
8. Dry contact outputs for power loss, high level and float enabled alarms shall be supplied with the controller.
9. The following standard alarm conditions shall be provided on the graphical screen display covered more fully in section: 3.15 of this specification.
  - 1) Main Screen Text Alarm Alert
  - 2) Pump 1 Start Fail
  - 3) Pump 2 Start Fail
  - 4) Pump 1 Seal Fail
  - 5) Pump 2 Seal Fail
  - 6) Pump 1 Overtemp
  - 7) Pump 2 Overtemp
  - 8) High Level Alarm
  - 9) Float Backup Enabled
10. The controller shall be the LSC-C 200 as manufactured by EG Controls of Jacksonville Florida.

### **3.15 Graphical Operational Screens**

The controller, color soft touch Graphical Interface, shall contain the following screens:

#### **3.15.1 Menu Screen:**

The Menu Screen shall be comprised of informational and operating screens and Set Up and data entry screens. The menu buttons on the screen shall be clearly

defined an easy to locate. Touching the selected buttons shall call up the selected screen for display.

### **3.15.2 Main Screen:**

The Main Screen shall provide an overview of the pump control systems operational status by graphically depicting the wet well level with wet well transmitter range, lead and lag pump status and configuration, lead and lag pump start and stop setpoints, calculated inflow and outflow bargraphs, alarms present indication and other digital readouts and display buttons as required to present a clear view of the pump stations operational status.

### **3.15.3 Pump Status Screens:**

The Pump Status Screen shall be designed to give you an up-to-date status of each pump in your pump control system. Each pump status screen shall use icons, vertical and horizontal bargraphs, digital readouts and display buttons to provide wet well level, wet well transmitter range, HOA status, pump configuration, pump run status, pump status, fail reset button, pump lock out button, alarm text, pump run hours, total pump starts, pump starts per hour, pump hours reset pushbutton, pump starts reset pushbutton and station outflow in GPM. In an alarmed condition the pump status screen shall depict, through the use of pop up windows, five alarm conditions, start fail alarm, seal fail alarm, overtemp alarm, overload alarm and excessive pump starts per hour alarm.

### **3.15.4 Pump Alternation Set Up Screen:**

The Pump Alternation Set Up Screen shall allow for automatic alternation selection or manual line up selection. If manual line up selection is selected lead pump selection shall be available and shall be selectable from the alternation screen. Selection for Last On First Off (LOFO) or First On First Off (FOFO) shall be provided and shall be selectable from the screen. If automatic alternation is selected alternate at pumps off, alternate at specific time of day allow for a minimum of two times, alternate every X number of hours shall all be selectable from the alternation screen.

### **3.15.5 Help Screen**

Help Screens shall be selectively provided through out the graphical interface to assist the operators in properly utilizing a particular operational screen.

### **3.15.6 Test Screen**

A system test screen that provides wet well level simulation for the testing of the pumps and system alarms shall be provided. The system test screen shall display and update the simulated wet well level, the actual wet well level, pump line up, pump run status, pump configuration, station inflow and station outflow and all alarm conditions.

### **3.15.7 Alarm History Screens**

An alarm history screen shall be provided. The alarm history screen shall record and display the alarm entry number, the alarm identification number, alarm message and alarm confirmation. The screen shall display the last eight (8) recorded alarms.

### **3.15.8 Seal Fail Enable Screen**

A Seal Fail Enable Screen shall be provided. The seal fail enable screen shall allow for the enabling or the disabling of the seal fail alarm for the station pumps. The enable selection shall cause an alarm to occur and the pumps to be stopped when a seal fail occurs. The disable selection shall cause an alarm to occur, but the pumps shall continue to run.

### **3.15.9 Trend Screens**

A Trend Screen shall be provided. The trend screen shall be comprised of two (2) real time trend screens. Each trend screen shall represent a 60 minute time segment. The screens shall be as follows:

1. Pump Performance Trend Screen

The pump performance trend screen shall provide for the comparison and evaluation of a station pump's individual performance. When the trend is initiated it shall display the calculated pump discharge flow for the pump that is currently running. Only one pump shall be allowed to trend at any given time. Individual pump performance trends shall be retrievable up to a 30 day period.

2. Wet Well Trend Screen

The wet well trend screen shall provide for the comparison and evaluation of a station's overall performance. The wet well trend screen shall trend the wet well inflow and the wet well outflow. The timing and operation of the screen shall be the same as the pump performance screen.

### **3.15.10 Pump Set Up Screens**

A Pump Set Up Screen shall be provided. The pump Set Up screen shall allow for the establishment of operator setpoints for the pumps start level, stop level and maximum starts per hour that each pump may have before an alarm is activated. The setpoints entry shall be accomplished directly from the pump Set Up screen.

### **3.15.11 Flow Set Up Screen**

A Flow Set Up Screen shall be provided. The flow Set Up screen shall allow the operator to select the configuration of the wet well and specify the dimensions of the wet well appropriate for the chosen configuration. The information shall be utilized as a part of the flow algorithm used to calculate the station's flow.

A flow bargraph trend minimum setpoint and a flow bargraph trend maximum setpoint, shall be provided on the screen These setpoints shall establish the minimum and maximum flow values that shall be displayed.

### **3.15.12 Timer Set Up Screen**

A Timer Set Up Screen shall be provided. The timer Set Up screen shall at a minimum provide for the following timer adjustments from the Set Up screen:

1. Pump #1 time to wait for run feedback in seconds
2. Pump #2 time to wait for run feedback in seconds
3. Lead pump start delay after lead start level is reached in seconds
4. Lag pump start delay after lag start level is reached in seconds
5. Delay between lead and lag pumps called to run in seconds
6. High level alarm delay in seconds
7. High level alarm reset delay in seconds
8. Low level alarm delay in seconds
9. Low level alarm reset delay in seconds
10. Level transmitter failure delay in seconds
11. Level transmitter failure reset delay in seconds
12. Pump #1 seal fail alarm delay in seconds
13. Pump #2 seal fail alarm delay in seconds
14. Pump #1 overtemp alarm delay in seconds
15. Pump #2 overtemp alarm delay in seconds
16. Phase fail alarm delay in seconds
17. Simulation auto cancel time duration in seconds

### **3.15.13 PLC Time Set Up Screens**

A PLC Time Set Up Screen shall be provided. The PLC time Set Up screen shall allow the operator to specify the the time and date and communicate the information to the PLC. The time shall be provided in hours, minutes and seconds and shall be entered through appropriate box's that shall be provided on the screen. All three values shall be required to be entered into the PLC. The date shall be provide in year, month and day of the month and shall be entered through appropriate box's that shall be provided on the screen. All three values shall be required to be entered into the PLC.

### **3.15.14 Alarm Set Up Screen**

An Alarm Set Up Screen shall be provided. The alarm Set Up screen shall provide for the setting of the level setpoints for the following conditions:

1. High level alarm in feet
2. Low level alarm in feet
3. Level transmitter failure

Entry box's shall be provided on the screen for the alarm setpoint and for the alarm re-setpoint.



### **3.15.15 Engineer Set Up Screen**

An Engineering Set Up Screen shall be provided. The Engineering Set Up screen shall provide for the scaling in engineering units of the level transmitter. Entry box's shall be provided on the screen for the level transmitter's low and high range parameters.

### **3.15.16 Screen Set Up Screen**

An Screen Set Up Screen shall be provided. The screen Set Up screen shall allow for the contrast adjustment of the graphical interface screen to insure maximum viewability.

### **3.15.17 Power Fail And Restore Screen**

A Power fail and Restore Screen shall be provided. The power fail and restore screen shall display the time power failed and the time power was restored during a power outage.

## **3.16 Pump Controller**

A Programmable Logic Controller with the required memory and functional capacity to perform the specified sequence of operation with the scheduled input and output points required in this specification shall be provided.

### **3.16.1 Hardware Ratings**

The hardware ratings shall be as follows

- A. Operating Temperature of range of 0 degrees to +55 degrees C
- B. Storage Temperature range of minus 40 degrees to +85 degrees C
- C. Humidity range of 5 to 95% relative humidity, non-condensing
- D. Noise Immunity in compliance to NEMA Standard ICS 2-230
- E. Operation Vibration Rating of 5.0 G at 10 to 500 Hz, 0.030 inch peak-to-peak Relay operation 2 G.
- F. Input group to backplane isolation and input group to input group isolation: 151 V ac for one second or 2145 V dc for one second
- G. Output group to backplane isolation or output group to output group isolation: 1836 V ac for one second or 2596 V dc for one second.

### **3.16.2 System Configuration:**

The Processor System shall include a processor, base unit / power supply, random access erasable-programmable read only memory, input/output modules and communication modules.

- A. System Ratings shall be as follows:
  - 1. Input / Output Capacity capable of supporting up to 128 I/O points (8 I/O modules maximum)
  - 2. Scan Rate of 1.0 milliseconds per 1K ladder logic program consisting of simple ladder logic and communication servicing.
  - 3. Programming Instructions: 89
  - 4. Bit Execution Time (XIC) of .9 microsecond
- B. Programming Language shall be Ladder Logic
- C. Minimum Programming Instruction Set shall be as follows:
  - 1. Language Characteristics: Ladder diagram
  - 2. Logic Operations: AND, OR, XOR, NOT
  - 3. Register Operations: Store, recall
  - 4. Math Operations: Addition, subtraction, multiplication, division, square root, matrix operations
  - 5. Process Control: Proportional-Integral-Derivative

### **3.16.3 System Processor**

- 1. Process Memory shall be as follows:
  - a. Program memory of 14K Words.
  - b. Data Logging memory of 48Kbytes and independent of Program memory.
- 2. Processor Performance shall be as follows:
  - a. Capability of controlling up to (16) I/O Modules
  - b. Typical Throughput Time of 1.0 k/ms program consisting of simple ladder logic and communications servicing.
  - c. Bit Execution Time of less than 0.9 microseconds
  - d. Proportional Integral Derivative Control with a 252 microsecond execution time
  - e. Offline programming and editing.
- 3. Processor Features shall be as follows:
  - a. Standard RAM Memory Back-up provided through minimum two year lithium battery.
  - b. LED indicators for: POWER, RUN, CPU Fault, Forced I/O, Battery Low, Comms
  - c. Separate RS-232 channel that supports RS-232 DF1 full-duplex or DF1 half-duplex slave, DH-485, Modbus RTU Slave and ASCII protocols
  - d. Real Time Clock through combination Real Time Clock and Memory Module
  - e. Mode Switch Positions for Remote, Program and Run
  - f. Two analog trim potentiometers built into the controller.

### **3.16.4 Base Feature**

1. Base Features shall be as follows:
  - a. Power Supply
    - i. Line voltage of 85-265VAC
    - ii. Maximum inrush of 25A for 8ms
  - b. (12) inputs rated 120VAC
  - c. (12) relay outputs
  - d. Separate RS-232 channel that supports RS-232 DF1 full-duplex or DF1 half-duplex slave, DH-485, Modbus RTU Slave and ASCII protocols

### **3.16.5 Discrete Input Modules (Non-Isolated)**

1. Features shall be as follows:
  - a. Operating voltage of 79 to 132V AC
  - b. (16) Non-isolated Inputs
  - c. Removable terminal block
  - d. Terminal identification diagram one each module
  - e. Terminal blocks to have barriers on 3 sides
  - f. LEDs to indicate the status of each I/O point
  - g. Optical isolation between digital and field circuits
  - h. Wiring terminals with self-lifting pressure plates to secure two #14 AWG wires
  - i. No tools shall be required to install or remove modules. Modules shall have upper and lower panel mounting tabs as well as latches for DIN rail mounting.

### **3.16.6 Analog Input Modules**

1. Features shall be as follows
  - a. (4) input channels per module
  - b. Ratings
    - i. Current Rating of 0 to 20mA, 4 to 20mA
    - ii. Voltage Rating of Plus/Minus 10Vdc, 0 to 10Vdc,
  - c. Input Impedance
    - i. Current terminal 250 Ohms
    - ii. Voltage terminal 220K Ohms
  - d. Resolution of 14 bits unipolar; 14 bits plus sign bipolar with 50/60 Hz filter selected.
  - e. Overall Accuracy
    - i. Current Terminal Rating of Plus or Minus 0.35 percent full scale at 25 degrees C
    - ii. Voltage Terminal Rating of Plus or Minus 0.2 percent full scale at 25 degrees C
  - f. Non-linearity of plus or minus 0.03 percent of full scale
  - g. Repeatability of plus or minus 0.03 percent
  - h. Input channel configuration via configuration software screen or the user program
  - i. Input Group to Bus Isolation of 500VAC for (1) minute

- j. Removable terminal block
- k. Terminal identification diagram one each module
- l. Terminal blocks to have barriers on 3 sides
- m. LEDs to indicate the status of each I/O point
- n. Wiring terminals with self-limiting pressure plates to secure two number 14 AWG wires
- o. No tools shall be required to install or remove modules. Modules shall have upper and lower panel mounting tabs as well as latches for DIN rail mounting.

### **3.16.7 Relay Output Modules (Non-Isolated)**

1. Features shall be as follows:
  - a. Voltage rating of 5 to 265 V as at 63 Hz
  - b. (8) Relay outputs
  - c. Continuous current rating per point: 2.5 A ac not to exceed 1440 VA for the module Make: 7.5A, Break: 0.75 A @240V ac Make: 15 A, Break 1.5 A @120V ac
  - d. Continuous current rating per module: 16 A ac, 8.0A / common
  - e. Removable terminal block
  - f. Terminal identification diagram on each module
  - g. Terminal blocks to have barriers on 3 sides
  - h. LEDs to indicate the status of each I/O point
  - i. Optical isolation between digital and field circuits
  - j. Wiring terminals with self-lifting pressure plates to secure two number 14 AWG wires
  - k. No tools shall be required to install or remove modules. Modules shall have upper and lower panel mounting tabs as well as latches for DIN rail mounting.

### **3.16.8 Communication Interfaces**

1. RS-232 Network
  - a. Provide and configure a modem through the RS-232 port on the processor to handle SCADA communications.
  - b. Support baud rates between 300 and 38.4k
  - c. Support RTS/CTS/DCD hardware handshake signals
  - d. Provide dial-out capability.

The PLC shall be the MicroLogix 1500 as manufactured by Allen Bradley or approved equal.

The operator interface unit shall be compatible with Allen Bradley MicroLogix 1500 PLC. The system supplier shall submit for approval system graphics depicting the operator access screens for monitoring and control of the Lift Stations as defined herein.

### **3.17 Data Logging**

The control system shall perform two (2) data logging functions.

1. wet well inflow shall be data logged at one minute intervals. Each value shall be time /date stamped and be in delimited format for direct import into Microsoft Excel, Microsoft NotePad, WordPad and Word. Storage duration shall be for a minimum of 226 days.
2. All alarm logging shall be to an alarm file. Each alarm shall have plain text descriptors, time/date stamps, and be in delimited format for direct import into Microsoft Excel, Microsoft NotePad, WordPad and Word. Storage duration shall be for a minimum of 226 days.

Data shall be stored on a 128 MB flash drive. The flash drive shall be removable for direct transfer to a PC via a USB port.

### **3.18 Primary Level Sensor**

The Submersible Pressure Transducer shall be specifically designed to meet rigorous environments encountered in level measurement applications. It shall provide repeatable, precision depth measurements under the most adverse conditions.

This transducer shall incorporate an isolated diaphragm sensor which is specifically designed for use with hostile fluids and gasses. The sensor will utilize a silicon pressure cell that has been fitted into a stainless steel housing with an integral, compliant stainless steel barrier diaphragm. The sensor assembly shall be housed in a rugged 316 SS case that provides for a variety of pressure inputs as well as electrical output connections.

It shall have a static accuracy of +/- 1% FSO BFSI:

Construction shall be Welded 316 SS construction.

It shall be Datalogger compatible.

The transducer will be fully temperature compensated.

The Submersible Pressure Transducer shall be manufactured by Keller PSI.

### **3.19 Back Up Level Sensor**

#### **A. Float Sensor**

The backup float sensor shall have the following physical characteristics:

- All time delays and other components inherent in this system shall be incorporated within the pump controller.
- The system shall require 4 floats (to be supplied and installed by the Contractor at wet-well levels as determined by the Consulting Engineer).
- The float system shall be powered by 24 VDC.
- Manual reset from float to analog transmitter shall be accomplished through the graphical screen display.

## 3.20 Enclosure

The graphical screen display and HOA switches shall be mounted on the inner door of the enclosure.

The (maximum) size of the enclosure shall be (XXH x XXW x XXD). The enclosure shall be NEMA type 12 with drip shield which is designed to house electrical and electronic equipment. The enclosure shall be of the type for use outdoors to protect the enclosed equipment against falling rain and the formation of ice on the enclosure.

The material used for construction shall be cold roll steel, with a minimum thickness of 14 gage. All seams shall be continuously welded and the welds will be ground to present an attractive appearance. Body stiffeners shall be welded into the enclosure to further insure a rigid construction. The integrity of the door seal shall be assured by using an oil-resistant gasket, bonded to the inside of the doors with an oil-resistant adhesive, and held in place by steel retaining strips. The door seal shall be made complete by using a three point latching mechanism, operated by an oil-tight, key-locking handle.

The Enclosure shall be supplied with a painted cold rolled steel floor stand kit.

Enclosure shall be as manufactured by Hoffman Enclosures or approved equal.

## **4. QUALITY ASSURANCE**

### **4.1 Manufacturer's Experience**

The manufacturer of the control system shall be certified by Underwriters Laboratories (UL) as being a UL 508 listed systems panel manufacture certified to install a serialized label for quality control and insurance liability considerations.

The manufacturer of the control system must submit documentation verifying at least 10 years of experience in manufacturing constant speed control systems of a similar size and scope.

The manufacturer of the control system must submit to the Consulting Engineer documentation proving experience in successfully designing and manufacturing at least 10 similar systems of a similar scope.

The manufacturer of the control system must carry blanket liability insurance of at least \$2 million.

### **4.2 Manufacturer's Quality Control**

The complete control system, shall be functionally tested at the manufacturers facility and certified as a complete system to assure proper operation per specification in order to minimize costly field changes.

All components must be mounted with stainless steel hardware.

### **4.3 Manufacturer's Approval**

Manufacturers listed in this specification do not constitute approval. All controls must have the capabilities and functions as outlined in the following paragraphs.

### **4.4 UL Approvals**

All components that make up the system shall meet UL (Underwriters Laboratories) standards and bear a UL label. The system enclosure shall also bear the UL label certifying that the system meets all UL requirements.

## 5. SUBMITTAL REQUIREMENTS

**NOTE: Non adherence to the request for information below, shall be cause for the submittals to be disapproved.**

### 5.1 Base-Bid Approval

The base bid control system shall be the **LSC-C 200** system as manufactured by EG Controls, Jacksonville, Florida. All bidding contractors shall base their bids on the base bid control system. Alternative deductive systems will be considered only after contract award and must be specified with any applicable deducts at bid time in order to receive consideration. Bidder must submit along with his bid package appropriate cut sheets, circuit drawings, display screen print-outs, and detailed bill of materials for any alternative control systems. Acceptance of an alternative system is subject to approval of its quality and conformance with established standards. The contractor shall reimburse the engineer for any additional expenses to review the system and pay additional costs associated with use of the alternative system.

### 5.2 Substitutions

The Engineer will consider proposals for substitution of materials, equipment, methods, and services only when such proposals are accompanied by full and complete technical data and all other information required by the Engineer for the proposed substitution.

Substitution of materials, equipment, methods, and/or services is not allowed unless such substitution has been specifically approved by the Engineer.

Where the phrase "Or Equal", "Pre-approved", or "Pre-approved equal" occurs in the specification, do not assume that any materials, equipment, methods, or services will be approved as equal unless the item has been specifically pre-approved by the Engineer.

### 5.3 Shop Drawings

All drawings are to be of "computer generated" class, 8<sup>1</sup>/<sub>2</sub>" X 11" in size, and bound.

All equipment and materials shall be new and shall be specifically designed for the function herein.

Approval for fabrication and installation will be made only after submittal and review of all shop Contract Documents. The minimum information required for approval shall include eight (8) sets of the following.

Computer generated, 3-line electrical diagram of the power and control system.

Complete electrical schematics detailing every wire and connection within the system as well as all field connections.



Bill of material and product data sheets on all high voltage components (>120VAC), drives, switches, and other critical/important components.

Detailed drawings of the enclosure (size, construction, entry/ exit, and mounting).

Exploded detail of every face plate, light, switch or meter mounted on the exterior of the enclosure.

## **5.4 Record Documents**

The following documents shall be provided:

"AS-BUILT" DRAWINGS: 8 sets of "Shop Drawings" are to be supplied and marked in colored ink as depicting "As-built" conditions. These are to include any field modifications made by the authorized start-up personnel during installation, start-up, or testing.

Original copy of the final Q.C. report.

Operation and Maintenance Manuals: the control system manufacturer shall supply a complete and detailed operation and maintenance manual prepared for this system.

## **6. WARRANTIES**

***NOTE: All guarantees implied or stated by the control system manufacturer shall be passed in full force to the owner. The manufacturer of the control system shall warrant all components in the system for unit responsibility purposes.***

### **6.1 Components**

As a minimum, all components in the specified control system shall carry a comprehensive, parts only, twelve (12) month guarantee against defects in workmanship and material from the date of final inspection and acceptance, not to exceed 18 months from the date of shipment from the manufacturer's facility.

## **7. EQUIPMENT IDENTIFICATION**

All electrical equipment shall be identified in accordance with these specifications.

All identification labels, both within the enclosure and external, shall be laser-screened laminated mylar.

All control wiring shall be numbered on each termination.

Screw-in type, engraved nameplates or laser-screened laminated mylar shall be provided to identify all individually mounted push buttons, rocker switches, lights, meters, disconnect switches, circuit breakers, motor starters, transformers, relays, fuses, phase monitors, surge arrestors, and any other equipment for which identification is required for eventual service or replacement. This includes the appropriate equipment within the cabinet. Embossed tape is not acceptable.

## **8. EXECUTION**

### **8.1 Field Installation And Start-Up**

#### **8.1.1 THE CONTRACTOR**

The Contractor shall include in his bid the services of a trained representative for whatever period of time, assuming 1 trip, is required to inspect, start-up, test the control system, and instruct plant personnel in the proper maintenance and operation of such equipment.

#### **8.1.2 THE OWNER**

The owner of this equipment shall supply any personnel to assist the start-up crew which are required to oversee or perform actual work if so required by labor/credit contracts. This cost shall be born by the Contractor.

#### **8.1.3 THE MANUFACTURER**

Prior to final approval, the manufacturer shall submit a letter certifying that the installation has been tested, and functions as per the plans and specifications.