INSTRUCTION MANUAL

19-001-350R2

THIS MANUAL IS FOR TECHNICIAN USE ONLY

PACE™ Integrated Pump Controller

Human Machine Interface (HMI) for the Silent Storm VFD Pumping System

TECHNICIAN GUIDE

FLOWTRONEX

a xylem brand

Acknowledgements

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NOTE: The information contained in this book is intended to assist operating personnel by providing information about the characteristics of the purchased equipment. It does not relieve the user of their responsibility of using accepted engineering practices in the installation, operation, and maintenance of this equipment.

For additional questions, contact:
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WARRANTY INFORMATION

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THIS WARRANTY IS EXPRESSLY IN LIEU OF ALL OTHER WARRANTIES, INCLUDING BUT NOT LIMITED TO IMPLIED WARRANTIES OF MECHANTABILITY AND FITNESS, AND CONSTITUTES THE ONLY WARRANTY OF COMPANY WITH RESPECT TO THE PRODUCT(S).

If within one year from date of initial operation, but nor more than eighteen months from date of shipment by Company of any item of product(s), Purchaser discovers that such item was not as warranted above and promptly notifies Company in writing thereof, Company shall remedy such non-conformance by, at Company affected part of the product(s). Purchaser shall assume all responsibility and expense for removal, reinstallation, and freight in connection with the foregoing remedies. The same obligations and conditions shall extend to replacement parts furnished by Company hereunder. Company shall have the right of disposal of parts replaced by it.

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Introduction

This manual is written for Flownet Technicians and is an introduction to the Flowtronex PACE HMI (Human Machine Interface). The HMI is a browser-based system which allows the user to interact with the settings and reports of the pumping system. This manual only covers the HMI aspect of the system. Please see the Silent Storm VFD Pumping System Instruction Manual for any questions not related to the HMI.

This manual assumes that the reader has used and understands basic Internet browser operation and has used a Microsoft© Windows Operating System GUI (Graphical User Interface), such as Windows 2000©, Windows NT©, Windows ME©, or Windows XP©. This device uses Windows CE-as an operating system (OS). Windows CE© is a component-based version of the Windows operating system designed for embedded devices, such as PDAs or touch-panel displays.

This manual also assumes the user has some basic knowledge of pumps and pumping systems.

Note: Button names are shown enclosed in square brackets, such as [Button], whenever the actual key or button graphic is not displayed.

The interface is displayed at the pumping station on the HMI. Users make selections of the options and enter data using a stylus or hands, and tapping directly on the HMI's color, touch-screen panel.

CAUTION: Equipment Damage Hazard

Only use a stylus or clean hands on the HMI touch-panel device to access screens and enter data. Use of any other tool, sharp object, or contact with dirt or chemicals can cause damage to the screen.

Failure to follow these instructions indicates a potentially hazardous situation, which, if not avoided, may result in equipment damage and void any warranty.

CAUTION: Equipment Damage Hazard

To Clean the equipment:

Disconnect the equipment from any AC outlet, use a clean damp cloth. Do not use liquid or spray detergents for cleaning.

Failure to follow these instructions indicates a potentially hazardous situation, which, if not avoided, may result in equipment damage and void any warranty.

HMI Overview

The Flowtronex PACE is a modular and scalable architecture that is used by the HMI (Human Machine Interface) to control a station's pumps. It also handles a variety of changing conditions using a touch panel display including normal operation, operation with a variety of auxiliary equipment including lake fill controls, boosters, filtration, and/or fertilization injection (fertigation) equipment, and operation with timed water features.

A web-based version of the application is operational on the HMI and permits the user to supervise the pumping station's operation remotely at any time from any internet-accessible computer. The web-based screens are identical to the screens viewed on the HMI. Web Reports can also be viewed and printed by users who access the HMI interface via the internet.

Data and information is exchanged with the pumping station's master controller, also called a Programmable Logic Controller (PLC), located physically in the NEMA 4 enclosure. The communication exchanges are made over Ethernet. A primary PLC is responsible for the real-time control of the main pumps, while additional PLC(s) are used to control auxiliary items. The HMI provides a graphical user interface (GUI) which permits the pumping station to be monitored, and allows the controls or variables to be changed when necessary. All monitoring and control information can be sent to the pumping station remotely over the Internet using the web-based version. This basic communication between the remote user, the HMI, and the pumping station is illustrated below.

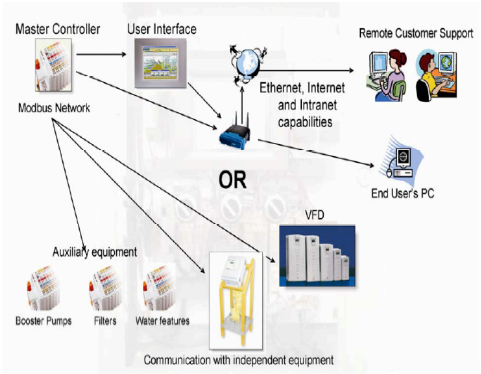


Figure 1: Basic Operation

TYPICAL PUMPING OPERATION

Several common control variables including flow, pressure, and level are used for operating an automatic pumping system. Pump starts and stops are based on the changes in these control variables. A VFD (Variable Frequency Drive) is used to regulate the speed of the lead pump, replacing the function of a control valve. Pressure recovery can be made smoothly, resulting in power and cost savings.

When pressure is used as the key process variable, the VFD pumping system constantly monitors pressure to maintain the required demand. Pump starts and stops are based on the changes in the system pressure. For example, a pumping system with one Pressure Maintenance (PM) pump and two interchangeable main pumps may be grouped into several different combos (combination of pumps) that start or stop a specific pump, or a sequence of pumps, according to defined setpoints.

Each combo has an individual start pressure that references a setpoint pressure and a start delay time. At very low demand, the PM pump maintains the setpoint pressure. Once the demand becomes greater than the PM pump can handle, the first combo is activated. The lead pump in this combo is controlled by the VFD. As demand increases, additional lag pumps are added, or a different combination of pumps is activated.

Other configurations are also possible. Consult your Flownet Technician for proper operation of your system.

Touch-Screen Panel Operation

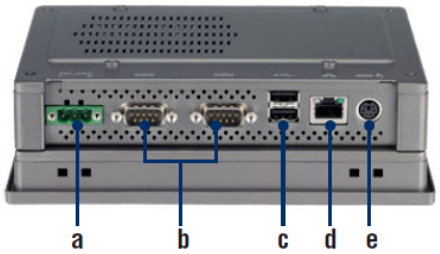
This Flowtronex® Pace HMI device manual describes the operation of the touch-panel display, located on the enclosure door of the control unit of the pumping station.

- Use a stylus to tap the buttons or fields when using the touch-screen panel.
- Use the Enhanced Key Pad to enter text or numbers in blank fields. Tap and hold the stylus in a blank field to open the Enhanced Key Pad pop up screen.
- A USB Keyboard may also be used instead of the Enhanced Key Pad. Plug in the USB Keyboard into the back of the display.
-

Danger: Electric Shock Hazard

Disconnect power before opening any electrical enclosure. Any procedure requiring opening an electrical enclosure must be performed by qualified personnel only.

Failure to follow this guideline could result in injury or death.



a. Power Receptor
b. COM (RS-232)
c. USB 2.0
d. LAN (10/100/1000)
e. PS/2

Figure 2: Connection for USB Keyboard (c).

ENHANCED KEY PAD

Tap and hold the stylus in an editable field (indicated by a white background) to open the Enhanced Key Pad.

To use an Enhanced Keypad:

- To clear an entry, tap ⬅ to backspace over entry.
- To close key pad without saving entries, tap the red ✖ on the key pad.
- To switch between various alphabetic and numeric key pads, tap -> or <-
- To submit an entry tap ✔

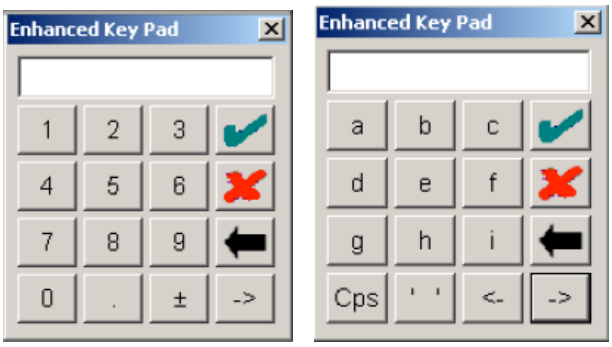


Figure 3: Enhanced Key Pad

Basic Screen Layout

The application uses a three-part structure for all screens:

1. **The Navigation Bar**, located on the far left of the screen, displays buttons to tap which will navigate to other key areas of the application. The content of the navigation bar changes depending on what type of user is logged in.

2. **The Header**, located at the top center of the screen, displays the screen name in the banner, and (depending on the buttons selected on the right) the date and time, or the pumping station's current flow and pressure readings.

NOTE: A flashing header is indicative of a system fault.

3. **The Main Window**, located in the center of the screen, displays one or more panes of information about the pumping station. A grayed-out field in this window is read-only. Other fields (with a few exceptions) may be edited.

Figure 4: Basic Screen Layout

User Types

There are different types of users recognized by the system:

Guest: Only operation screens are accessible in view-only mode. Users are logged in as a Guest by default.

Supervisor: End-User configurable setup and operation screens are accessible. Supervisors must log-in using a password.

Technician: All setup and operation screens are accessible. Technicians must log-in using a password. See the Technician Guide for additional functions.

Note: Some values require you to set the "Enable Edit" checkbox before you can change the values. This is a precautionary measure intended to prevent unwanted and accidental register value writes. These values are available to technicians only. Values normally accessed at the Supervisor level or lower are not affected.

Touch Panel Log In

Tap [Log In] from the Home Screen.

The screen displays the current user type at the top of the screen.

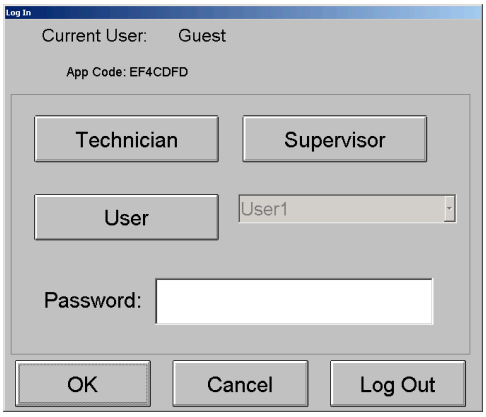


Figure 5: Log in Screen

Default user is a Guest user. No log in is required.

To log in as a Technician, tap [Technician], and then tap on the empty Password field to enter the Technician password. Tap [OK] to log in or [Cancel] to exit without logging in.

To obtain a Technician password, call Flowtronex customer service and give them the APP code displayed on the screen. Customer Service will then give you a password corresponding to that APP code which will remain active until the last day of the current month.

After a password has expired, a new APP code must be generated allowing you to get a new password. See Security Setup for information on how to generate an APP code.

NOTE: The web-based screens require an immediate log-in as either a guest (no username or password required), a Supervisor (username and password are required) or a Technician (username and password are required). The log-in screen will be displayed first on the web-based application only.

Operation Menu

Tap [Operation] from the Home screen.

The Operation Menu allows you to view the pumping station's operational trends (System View), flow totals, pump and auxiliary equipment status, alarms, events, lockouts, and power consumption (KW Data).

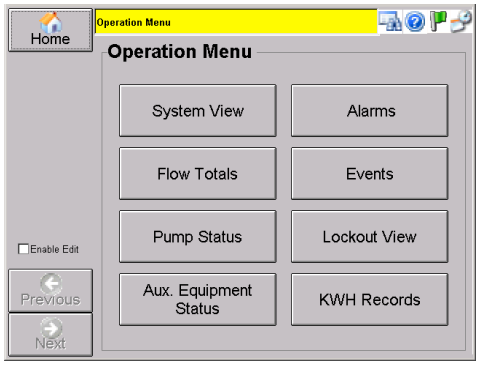


Figure 6: Operation Menu

SYSTEM VIEW & TRENDS

Tap [System View] from the Operation menu.

System View accesses color-coded operational trends or historical data for several system variables such as flow, pressure, speed, and setpoint.

Figure 7: Trends Screen

In the System View screen, a supervisor can change the setpoint using the User SP field.

You can turn on and off logged channels on the viewer by tapping the value at the bottom of the screen.

Power readings may not be available on all systems. Also on some systems a power reading of 0 will cause the Power display to disappear, and will reappear when power readings return.

Demand is a function specific to interaction with Lynx irrigation control systems and will only display when this data is available from Lynx.

Configure Period Screen

Tap  from the System View menu.

The Configure Period screen allows you to set a date and duration for viewing system information.

The trends will be shown for the Duration value, ending at the current time. When 'Now' is checked, the system defaults to the current date and time. If 'Now' has been checked, 'Duration' is the only editable field.

For viewing historical data, uncheck 'Now'.

Enter the start date and time, along with duration to view data for desired time. Tap [Apply] to apply changes or [Close] to cancel any changes.

NOTE: If 'Now' is left unchecked, the system does not default back to the current date and time.

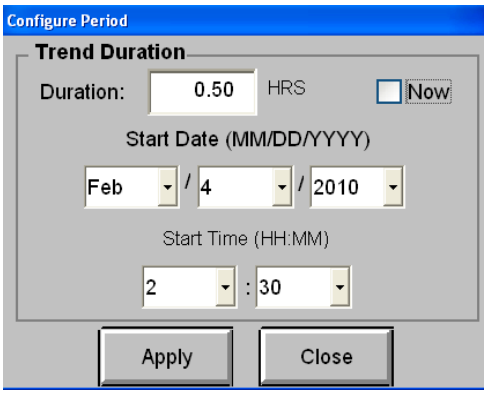


Figure 8: Configure Period

The trends graph may be enlarged for a better view by tapping on it.

Configuring the Data Shown on the Screen

In technician mode, you can change the data the screen shows. Click on "Configure Data".

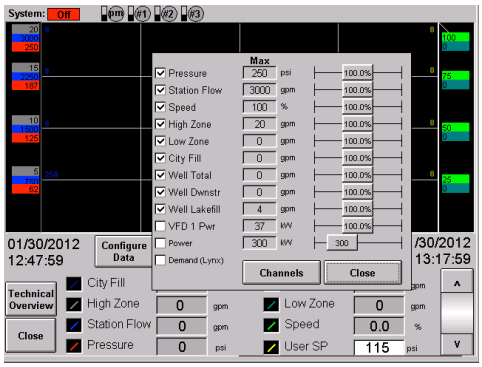


Figure 9: Configure Data

Check the box next to the data you want to show. Not all data is available for all systems. Use the slider bar on the right to adjust the graph scaling to a value that makes it most comfortable to read. 100% means the graph scale is the same as the analog scaling max value. 110% means the graph scaling is 110% of the analog max scaling for the channel. The exception here is the KW reading, which is an absolute number because KW is read directly, rather than scaled.

Click "Channels" to access the calibration screen directly from the "Configure Data" screen.

This screen is accessible also from "Setup"->"Options Setup" and is discussed in detail in that section.

Click "Technical Overview" to access details of system operation. This is also accessible from the "Green Flag" button on the header of other screens.

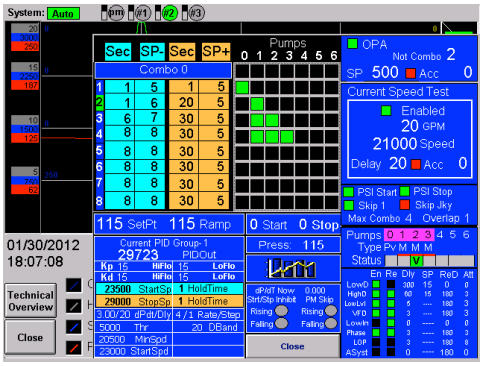


Figure 10: Technical Overview

This screen shows an overview of the configuration of the station. Most data that is necessary for tuning is shown, and the settings page for the information can be accessed by touching the value. For technicians, the fields available on this screen should be fairly self-explanatory. However, some fields can use some clarification:

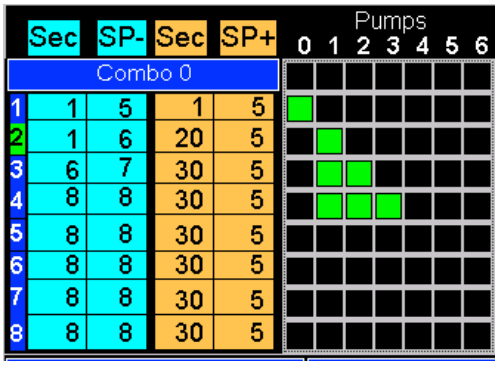


Figure 11: Combo Information

This field shows, from left to right, the current combo (highlighted), start time, psi below setpoint, stop time and psi above setpoint to stop, for each combo. To the right is a table detailing the pumps to run in each combo. The example above shows combo 1 consists of the PM Pump, Combo 2 consists of pump 1 (or any other single pump in the same group), combo 3 is two main pumps, and combo 3 is 3 main pumps.

Figure 12: Combo Information

This shows the Overpressure accumulator settings. “Not Combo” indicates that OPA will operate at any combo level above 2. “Factor”

FLOW TOTALS

Tap [Flow Totals] from the Operation menu.

The totalized values (in GAL) for the daily, weekly, monthly, and yearly flow are displayed in a tabular format.

Tap [Next] to successively view the totals for each day, week, month and year. Use the scroll bar to move up and down or left and right.

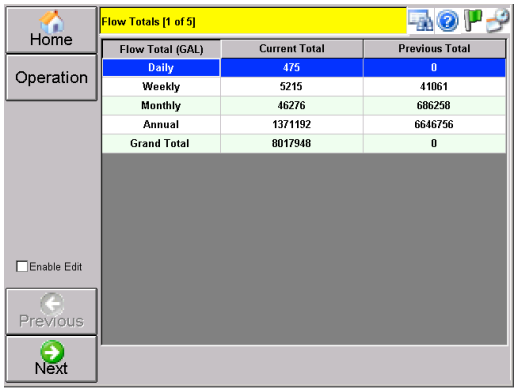


Figure 13: Flow Totals, Overview

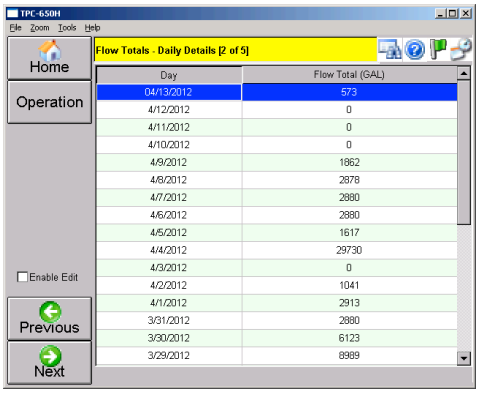


Figure 14: Flow Totals, Daily Flows

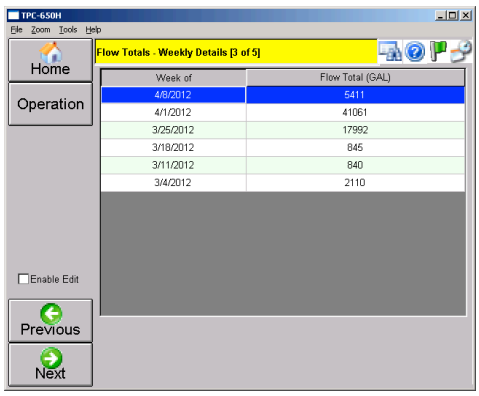


Figure 15: Flow Totals, Weekly Flows

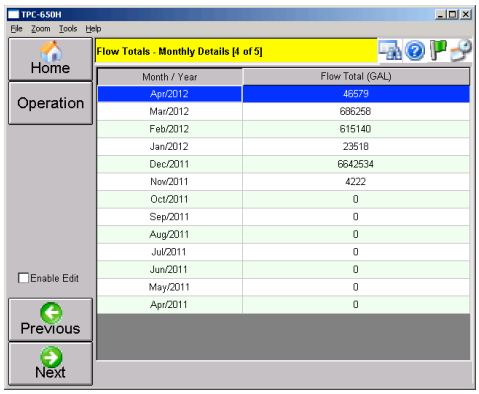


Figure 16: Flow Totals Monthly Flows

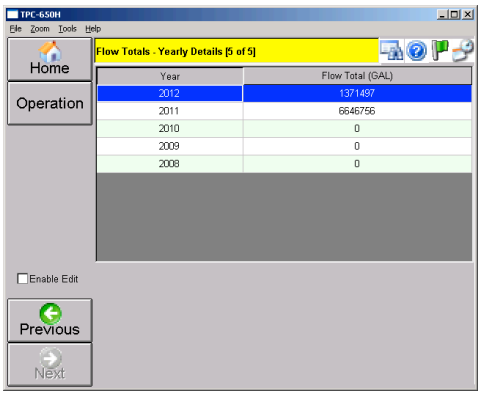


Figure 17: Flow Totals, Yearly Flows

PUMP STATUS

Tap [Pump Status] from the Operation menu.

This screen displays an animated graphical display of all the pumps in the system (up to eight pumps).

Red, no animation: Stopped pump

Green, rotating center: Running pump

Yellow, flashing center: Fault condition

Individual pump stats (runtime hours, number of starts, and pump capacity in GPM) can be viewed by tapping [Stats] for each pump.

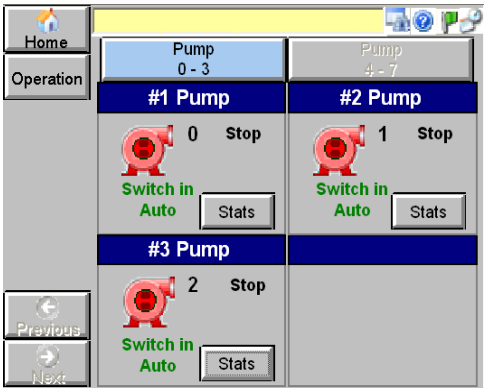


Figure 18: Animated Pump Status

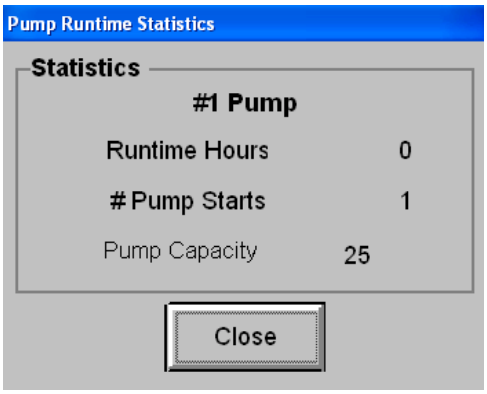


Figure 19: Individual Pump Stats

AUXILIARY EQUIPMENT STATUS

Tap [Aux. Equipment Status] from the Operation menu.

By tapping [Previous] or [Next], you can navigate the status screens for each device that has been set up.

NOTE: The screens described below will only be displayed if they are applicable to the current system.

Booster Pumps:

Booster Pumps are typically custom features and the interface depends greatly on the specific site. However some basic functionality is provided. Booster pumps typically require an auxiliary PLC.

Up to three booster pumps may be monitored simultaneously. All fields are read-only with the exception of 'Booster SP'. This pressure (PSI) value remains same for all installed boosters, and is generally higher than user defined SP.

Red, no animation: Stopped

Green, rotating center: Running

Yellow, flashing center: Fault condition

Tap [Next] to move to the next status screen.

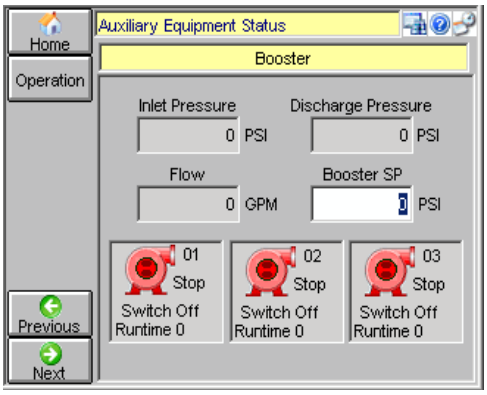


Figure 20: Booster Monitoring Screen

Automated Lake (ALS) Monitoring Screen

This screen is used to monitor the Automated Lake Screen. 'Accum Hours' is the total accumulated time ALS has been running for. 'ALS Switch' denotes the position of ALS switch on the enclosure. 'Cleaning' and 'Flushing' denote if the respective cycles are on or off.

Tap [Next] to move to the next status screen.

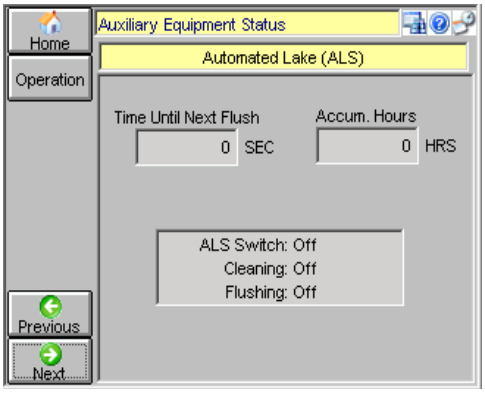


Figure 21: ALS Monitoring Screen

Lake Level Controls Monitoring Screen

A maximum of eight lake level controls can be monitored/configured on this screen. Supervisor access or higher is required to configure, but guest level access can view the settings and status information.

The Lake Level Control screen shows the pump number, whether the pump is currently on or off, if the enclosure switch is set to on or off, and also gives a pump's runtime total in hours. If a well pump is used, the well level is shown in feet in a read-only field.

Tap [Next] to move to the next status screen.

Lake Level/Transfer/Timed Pump Monitoring Screen:

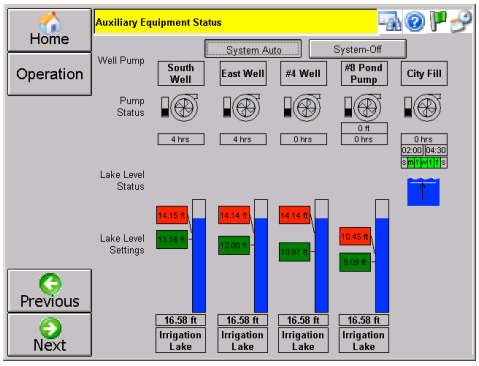


Figure 22: Lake Level Controls Monitoring Screen

This screen allows you to see the status of the Lake Level/Timed pump control system at a glance. Pump status (Off, Run, Fault), switch status (On/Off), Level settings can be viewed/adjusted (When logged in as Admin, Technician, or Supervisor only), pump hours can be monitored, Start/Duration times for timed pumps can be monitored, lake levels and/or probe status (as equipped).

Timed Pump Monitoring Screen (Non-Integrated Only)

Currently, only one timed pump can be set up and monitored on the Timed Pumps screen. The screen is read only, and gives the pump number, status, and the total run time in hours.

Red, no animation: Stopped

Green, rotating center: Running

Yellow, flashing center: Fault condition

Select [Next] to move to the next status screen.

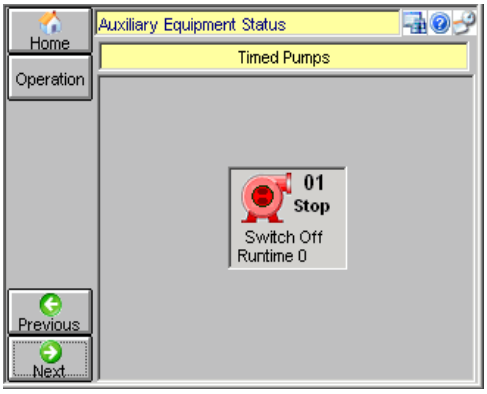


Figure 23: Timed Pump Monitoring Screen

Simple Filters Monitoring Screen

Simple filters include Wye strainers and other filters controlled by a simple on-off flush signal. This screen will monitor all installed filters. ΔP denotes differential pressure.

Red, no animation: Stopped

Green, rotating center: Running

Yellow, flashing center: Fault condition

A green colored graphic denotes that the filter is flushing.

Other information displayed includes filter number, run time (in hours), and whether the enclosure switch is set to on or off.

Tap [Next] to move to the next status screen.

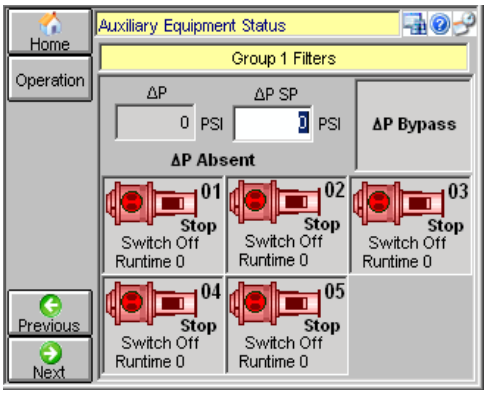


Figure 24: Simple Filters Monitoring Screen

Scanner Filters Monitoring Screen

The scanner filter monitoring screen shows the status of a single filter with up to eight chambers.

The inset box shows if the flush cycle is on or off, if the enclosure filter switch is set to on or off, if ΔP is bypassed, and if a filter faults, 'Fault' blinks as a notification. Text showing that ΔP is present or absent is displayed below the box.

Red, no animation: Stopped

Green, rotating center: Running

Yellow, flashing center: Fault condition

Tap [Next] to move to the next status screen.

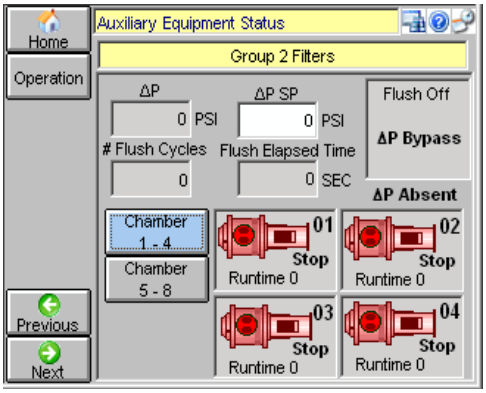


Figure 25: Scanner Filter Monitoring Screen

Solid Separators Monitoring Screen

This screen shows the status information for up to five installed filters. The Solid Separators Status icon also shows the filter number, the status, whether the enclosure switch (Switch) is set to on or off, if the Flushing switch is set to on or off, the time until the next flush is shown in seconds ('Til Flush), and filter Runtime is displayed in hours (Runtime).

Red, no animation: Stopped

Green, rotating center: Running

Yellow, flashing center: Fault condition

Tap [Next] to move to the next status screen.

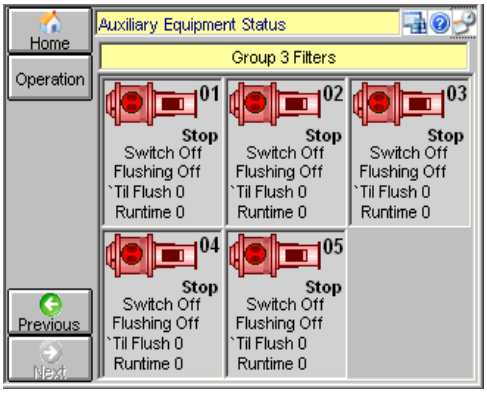


Figure 26: Solid Filter Monitoring Screen

ALARMS

Tap [Alarms] from the Operations menu.

The alarms screen shows all current and unacknowledged alarm events. Use the vertical scroll bar to view all alarm events if necessary.

The latest alarm flashes in the banner at the top of the screen till it is acknowledged using [Ack All].

NOTE: Be sure to scroll to the bottom of the alarm events list before using [Ack All] to ensure that all alarms have been viewed.

Alarm notifications are color coded.

Red: Active, Unacknowledged Alarm

Green: Active, Acknowledged Alarm

Blue: Inactive, Unacknowledged Alarm

To view alarm events from the past, from the drop down menu at bottom left, select 'History'. Tap [Period], and enter the start and end dates in a pop up screen. Tap [Apply] to save changes or [Close] to cancel.

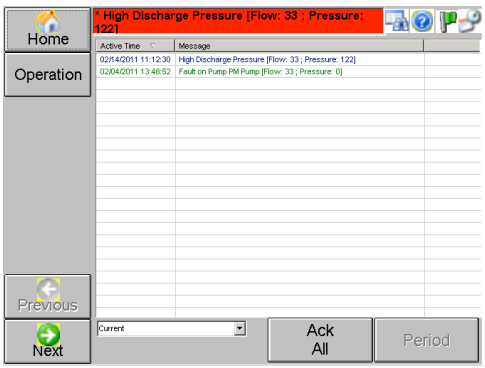


Figure 27: Alarms Screen

EVENTS

Tap [Events] from the Operation menu.

This screen shows system events for current day, date & time, and a short message about the event.

To view past events, tap [Period] and specify the start and end date to view the events.

More events may be viewed using the vertical scroll bar.

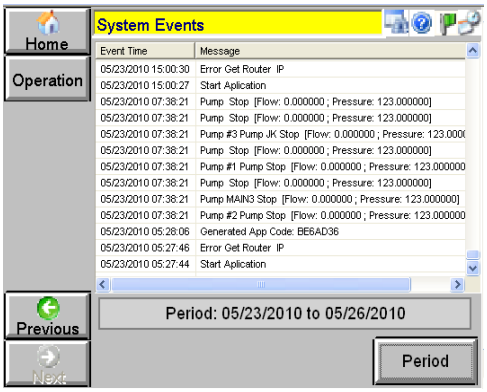


Figure 28: Events Screen

LOCKOUT VIEW

Tap [Lockout View] from the Operations menu.

Lockouts are common when water usage and power restrictions limit pump usage to a certain time.

Different lockouts may be viewed using the numbered tabs at top. The Day selected, the Start Time, the Duration, the Combo number selected, the Combo SP (combo setpoint), and the pump Speed are shown.

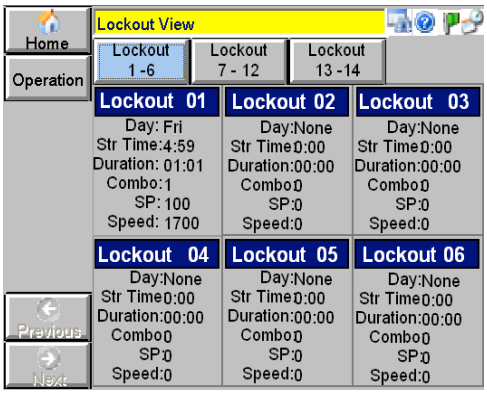


Figure 29: Lockout View Screen

KWH RECORDS

Tap [KWH Records] from Operations menu.

The KWH Records are similar to the Totalizers and record power usage.

NOTE: The data on this screen is available only when used with Toro™ or Lynx™ irrigation control systems and/or KW Measurement hardware is installed.

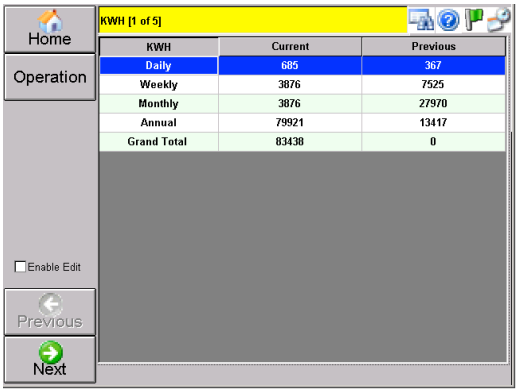


Figure 30: KWH Records, Overview

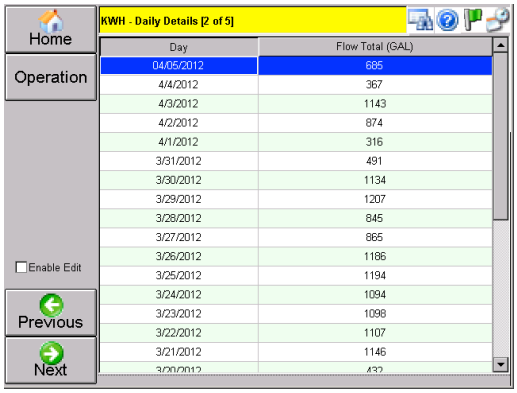


Figure 31: KWH Records, Daily Usage

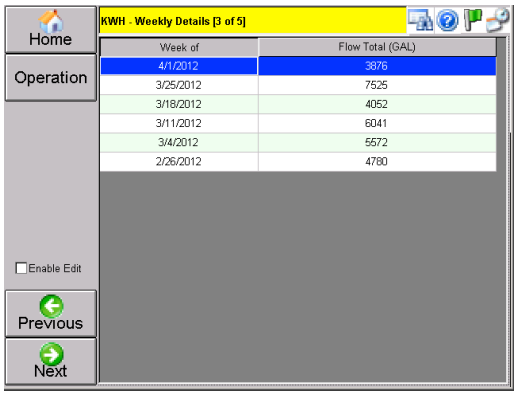


Figure 32: KWH Records, Weekly Usage

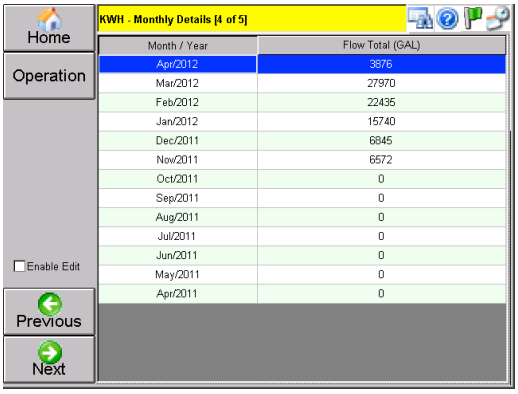


Figure 33: KWH Records, Monthly Usage

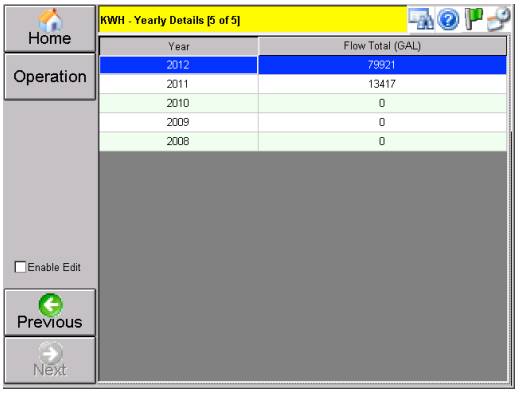


Figure 34: KWH Records, Yearly Usage

Note: KHW Metering and records are subject to calibration and will only monitor the loads connected to the measurement equipment, primarily irrigation pumps. The records are intended as a reference to plan irrigation for maximum efficiency and are not to be used as a custody transfer or billing meter.

Setup Menu

Tap [Setup] from the Home screen.

The Setup menu is available for Supervisor use only.

> **CAUTION:**
>
> Changing the settings in the Setup Menu will affect the functionality of the system. It is advisable to record any current settings before making changes.

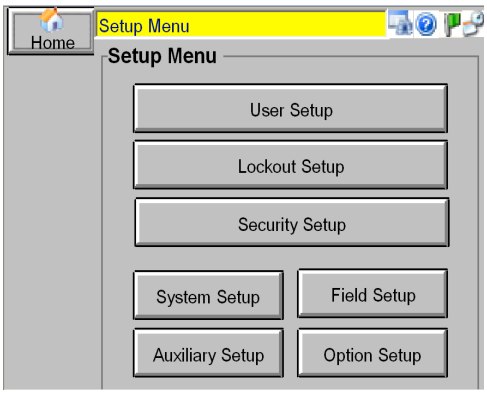


Figure 35: Setup Menu

USER SETUP

Tap [User Setup] from the setup menu.

This menu allows a supervisor to set the date/time, language, colors, and units. A lamp test to check all lamps on the control panel may also be performed.

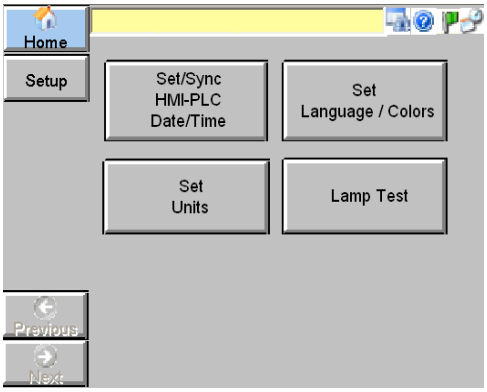


Figure 36: User Setup Menu

NOTE: The [Set Language/Colors] and [Set Units] menu selections are not currently available.

Set/Sync HMI-PLC Date/Time

Tap [Set/Sync HMI-PLC Date/Time] from the User Setup menu.

This screen allows the date and time to be set, and synchronized for the PLC and HMI. Tap [Synchronize] to synchronize HMI & PLC date and time.

In a new pop up screen, enter the date and time. Tap [Set Date/Time – Close] to save changes. Tap [Clear Totalizers] to clear all totalizers.

Note that when the HMI time is set, the HMI will automatically sync the PLC time once/day.

CAUTION:

Synchronization should not be done while using the Internet-based remote client as this has the potential to negatively affect the time settings of the system. Syncing should only be performed locally.

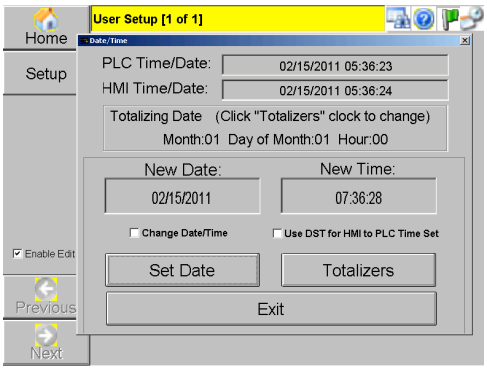


Figure 37: Set/Sync HMI-PLC Date/Time

Lamp Test

Tap [Lamp Test] from the User Setup menu.

Holding this button for 3 seconds causes all lights on the control panel to light up briefly. Any bulb that does not light up should be replaced.

LOCKOUT SETUP

Tap [Lockout Setup] from the Setup Menu.

Lockout setup is similar in appearance to the Lockout View accessible in the Operation menu.

Individual lockouts may be setup by tapping over each lockout inset. Tapping any inset opens a configuration window. The day, start time, and duration may be entered in the interval tab at the top. In the parameter tab, the combo number, setpoint, and speed can be entered. Tap [Apply] to save settings or [Close] to discard any changes.

An individual lockout setup screen is shown below.

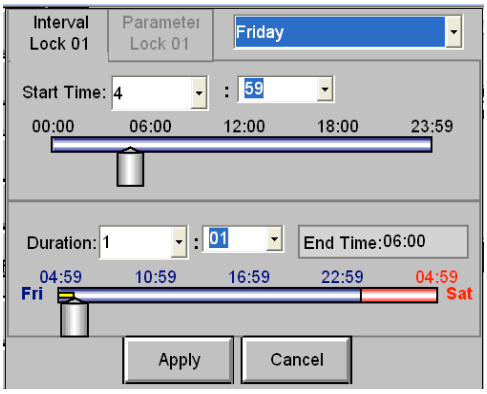


Figure 38: Individual Lockout Setup

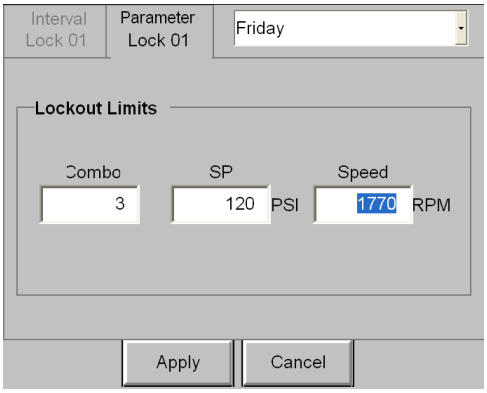


Figure 39: Parameter Tab in Lockout Setup

The screen shown in Figure 38 sets up a lockout for Friday beginning at 4:59 AM. The duration is set to be 1 hour and 1 minute. Thus this lockout will end at 6:00 AM on Friday. The animated display gives an indication about time. The Parameter tab enables a user to define Combo number, maximum pressure, and maximum speed in RPM.

SECURITY SETUP

Tap [Security Setup] from the Setup Menu.

The Supervisor can change the password assigned to him/her, and set the number of days after which the password expires (in the editable field). To change the password, tap [Change Password] to change the supervisor password. Enter the new password in the 'Password' and 'Confirm Password' field. Tap [Apply] to save changes.

NOTE: Tap [Generate App Code] if your current Technician password has expired. Use this App code when calling customer service to obtain a new password. The [Generate App Code] button is available to any user without a password.

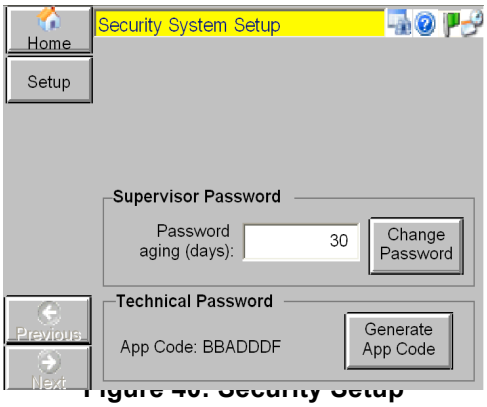


Figure 40: Security Setup

SYSTEM SETUP

Tap [System Setup] from the Setup Menu.

A statement will appear warning you that changing system settings could affect the functionality of the entire system. You must accept this to proceed.

You can navigate the status screens for each device that has been set up by tapping [Previous] or [Next].

NOTE: The screens described below will only be displayed if they are applicable to the current system.

Job Information

Enter the job information such as 'Job Number', 'Job Name', 'Main PLC IP (usually 192.168.1.10), and 'Phone Number'. Notice that the fields 'HMI Version' and 'PLC Version' have been grayed out, and are not editable.

Tap [Next] to move to the next System Setup screen.

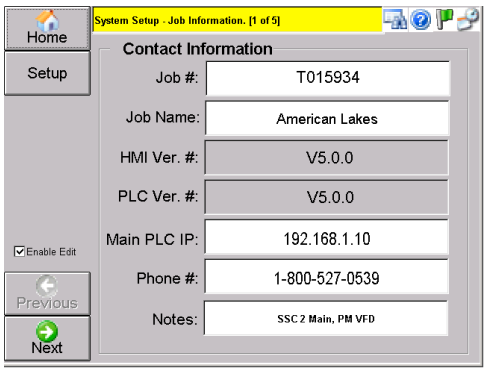


Figure 41: Job Information

Basic Pump Information

The number of pumps can be selected from a drop down menu. Each pump can be assigned a name in the editable fields at the bottom of the screen.

Tap [Next] to move to the next System Setup screen.

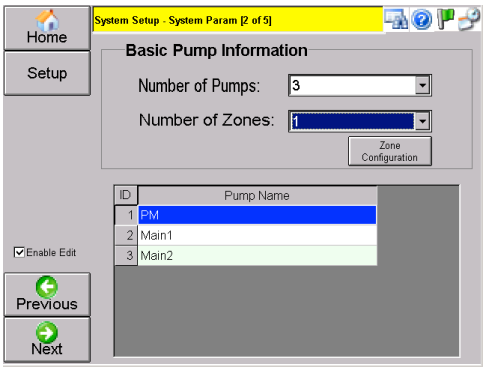


Figure 42: Basic Pump Information

Zone Configuration

The number of flow zones is adjusted here. Up to 7 zones can be selected. This controls how many flow totalizers are operable. Each flow zone will keep track of water usage by day, week, month and year (5 years).

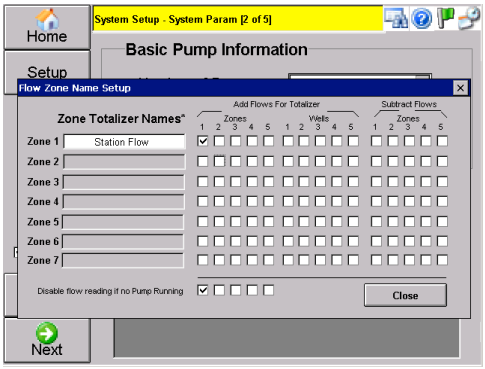


Figure 43: Zone Configuration

The name of the flow zone is set here. Also, the flow channel that is totalized for each zone is configured here. These channels match the flow channels from calibration. In addition to picking a single channel for a particular zone, multiple channels can be added together to form a single flow zone by selcting more than one "Zone" to totalize. Well pump flows can also be selected for flow zones and even added to irrigation channels as required. Flow zones can also be subtracted from the total by selecting a "Subtract Flows" channel. This may be required when a meter reads flows going to more than one zone, and one of these subsequent zones is metered separately.

Flow filtering is setup here as well. By selecting "Disable Flow Reading if No Pump Running" for a channel, that flow reading will be zero' out when no pump is running. This is in case the system picks

up fluctuations that cause the meter to generate undesirable small flows when the pumps are not running.

Pump Configuration

Each pump can be selected from a drop down menu in this screen. Each pump can be assigned a group, type, and number of VFDs that are going to be used. Also selections can be made regarding the pump being a XL, VFD, HPT, HSS, or Only pump for this VFD.

Enter the minimum run time, Spindown Time, Pump Capacity, Feedback Delay for each pump.

Tap [Next] to move to the next System Setup screen.

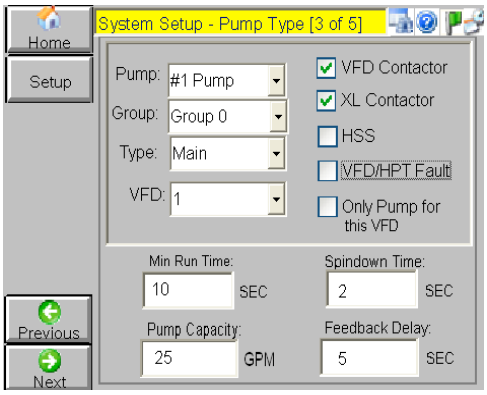


Figure 44: Pump Configuration

After defining your contactor pump setup, a quick start-stop on Test mode is recommended to verify the settings are right. (Check XL or VFD contactors and VFD relay per pump).

To run a Quick Start-Stop test, perform the following:

Set all pump switches to OFF

Put the system switch into TEST mode.

For the pump being tested:

Turn ON the pump switch for 3-4 seconds to verify proper setup.

The pump should run when switched to ON and stop when switched to OFF.

The pump should not fault – which is indicated by a flashing pump switch light.

Caution: Pressure surges

Care should be taken to isolate the irrigation system from pressure surges during this test.

Tap [Next] to move to the next System Setup screen.

Alarm Setup

This screen allows you to select various alarm types from the drop down menu, and fill in the required settings for each alarm.

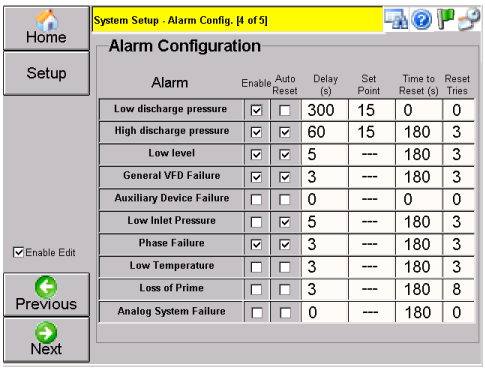


Figure 45: Alarm Setup

Default settings (standard factory settings) can be found in Appendix D.

Tap [Next] to move to the next System Setup screen.

Combo Options

This screen allows you to checkmark various combo options. 'PSI Start Enable' and 'PSI stop Enable' are essential. Without these two, the station will not start stop based on pressure indications. All other check-marks are need based.

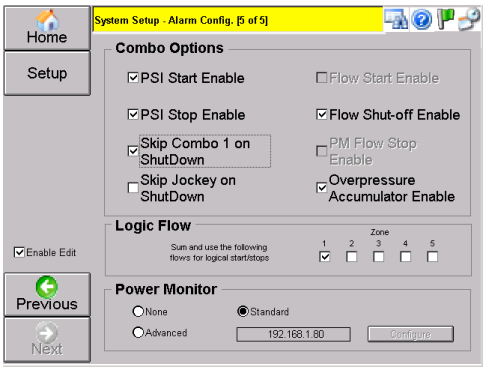


Figure 46: Combo Options

Logic flow enables you to select which zones are used for flow shutoff. The zones are added together to provide the flow to compare to the flow shutoff setpoints.

This screen also contains the power monitor.

This is the final System Setup Screen. Tap [Previous] to move to the prior System Setup screen or tap [Setup] to return to the menu.

FIELD SETUP

Tap [Field Setup] from the Setup menu.

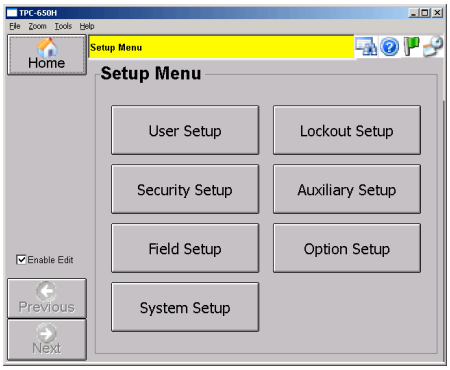


Figure 47: PID Settings

After the pumping station is configured with initial values at the factory, field technicians can use the four Field Setup screens to tune or optimize the station operation.

You can navigate the status screens for each device that has been set up by tapping [Previous] or [Next].

NOTE: The screens described below will only be displayed if they are applicable to the current system.

PID Tuning

All fields which have been grayed out are read only.

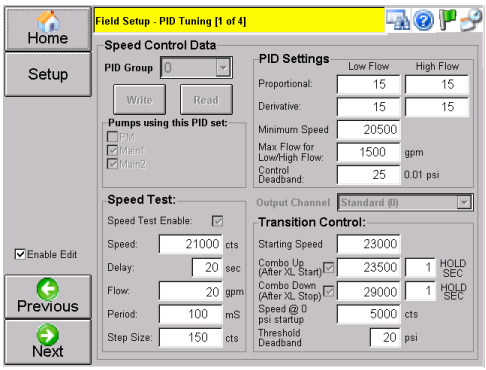


Figure 48: PID Settings

PID Group:

There are 5 PID sets available for use that are chosen by which pump(s) are running on VFD.

Pumps using this PID Set:

The decision on which PID set to use is based on the “best” fit of pumps running on VFD and the pumps selected here.

Read:

Click “Read” to read the PID values from the PID group set selected (this is automatically clicked for you when you enter the screen).

Write:

Click “Write” to save the values to the PID group.

Copying PID data:

The Read/Write buttons are provided to allow the technician to copy values from one PID group to the other. To copy, select the PID group to copy from and click “Read”, then select the PID group to copy to and press “Write”.

Speed Test:

Speed test is a method to shut down the lead VFD. When only 1 VFD is running. The PID value is artificially reduced and the system is monitored for PID response (pressure drop).

Speed Test shutdown is initiated when flow falls below “Flow “ for “Delay” seconds.

“Speed” is the speed to which the PID must drop to pass speed test and shut down the pump.

“Period” is the time between steps for the speed test routine to lower the PID output, and “Step Size” is the amout of PID drop per step.

If the speed test routine detects the PID ramping up during the test, speed test will abort and operation will return to normal until flow is again below the “Flow” setpoint for “Delay” seconds.

Proportional and Derivative settings, high and low flow:

Configuring the proportional and derivitave values is essentially a trade-off. Both these values have an impact on the system response. A high proportional value causes the system to respond faster, thus reaching the setpoint faster. At the same time, this faster response means, that the system will easily overshoot the desired setpoint. This can be checked by lowering the proportional value, and increasing the derivative (d-Term) value. The integral value controls the sampling rate of the PID loop. The derivative term controls the systems

response to rapid changes in pressure, regardless of the value of the pressure. This system uses this to begin reducing VFD output speed when pressure is rising quickly, helping to avoid overshoot. The system can also detect fast pressure drops to begin increasing VFD output speed before large errors are detected, increasing the systems responsiveness.

Good starting values are 25 for Kp and 12 for Kd. Increase Kp when the system lags too long changing the speed when pressure is away from setpoint but relatively steady. Decrease Kp and increase Kd to reduce overshoot. Decrease Kd when the system becomes unsteady near setpoint under steady demand. Generally speaking, only use enough Kd to reduce overshoot.

Low and high flow settings:

The low flow and high flow settings are used together to calculate the P and D terms at any given time. The low flow settings are what the P and D terms would be if flow were 0. The High Flow settings are what the P and D terms would be if flow were greater than or equal to "Max Flow for Low/High Flow". The value to use for each parameter is calculated based on the flow at the time.

Example: Low Flow Proportional is 10, and High Flow Proportional is 20, "Max Flow for Low/High Flow" is 2000. At 1000 gpm, the proportional value will be calculated to be 15. At 1500 gpm, the proportional value will be calculated to be 17.5.

Minimum Speed: This is the minimum speed that the system will operate the VFD under PID control. This speed should equal the minimum speed that the pump will flow water at setpoint pressure. Setting this value too high can cause overpressurization at low demands, but having this value too low can cause the PID to hunt since the speeds below the "true" min speed are ineffective and cause unnecessary delay in the PID when operating in these speed ranges. Note that allowances must be made for varying inlet pressure and adjustable setpoints. Generally speaking, a low Min speed is better than a too-high min speed, but the closer to "true" min speed this is set, the better the system will operate.

Control Deadband:

This value controls how far from setpoint the pressure must be before the PID responds. The units here are in 0.01 psi, so 25=0.25 psi (one quarter-pound). This smooths the PID response near setpoint and allows flow waves in the irrigation to dissipate. However, to large a value here will cause the system to delay response and could cause the system to "get behind" in response to a large change in demand.

Transition Control:

Starting Speed: Starting speed of the Main VFD when the Main Pump first starts. Should be high enough to "kick start" the pump since it is starting under unsupplied demand, but care must be taken not to force the system to overshoot under low demand situations. Start the system with demand just greater than the PM Pumps (or Jockey Pump, as supplied) capacity and adjust for minimal overshoot.

Combo Up (After XL Start): This setting controls the speed the VFD running the main pump will be forced to when a fixed speed lag pump starts. This helps prevent overpressuring by reducing the capacity of the VFD Pump, which is then being provided by the fixed speed pump after it starts. Generally set to 1/3 the value between min speed and 32767. This speed will be held for "Hold Sec", which is generally set to 1 (may need to increase for systems using soft-starters for fixed speed lag pumps).

Combo Down (After XL Stop): This setting controls the speed the VFD running the main pump will be forced to when a fixed speed lag pump stops. This helps replace the capacity provided by the fixed speed pump and eliminate pressure dips when these pumps are shut off. Generally set to 2/3 the value between min speed and 32767. This speed will be held for "Hold Sec", which is generally set to 1.

Speed at 0 psi Startup: This setting controls the speed the VFD of the Jockey OR main will start if pressure is very low when the pump starts (see deadband below). This setting should be adjusted to be the point the pump just begins to flow water at 0 psi discharge. The actual starting speed will be calculated between this speed and "Combo Down (After XL Stop)" speed setting, depending on the actual pressure at the time of start. A function is used to calculate the speed between these points.

Threshold Deadband (psi): Determines the pressure below setpoint to use the Threshold function for determining starting speed. If set to "20", the threshold function is used to calculate starting speed when pressure is equal to or less than 20 psi below setpoint.

The VFD 1st start factor corresponds to the starting speed of the first main or Jockey pump starting on VFD. A high value causes the VFD to start running at a higher speed, creating more pressure. This

helps the system to reach the setpoint faster, but at the same time the system may overshoot the setpoint very quickly since the PID does not have enough time to react to the fast occurring changes. A very low value will make the system take a lot of time to reach the setpoint.

The values shown in figure 34 below have been determined from empirical tests, and can be used as defaults, but each system needs to be tuned, as pumps and systems are different.

Low Flow (Proportional & Integral) denotes the PID sensitivity on the first start of the first main.

Tap [Next] to move to the next Field Setup screen.

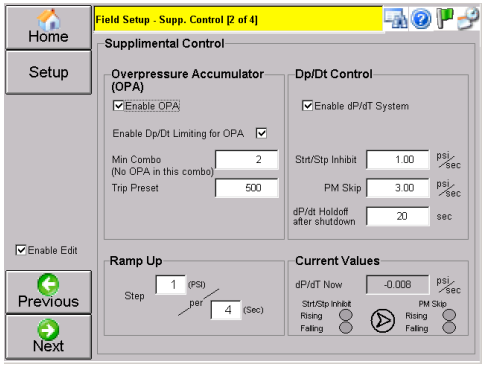


Figure 49: OPA, Ramp Up and Dp/Dt control

OPA Enable

This is a method used to shut down lag pumps operating across-the-line in a system that uses both VFD and XL (across-the-line) pumps. Check this box to enable.

The overpressure accumulator measures the overpressure, and calculates a value to addd to the Overpressure Accumulator depending on this error on each program scan. The system will shut off a lag pump when “Trip Preset” is reached.

Min combo: Combo # on which, OPA is not desired because it is desired that the last pump stop in speed test.

Ramp Up:

Step (psi): During ramp-up, the # of psi the system will step up. See “Step (sec)”. Normally set to 1 psi.

Step (sec): During Ramp Up, the time between ramping the setpoint. Normally set to 4 sec.

dP/dT Control:

Enable (Checkbox): Controls whether the “dP/dT” pump start/stop control functionality is utilized. Check to utilize the rate of pressure drop when starting/stopping pumps.

Start/Stop Inhibit : The rate at which the system will inhibit pump starts or stops as the pressure rise or drops during the decision process. Generally 0.5-1.0 is adequate to reduce pump cycling.

PM Skip: Controls how much pressure drop will cause the system to automatically skip the PM Pump in the sequence. Fast pressure drop indicates a large demand has suddenly been applied to the irrigation system. This is used to detect the need to skip the small pressure maintenance pump so that the main pump can meet this demand as quickly as possible, avoiding unnecessary pressure dips. Start with values at 1.0 and monitor. To disable this feature but continue to use the Start/Stop inhibit system above, set this value to 10 or greater.

dP/dT Inhibit(sec): After the main pump stops, systems will often experience short pressure dips that may cause the PM Skip system to restart the main pump. Set this value to 20 seconds to prevent the PM Skip process from restarting the main pump within this period of time.

Current dP/dT values are shown to assist in tuning the dP/dT system.

Combos

This screen allows you to configure various options in a combo.

Select the maximum number of combos (up to eight). For Combo 0, which is the ‘no pump’ combo, all values except Overlap gray out. A brief description of all parameters follows.

1. Delay Timer:

Start: number of seconds the station delays before the start of the specified combo, once ΔP has been reached

Stop: number of seconds the station delays before it stops the specified combo, once ΔP has been exceeded.

2. Normal Differential:

System is not in ‘Bypass’ mode.

Start: Start a specified combo when the difference between the actual pressure and user defined SP exceeds this value.

Stop: Stop a specified combo when the difference between the actual pressure and user defined SP exceeds this value.

3. Bypass Differential:

System is in VFD Bypass mode. Enabling bypass for a particular VFD causes all pumps using that

VFD to go into “Bypass Mode” which means they will operate as fixed-speed pumps.

Start: Start a specified combo when the difference between the actual pressure and user defined SP exceeds this value.

Stop: Stop a specified combo when the difference between the actual pressure and user defined SP exceeds this value.

Tap [Next] to move to the next Field Setup screen.

Figure 50: Combos

Combo Pumps

This screen allows you to configure which pump will be used in which combo.

Tap [Next] to move to the next Field Setup screen.

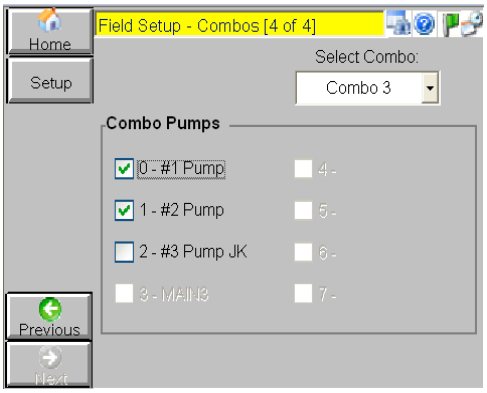


Figure 51: Combo Pumps

AUXILIARY SETUP

Tap [Auxiliary Setup] from the Setup menu.

These screens allow you to setup and configure any auxiliary equipment. Check any auxiliary equipment that needs to be set up.

Each enabled item requires an IP address to communicate to the PLC using the Modbus protocol, which can be entered by double clicking on the IP address field.

Default IP addresses can be found in Appendix E.

Note: Pace 5.0+ supports integrated auximilary equipment. Setting the IP address of the auxiliary equipment to the same as the main PLC enables the integrated auxiliary device.

You can navigate the status screens for each device that has been set up by tapping [Previous] or [Next].

NOTE: The screens described below will only be displayed if they are applicable to the current system.

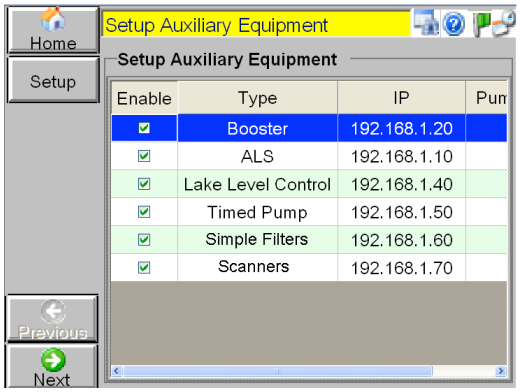


Figure 52: Auxiliary Equipment Setup

Note: Timed Pump operation is included in Lake Level control operation if using and integrated controller (included in main PLC).

Booster Setup

The terms in this menu are described below:

Stop Pressure: If pressure rises above this value, system stops.

Low Inlet Pressure: If inlet pressure falls below this value, a Low Inlet fault is activated.

Low Dschrg Pressure: If pressure falls below this value, a Low Discharge fault is activated.

High Dschrg Pressure: If pressure rises above this value, a High Discharge fault is activated.

Pressure SP: User defined pressure maintained for the booster.

Tap [Pump Config] to enter configurations for each of the booster pumps in a popover screen. Up to 3 pumps may be configured.

Tap [Time Delay] to enter time delays in a popover screen.

Tap [Next] to move to the next Auxiliary Setup screen.

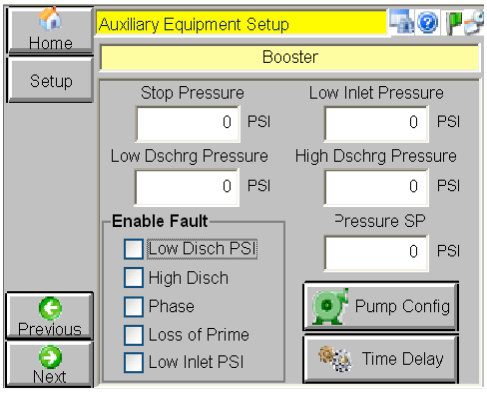


Figure 53: Booster Setup

ALS Setup

In this screen, Flush Times and Flow Rates may be edited.

Time until Flush (sec): Time period between flushes.

Duration of Flush (sec): Time duration for the flush.

Flow Start Cleaning (GPM): Flow rate when flush starts.

Flow Stop Cleaning (GPM): Flow rate when flush stops.

Tap [Next] to move to the next Auxiliary Setup screen

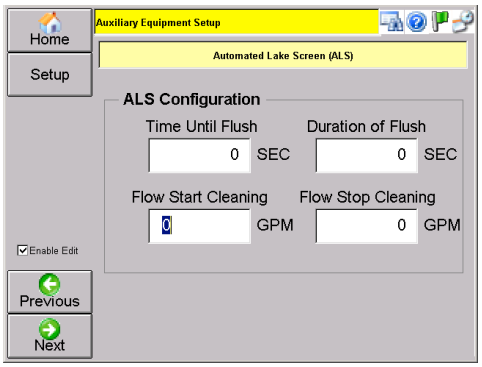


Figure 54: ALS Setup

Lake Level Controls Setup

This screen allows you to configure all aspects of Lake fill, transfer pump and timed pump operation when using an integrated lake level control system.

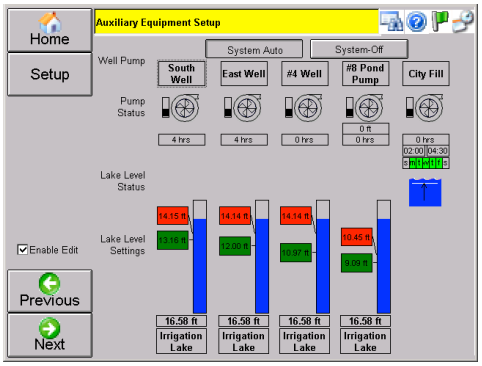


Figure 55: Lake Level Controls Setup

Up to 8 Well/Transfer/Timed pumps can be controlled when using the integrated system. Set the IP address of the lake Level Controls auxiliary equipment to match the main PLC to enable the integrated controls (Note: The IO mapping must be configured for the Lakefill/Transfer/Timed pumps to use the integrated system, consult the factory when adding equipment to 5.0+ Pace systems).

The master Auto button must be enabled for any of the level/timed pumps to run. Press “System Off” to disable all Level/Timed pumps. (Pump station operation is not affected).

Touch the pump name to configure the pump.

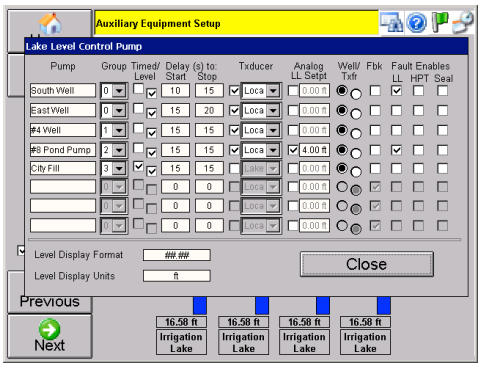


Figure 56: Level/Timed pump configuration

Set the pump name by touching the Name field for the pump you are configuring. This is the “Source”.

Each pump can be configured to run individually or as part of a pump group. For each pump to run standalone based on it’s own level control, select each pump to be in a separate group. To use the run-time of the pumps to “Lead Select” a group of well pumps, put them in the same group. When the first pumps level (or level/time combination) calls for the pump to run, all pumps in the group will be evaluated to determine which will run, based on run hours and switch settings.

Timed pump can be configured with or without level control. A timed pump will be enabled to run on the days specified, after the start time and for the duration specified. If also level controlled, then the pump will be allowed to run during the “enabled” period when the level in the controlled lake calls for the pump to run. If no level control is also configured, the pump will run after the start time and for the duration specified. Setting up the timed operation will be described in detail below.

Start and Stop delays apply to level control and are used to de-bounce, or account for wave action on the probes or transducer signal.

Selecting a transducer tells the system to use the transducer signal for level control rather than level probes/floats.

Well/Txfr allows you to set up the pump as Well or Transfer (Well pumps “Pump up” while Transfer pumps “Pump Down”, though this distinction only truly matters when using the transducer for level control, both modes require a signal-on to run when using probes for control).

Fbk selects whether the pump will provide a feedback (pump running confirmation) to the PLC. If selected, a pump fault will be reported if the pump does not provide this feedback signal when called to run. If not selected, the PLC will assume the pump is running any time it is called for.

Fault Enables select whether to enable faults for the well/transfer/timed pumps. LL enables Low Level Safety, HPT enables the High Pump Temp safety, and Seal enables the Seal Failure safety. HPT and Seal are typically for submersible sump-type pumps while Low Level safety is typically used for turbine or submersible turbine type pumps.

Configuring Timed Pumps:

Touch the pump image of any pump configured for timed operation to open the Run Time configuration screen.

Timed pump control consists of a Day to Enable, Start time and Duration. The start day, time and duration are taken together to determine if the pump is in an allowable period to run. If the current time is greater than the time period defined by Start time and day, and less than start time and day, plus duration, then the pump will be allowed to run. Note that this means it is possible for a pump to run

on a day that is not selected if the previous days duration setting extends past midnight.

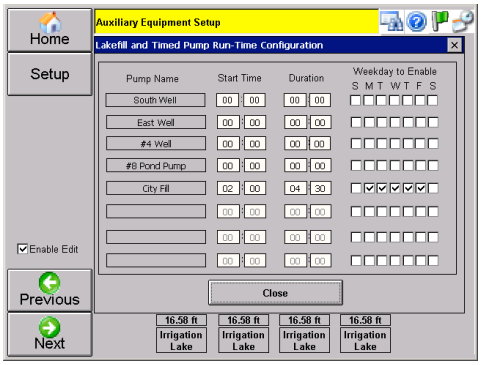


Figure 57: Integrated Timed Pump configuration

For example, assume the pump is configured as shown above. If the current time is Monday-Friday, between 2:00 AM and 6:30 AM, the city fill valve will be open if the probes for #8 Pond call for it. Any other time the controls will ignore the probes and the valve will remain closed.

If the setting were configured for 10:00 PM and the duration was set for 4:00 hors, the pump could run starting at 10:00 PM Monday-Friday, and would be allowed to run until 2:00 AM the following morning (even Saturday morning) but would not start Saturday or Sunday evening (and would thus not run Monday morning from midnight to 2:00 AM).

Lake Level Controls Setup (Non-Integrated only)

This screen allows you to enter the delay times for the pump to start and stop after a specified level has been reached. **Time to Fault** (sec) is the time delay for system to issue a fault after a fault occurs.

Tap [Lvl Setup] to enter the start and stop levels (feet) for up to 5 pumps in a popover screen. Specify the type of pump using the radio buttons.

A **well pump** starts when the well water level falls below the start level, and stops when the water level is above the start level.

A **transfer pump** starts when the water level in the tank is above the start level, and stops when the level falls below the stop level.

Tap [Next] to move to the next Auxiliary Setup screen.

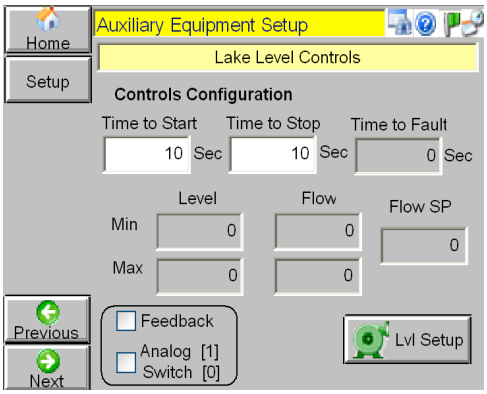


Figure 58: Lake Level Controls Setup

Timed Pump Setup (Non-Integrated only)

This screen allows you to enable the timed pump setup. If the 'Feedback Enable' box is checked, the pump will send feedback to the PLC.

Enable the checkboxes for each day that a pump needs to be timed. For each day enabled, enter the start time and duration in a pop up screen.

Tap [Next] to move to the next Auxiliary Setup screen.

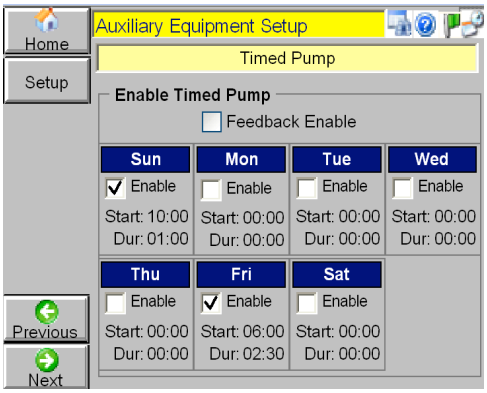


Figure 59: Timed Pump Setup

Simple Filters Setup

This screen allows you to setup the simple or Wye filters.

ΔP Present (sec) is the time between flushes when differential pressure is on, or when the analog differential pressure is less than the differential setpoint. Check the 'Wye' checkbox to enable a Wye filter, (which doesn't use ΔP) and enter values in editable fields.

Simple Filters Setup

This screen allows you to setup the simple or Wye filters.

ΔP Present (sec) is the time between flushes when differential pressure is on, or when the analog differential pressure is less than the differential setpoint. Check the 'Wye' checkbox to enable a Wye filter, (which doesn't use ΔP) and enter values in editable fields.

Tap [Next] to move to the next Auxiliary Setup screen.

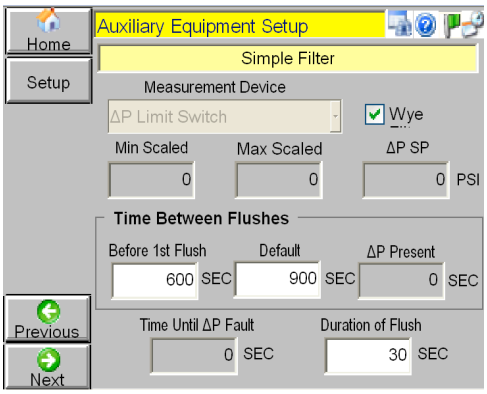


Figure 60: Simple Filters Setup

Scanners Filter Setup

The Scanners Filter setup screen is similar to Simple Filters setup, but it does not have the Wye filter option.

Select the filter from the drop down menu and enter values in the editable fields as needed.

Tap [Next] to move to the next Auxiliary Setup screen.

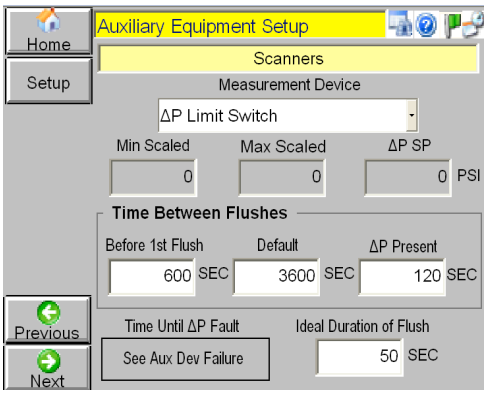


Figure 61: Scanners Filter Setup

Options Setup

Tap [Options Setup] from the Setup Menu.

NOTE: After the pumping station is configured with initial values at the factory, this menu allows you to configure additional options.

Tap over any field to access the desired setup options.

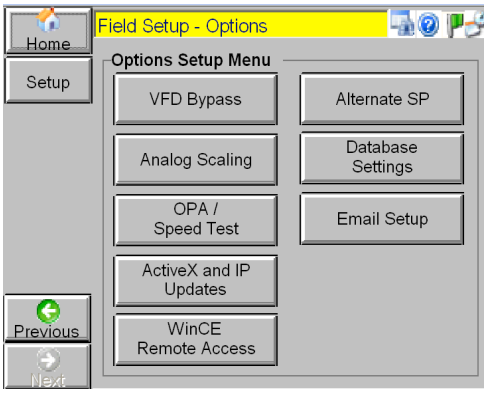


Figure 62: Options Setup Menu

VFD Bypass

Tap [VFD Bypass] from the Options Setup Menu.

This screen allows you to enable or disable bypass for desired VFDs using the radio buttons.

Tap [Close] to return to the Options Setup Menu.

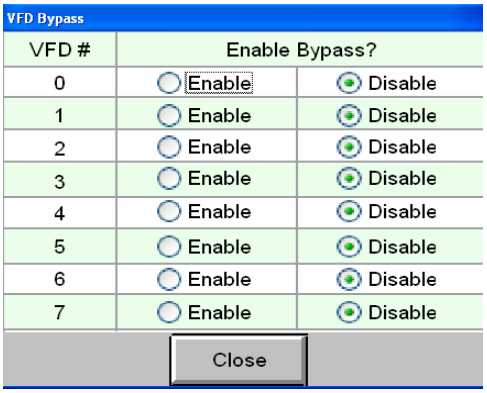


Figure 63: VFD Bypass

Analog Scaling

Tap [Analog Scaling] from the Options Setup Menu.

This screen allows you to scale raw values into engineering units for up to 4 analog signal inputs and outputs.

For each signal such as Pressure, the analog input values are shown on the left while the analog output values are shown on the right.

Use the scroll bar to scroll left and right. Enter values in all editable fields.

Tap [Edit Analog I/O Names] to change any of the names of the variables displayed (Flow, Pressure, etc). This can also be used when adding on functionality to the system. There are a few 'spare'

I/O names available and those can be edited to match the new variable for scaling.

Tap [Close] to return to the Options Setup Menu.

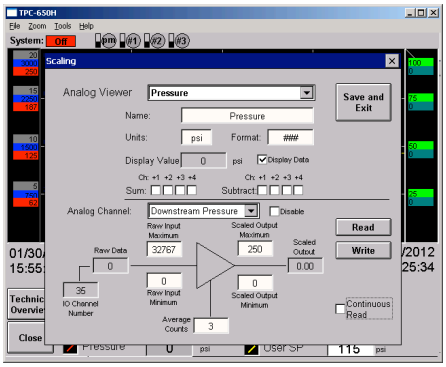


Figure 64: Analog Scaling

ActiveX and IP Updates

Tap [ActiveX and IP Updates] from the Options Setup Menu.

By default both ISSymbol URL and Agent URL are automatically populated.

View Current Configuration: View the entire URL in a popover screen.

Set Configuration: Set and save new web configurations.

Email: Get notifications via email.

Tap [Close] to return to the Options Setup Menu.

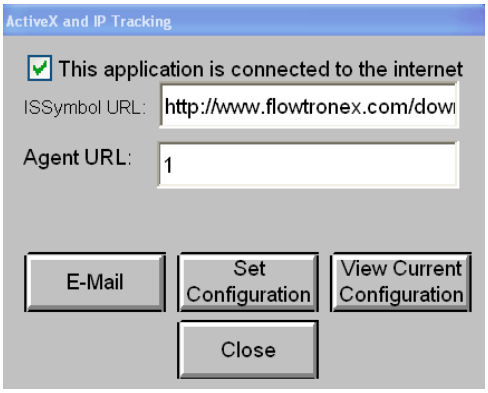


Figure 65: ActiveX and IP Updates

WinCE Remote Access

Tap [WinCE Remote Access] from the Options Setup Menu.

This screen allows you to communicate with a remote server using Telnet. This feature is intended for advanced custom jobs.

CAUTION:

Before using this feature or changing any settings on this screen, please call customer service.

Tap [Close] to return to the Options Setup Menu.

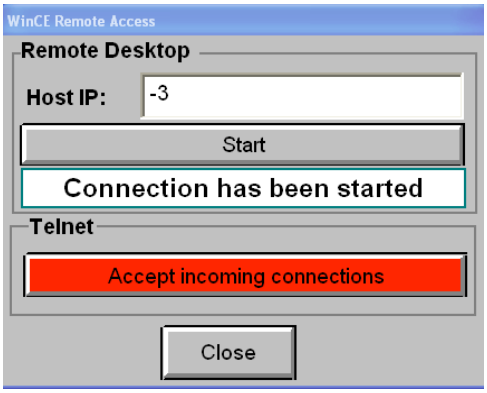


Figure 66: WinCE Remote Access

Alternate SP

Tap [Alternate SP] from the Options Setup Menu.

Enter and store different alternate setpoints in the pop up screen for Pressure SP and also alternate setpoints for Fertigation SP.

Tap [Close] to return to the Options Setup Menu.

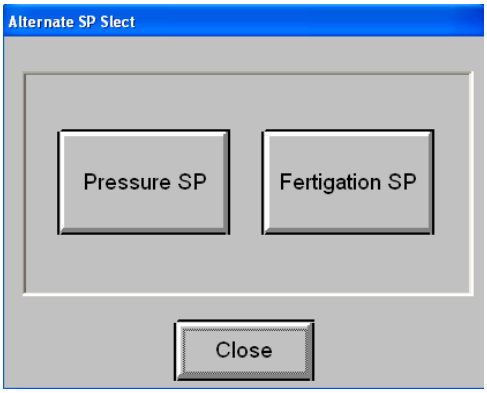


Figure 67: Alternate SP

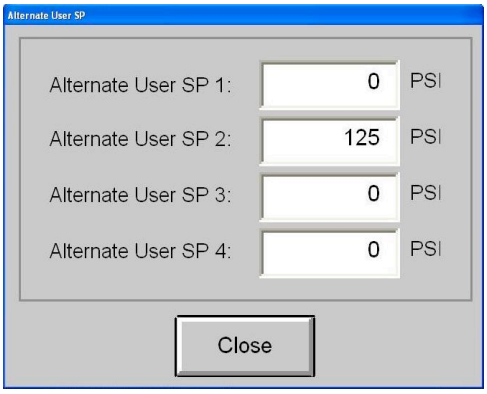


Figure 68: Pressure SP

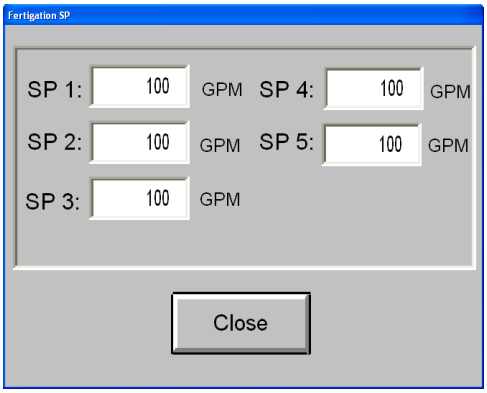


Figure 69: Fertigation SP

Database Settings

This feature helps make changes to database settings. The database is used to send and receive information from the irrigation control system. The "Gateway" software should be installed on the irrigation computer and network connections confirmed before enabling the remote database connection.

The defaults will include:

Data Server: 192.168.1.15

Database:

For Windows "7" connected systems:

C:\Program Files (x86)\Flowtronex\FlxStationDataII.MDB

For Windows XP and earlier systems:

C:\Program Files\Flowtronex\FlxStationDataII.MDB

Enable Remote: Checked.

Note:

The database should only be enabled after installing the "Gateway" software on the irrigation PC. While the system will operate correctly, unnecessary events and exceptions are generated which can load the HMI processor and take up valuable event-table space.

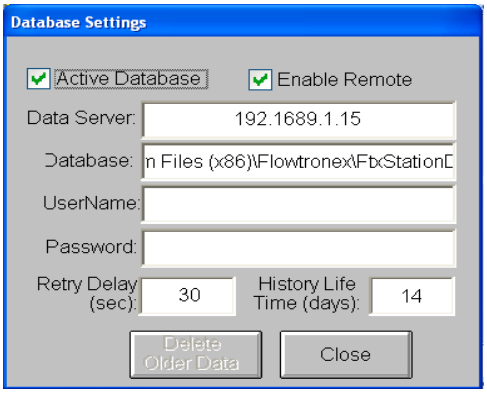


Figure 70: Database Settings

After enabling the database connection, the HMI must be restarted with the Gateway software running on the host irrigation computer. This can be accomplished through cycling power or by shutting down and restarting the application.

Email Settings

This page allows you to set up email addresses where Alarm and shutdown messages will be sent. These emails will notify the user if the station has shut down or experienced a problem that the site personnel should be aware of. This way the user will be notified immediately in case of a pump station problem. If a fault occurs, an email will be sent to him.

The email settings can be configured to send emails to multiple individuals or email addresses. The vast majority of cell phone providers also allow email messages to be sent to cell phones as text messages. A list of known formats is provided below.

Enable: Check this box to enable email alarms from the Pace controls.

Use Authentication: Check this box if your email service requires POP3 authentication.

Note: The IP address of the POP3 server must be the same as the IP address of the SMTP server. This is usually the case (both servers usually reside behind the same firewall/router).

To: Enter the email address to send the alarm messages to. Multiple email addresses can be

entered by separating the email addresses with a semicolon.

Examples: Me@gmail.com; TheBoss@test.com; SecondGuy@test.com; 555555555@verizon.net.

The following list shows email address formats for various cell carriers. Sending an email to these addresses will generate an SMS text message to the cellular phone.

T-Mobile: phonenumber@tmomail.net

Virgin Mobile: phonenumber@vmobl.com

Cingular: phonenumber@cingularme.com

Sprint: phonenumber@messaging.sprintpcs.com

Verizon: phonenumber@vtext.com

Nextel: phonenumber@messaging.nextel.com

US Cellular: phonenumber@email.uscc.net

SunCom: phonenumber@tms.suncom.com

Powertel: phonenumber@ptel.net

AT&T: phonenumber@txt.att.net

Alltel: phonenumber@message.alltel.com

Metro PCS: phonenumber@MyMetroPcs.com

Where "phonenumber" is the 10 digit phone number of the user.

SMTP: Enter the IP address of the SMTP server you will be using. Windows CE devices require the IP address rather than the server name.

See "Determining the IP address of the SMTP server" in Appendix F for these instructions.

From: Enter the complete email address used for this service. Most email servers will ignore your email request if the "From" address does not match the account.

Example: mypumpstation@runbox.com

User: For most email service providers, enter the first part of the email address without the domain name. Note that some providers require the full email address as your user name.

Example: mypumpstation

Password: The password to your email account.

Example: flowtronex

After configuring your email settings, test the setup.

Tap [Set] to load the information into the email generator. Then tap [Send]. A test email will be immediately sent to the address(es) provided.

If the colored box remains green after hitting Send, the configurations are working correctly. If the box turns red there has been an error. The number after "Status" indicates the type of error, table for which can be found in Appendix F. Additional troubleshooting options for email configuration can also be found in Appendix F.

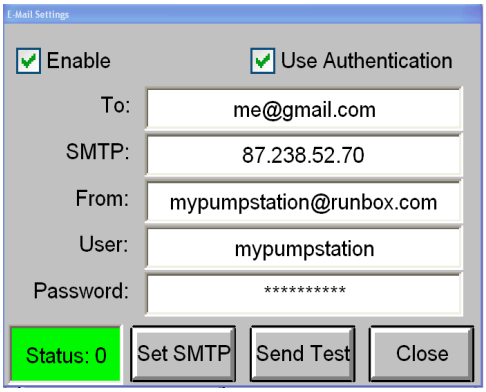


Figure 71: Email Settings

Occaisionally, the settings changes here may require restarting the HMI. Try this if you experience problems getting the test email to work. This can be accomplished through cycling power or by shutting down and restarting the application. Then see appendix "F" for other troubleshooting aids.

Setup/Configuration File

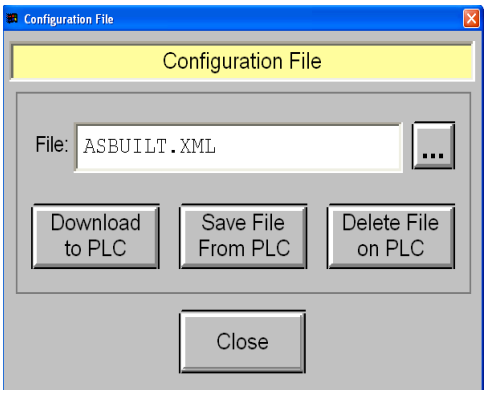
Tap [Setup File] from the Home screen.

Type the file name or browse for it using […].

The Configuration File screen lets you download an XML file to the PLC, save an XML file from the PLC, or delete an XML existing file on the PLC. The XML configuration files contain the setup settings for your pumping station.

CAUTION:

Downloading an incorrect XML file to the PLC may render the system inoperable. Ensure you have the correct file before selecting [Download to PLC].



Exit Application

Tap [Exit] from the Home Screen.

Exit will close the HMI interface and exit the application. When [Exit] is tapped, the CEView desktop is then displayed that gives the user the ability to change operating system files. A warning appears asking you to confirm your decision.

CAUTION:

No changes should be made to the operating system unless directed by a Flowtronex Customer Service technician. Functionality of the HMI and the pumping station may be affected by changes.

Figure 73: Exit App Warning

Networking and Remote Access

The general instructions and screen-shots provided in this manual for operating the HMI may be used when accessing the interface via the internet on a personal computer.

For instructions related to configuring your personal computer, please see appendix G.

Please note that when using a personal computer, the touch-screen functionality is not available. To navigate the screens:

- Click on the buttons with your mouse.
- Use your mouse to click in a blank field. Enter text or numbers using a standard PC keyboard.

Remote Software Log In

An identical version of the HMI software may be accessed remotely by an Internet IP (Internet Protocol) address. Type the following address into an internet browser:

From within your network (at the maintenance facility), open your web browser and type the following URL into the address line: http://192.168.1.15. This will take you directly to the HMI's web server.

To access your pump station from outside of your network, you must first determine the IP address of the router as seen from the internet. Note that this can be somewhat difficult to determine without help from your IT department (if you have one). The router IP address can be found through the use of 3rd party IP address resolution sites (available on the internet) or by navigating the router's administration pages.

In the pop up screen, enter your username and password to log in.

After the HMI interface opens, the user type (from Guest to Supervisor) may be changed by the standard procedure described for touch panel log in.

Web Reports

Internet users of the HMI interface can also view and print different reports. There is an Alarms Report, Historical Report, Usage Report, and Factory Reports. The navigation bar allows the user to access each report's setup screen and print the report. The trends screen can also be customized, a feature which is unavailable in the local HMI interface.

Log on to Web Reports

Log on to the reports menu by typing the following in the address bar of your browser:

http://000.000.000.00/reportmenu.html

where *000.000.000.00* is replaced by your IP address. Enter you username and password in the log in screen displayed. Click [OK] to submit or [Cancel] to cancel.

You can obtain your IP address through your IT department or internet service provider.

Web Reports Menu

After logging in, web reports menu is displayed containing the following buttons, Login, Trend View, Alarms Report, Historical Report, Usage Report, Factory Report, Print Setup, Print, and Exit.

NOTE: Factory Report is available only to a supervisor or technician. It includes a list of values of various PLC registers and is not covered further in this guide.

The banner at the top shows the current date and time. Using this bar, alarm reports, usage reports (in gallons), and several setup files in .xml format. All reports can be printed. Use [Exit] to exit the reports menu.

Figure 74: Web Reports Menu

Trend View

Select [Trend View] from the Web Reports Menu.

There are four key parts to the trends screen.

❶ **Mean Value Graph and Detail:** For each of the key variables (Flow, Pressure, Speed, and Setpoint) the mean values are displayed as a vertical bar graph on the top while the Maximum values are displayed in fields below.

❷ **Pump Run Log**: Graphically displays the pump operation for the time frame selected. These are color coded:

- Green - indicates pump is running
- Blue - indicates pump is running on VFD.
- Red - indicates pump is in a fault condition.

❸ **Variables Graph**: Line graph displays color-coded information for key variables over a specified time. The top bar of the graph also has zoom, period, and legend options. The grid below displays variable data. Click […] to choose line colors. Choose the start date, time and duration for the graph from fields positioned between the graph and grid.

❹ **Events Listing**: Details the time and events for a duration time defined by the user, as for the variables graph.

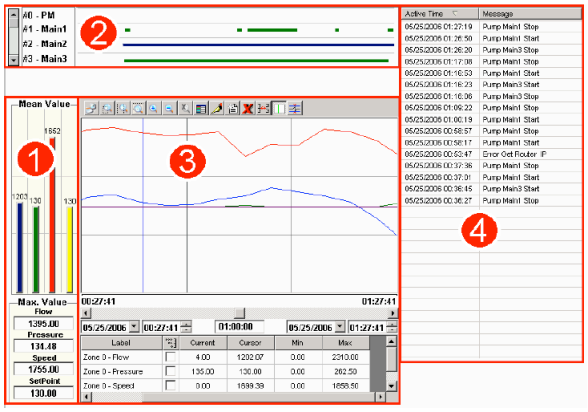


Figure 75: Trends View

Alarms Report

Select [Alarms Report] from the Web Reports Menu.

Alarms Report allows you to view the last 10 system alarms and events.

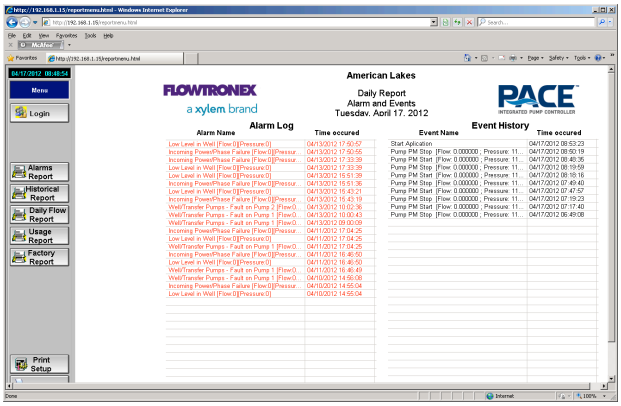


Figure 76: Alarms & Events

All reports can be printed using [Print], after a printer has been set up by clicking on [Print Setup].

Historical Report

Select [Historical Report] from the Web Reports menu.

Historical Report allows you to access the data and bar graph representation of your station's Annual, Monthly, and Weekly Flow information. The actual gallons are shown in the data table on the left, and three bar graphs (annual, monthly, and weekly) on the right.

All reports can be printed using [Print], after a printer has been set up by clicking on [Print Setup].

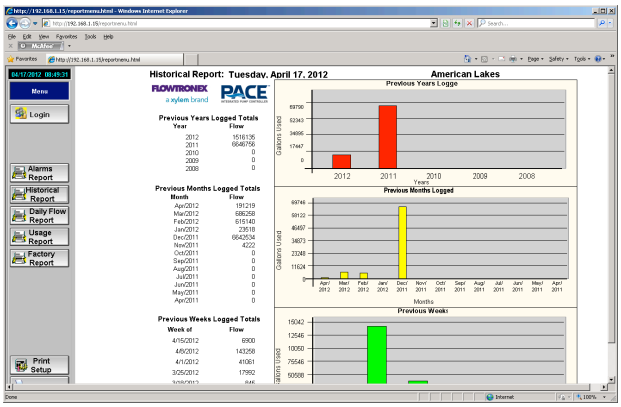


Figure 77: Historical Report

Usage Report

Select [Usage Report] from the Web Reports Menu.

Usage Report allows you to view the totalized flow values for each day, week, month, and year. The table in the middle on the left shows the times or counters when totalizers reset. Table on bottom left shows the number of starts, and runtime hours for each pump.

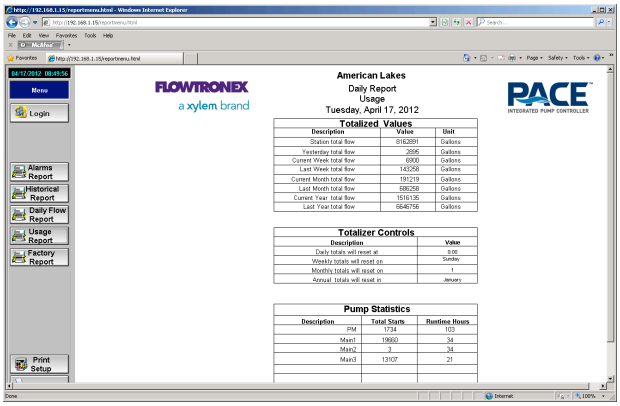


Figure 78: Usage Report

Smart Phone and PDA access:

A simpler web page is available for smart phone access. The IP address of this page is the external address determined in appendix "G", but a specific page address is required to access the simplified page: "<myIPAddress>/sma/logon.asp" where <myIPAddress> is the external IP address. Note that "192.168.1.15" will never be the correct address since the smartphone or PDA is always attempting to access the page from outside your network.

Appendix A–Glossary of Terms

The terms used in this manual are defined in the Glossary of Terms. In addition, other industry specific or product-specific terms are included that may be used by technicians or customer service when talking about your pumping system.

Across-the-line (XL)	Applying 100% of line voltage to a motor during startup and run. A simple large relay with a contact for each power phase (for 3 phase) is used to control the motor OFF/ON.
Analog	A signal that varies in some respect (voltage, current, frequency) in order to convey the value of some real world information (i.e. pressure, flow, temperature etc). A control system can take action based on the value of such a signal. Internally, the signal will be converted to some number based on the value of the signal.
Automatic lake screen	(ALS) A screen on the intake flume of the pump station, between the irrigation pond and the wet well, which is designed to be self cleaning by using a jet of clean water spraying from the inside-out during use.
Booster	A pump designed to increase the pressure of a pressurized irrigation line. This is usually used to move pressurized water from a lower to higher elevation area of the golf course.
Calibration	The act of or specific values used to scale the output of a measurement device to read real-world values.
Chemical injection	The process of adding chemicals to irrigation water to fertilize or medicate turf grass.
Combo	A capacity level representing a predefined group of pumps on a station. Normally Combos are defined as follows:
Combo 1	Normally the PM pump.
Combo 2	Lead pump. Normally the VSP.
Combo 3	Lead pump and first lag pump.
Combo 4	Lead pump and two lag pumps.
Control valve	A valve designed to automatically open/close in order to maintain a specific setpoint pressure, flow, or level.
Control variable	A value that a control system monitors in order to perform some useful function.
Cycling	This condition occurs when conditions require a pump to start if no pump is running, but require a pump to stop if a pump is running. This is excessive starting and stopping of one or more pumps and can be damaging to the equipment if allowed to continue.
Equal HP pumps	Also referred to as interchangeable pumps. Defines which pumps are available to start based on lowest run time. VSPs and XL pumps are defined in the PLC program. An XL pump can be an equal HP pump, but it will not start as a lead pump, because the lead pump will always be a VSP.

Filter	A device used downstream of the pumps to clean the water being pumped into the irrigation. These devices are typically self-cleaning, but require hardware/software to self-clean.
Fixed speed	Pumps run at a fixed RPM, defined by the motor windings and the frequency of the line voltage (50/60 Hz).
Frequency	(Hz) The number of oscillations per second of any system. Typically used to refer to electrical systems, such as AC power line frequency, or variable speed drive output frequency. This frequency defines the speed of an AC motor.
GPM	Gallons per minute. Units of flow for US use.
HSS	High speed switching. Starting pumps with a VFD to reduce inrush current and provide pressure control, but able to switch over to fixed speed so that the VFD is able to start another pump.
Input	A way for a control system to detect real-world occurrences. These can be digital or analog.
Inverter	Another term for Variable Frequency Drive (VFD). Actually, more correctly applied to the output circuitry of the drive, which converts DC voltage to AC voltage.
Lag pump	A pump used later in the pump sequence to support increasing irrigation demand requirements. The term lag simply refers to the fact that it does not start first.
Lake fill	(LLC) A circuit designed to keep a pond or lake at or above some minimum level of water.
Lead pump	The pump in a lead group which is chosen by the controller to start first. This is usually determined by finding the pump in the lead group with the lowest run-time.
Lockout	A system which limits the pump systems available pumps and or limits the speed of a variable speed pump during user-defined time of day or day of week.
Low level probe	A device that “shorts” out when removed from water. This removes the signal from the PLC and tells it that the pump is not safe to run due to a low water level condition.
Main pumps	The pumps which are relied on for supplying the irrigation at mid-high flow rates.
Must-run time	The amount of time (in seconds) that the pump must run.
Output	A way for a control system to generate real world actions. An output can be a 120VAC signal to turn on a pump, or a varying 4-20 mA signal to control the speed of a VFD. Many types of output are available.
Overload	A condition in which pumps are allowed to produce more flow rate than the motor that drives them is designed for. Also refers to a device in the control panel, which detects this situation and stops the pump in order to protect it.
Overpressure accumulator	A counter that is used to determine the lag pump shut down sequence.

Phase monitor	A device that analyzes incoming voltage and determines whether all voltage parameters are acceptable and the phase sequence is correct.
PLC	Programmable Logic Controller. A very robust/rugged computer designed for equipment control in harsh environments.
PM pump	Pressure Maintenance Pump. Handles very light flow rates and leaks to prevent the main pumps from cycling.
Pressure reducing valve	(PRV) A control valve designed strictly for maintaining a specific downstream pressure.
Pressure transducer	A device that converts actual pressure to a 4-20 mA signal that is input into the PLC which converts it back to an actual pressure reading.
PSI	Pounds per square inch. Units of pressure for US use.
Relay	This is a normally open or normally closed device that changes output state when it is energized or de-energized and sends or removes a 120VAC signal to the PLC.
SCADA	Supervisory Control And Data Acquisition.
Setpoint	The desired situation for a control variable. If the user wanted the irrigation system to operate at 120 PSI, that would be the setpoint for the controller.
Speed test	The method used to shut down a VSP during normal automatic operation.
Transfer pump	A pump designed to move water from one reservoir to another.
Units	Gives context to numbers in the PLC. Units describe what the number is about, such as PSI, GPM.
VFD	Variable frequency drive. This allows a pump to run at variable speeds.

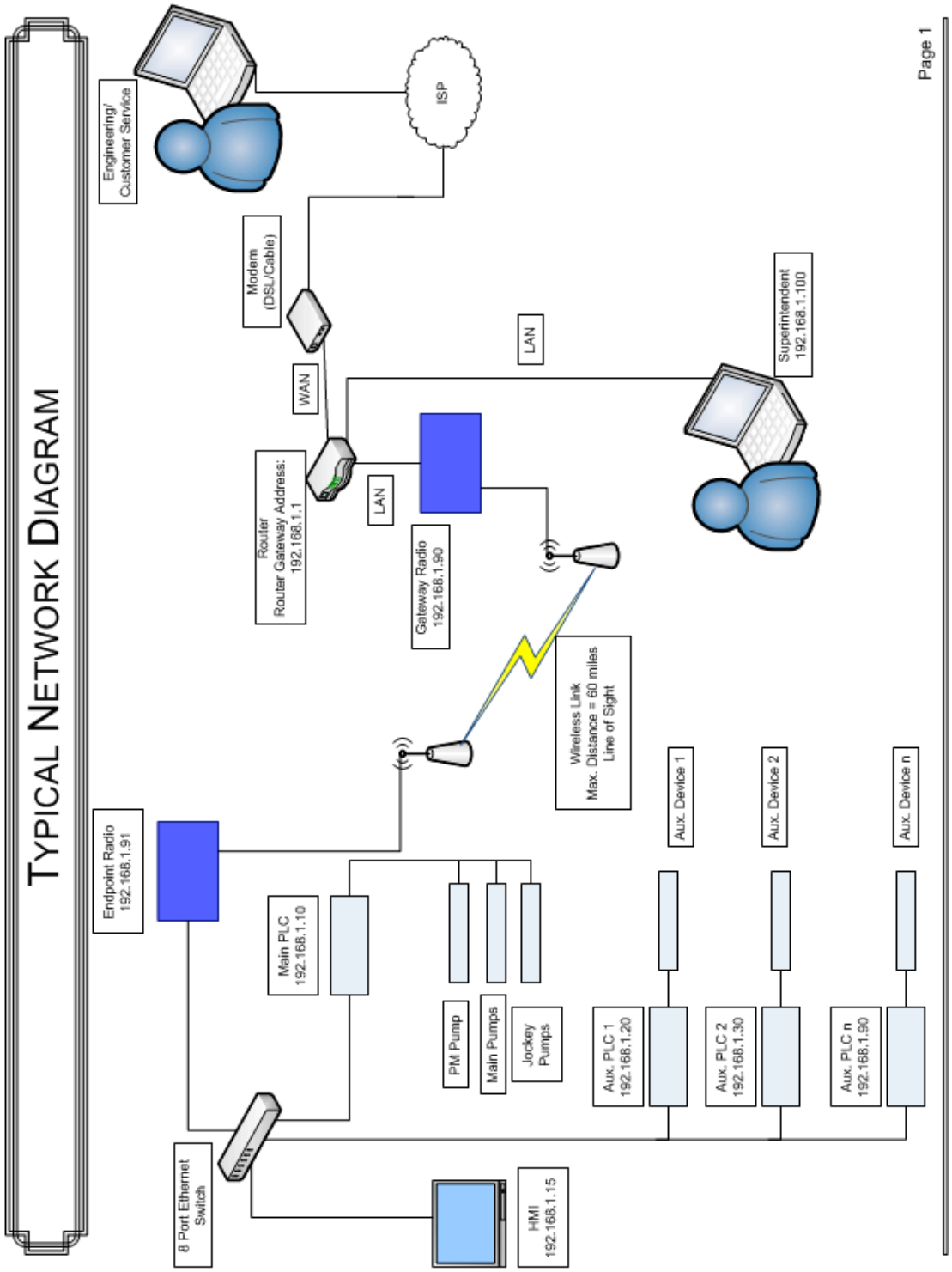
Appendix B – Panel Switch Settings

The following table shows the results of different switch settings on the main enclosure panel:

		Panel Switch Position								Contactor Position		
		SYSTEM			PUMP #			BYPASS VFD		VFD	XL	
Pump Type	Mode of Oper.	Test	Off	Auto	Hand	Off	Auto	Yes	No	Contactor / Enable	Contactor	Speed Control?
Lag, Lead, Jockey	Manual	N/A	N/A	N/A	False	True	False	N/A	N/A	Off	Off	None
	Manual	N/A	N/A	N/A	True	False	False	N/A	N/A	Off	On	None
	Test	True	False	False	False	False	True	False	True	On	Off	Speed Pot.
	Test	True	False	False	False	False	True	True	False	Off	On	None
	Auto	False	False	True	False	False	True	False	True	On	Off	PID Normal
	Auto	False	False	True	False	False	True	True	False	Off	On	None
PM (VFD)	Manual	N/A	N/A	N/A	False	True	False	N/A	N/A	N/A	N/A	None
	Manual	N/A	N/A	N/A	True	False	False	N/A	N/A	N/A	N/A	None
	Test	True	False	False	False	False	True	N/A	N/A	N/A	N/A	60 Hz Fixed
	Auto	False	False	True	False	False	True	N/A	N/A	N/A	N/A	PID Normal
PM (XL)	Manual	N/A	N/A	N/A	False	True	False	N/A	N/A	N/A	N/A	None
	Manual	N/A	N/A	N/A	True	False	False	N/A	N/A	N/A	N/A	None
	Test	True	False	False	False	False	True	N/A	N/A	N/A	N/A	60 Hz Fixed
	Auto	False	False	True	False	False	True	N/A	N/A	N/A	N/A	None

Table 1 – Enclosure Panel Switches

Appendix C – Networking Options



Appendix D–Typical Alarms Configuration

Alarm / Fault Name	Auto Reset Available	No. Reset Attempts	Type of Alarm	Alarm Delay (SEC)	Alarm SP (PSI)	Delay Time (SEC)
Low Discharge Pressure	No Auto Reset	N/A	Required	300	25	N/A
High Discharge Pressure	Auto Reset Allowed	3	Required	60	15	60
Low Level (in well or transfer pumps).	Auto Reset Allowed	3	Required	5	N/A	60
VFD Failure	Auto Reset Allowed	3	Required	2	N/A	60
Aux(iliary) Device Failure	Auto Reset Allowed	3	Optional	Var.dep. on type	N/A	60
Low Inlet Pressure	Auto Reset Allowed	3	Optional	20	N/A	60
Phase Failure	Auto Reset Allowed	3	Required	1	N/A	60
Low-Temperature Fault	Auto Reset Allowed	3	Optional	20	N/A	60
Loss of Prime	Auto Reset Allowed	3	Optional	20	N/A	60
Analog System Failure	Auto Reset Allowed	3	Optional	20	N/A	60

Table 2 – Default Alarms / Faults

Appendix E – Default IP Addresses for Auxiliary Devices

Integrated devices are all addresses at the Main PLPC's IP address, normally 192.168.1.10.

Non-Integrated (Legacy) Devices:

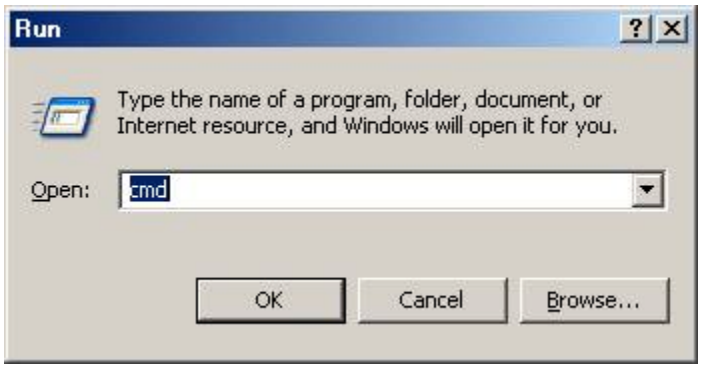
Auxiliary Device	IP Address
Booster	192.168.1.20
ALS	192.168.1.10 (Included on Main PLC)
Lake Level Control	192.168.1.40
Timed Pump	192.168.1.50
Simple Filter	192.168.1.60
Scanners	192.168.1.70

Table 3 – Assigned IP Addresses for Non-Integrated (Legacy) Auxiliary Devices

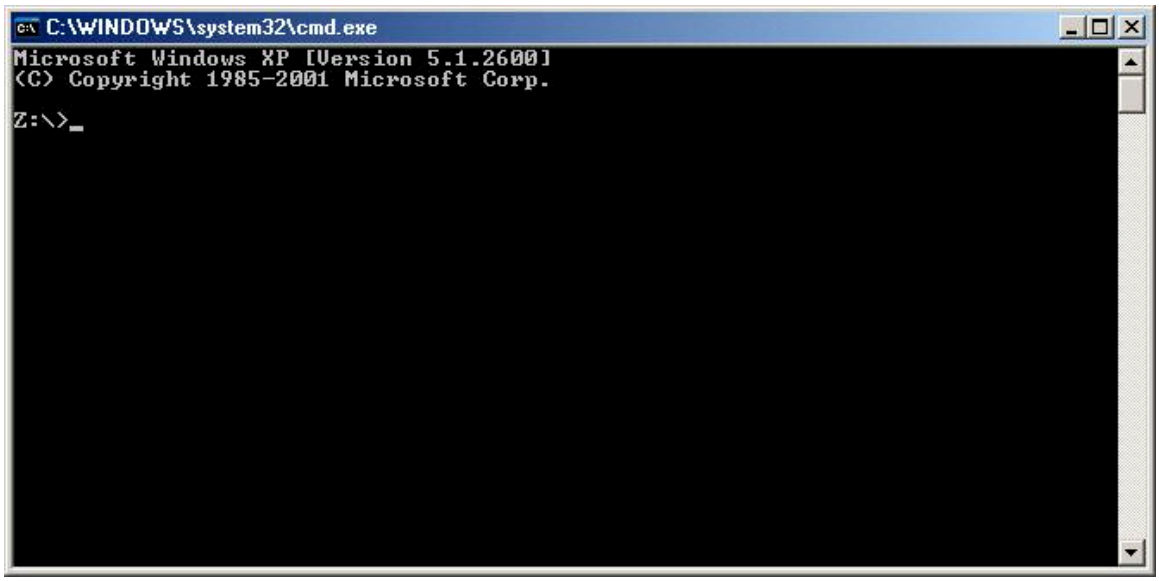
Appendix F – Email Troubleshooting

DETERMINING THE IP ADDRESS OF THE SMTP SERVER

On your Windows PC, Click “Start”, “Run”, type in “CMD” in the dialog and press enter.



You will see a DOS prompt window similar to that below.



Type “ping” followed by the server name of your SMTP service. Your email provider will be able to supply these server names as a standard part of the information needed to set up your email for outlook or other email programs.

```
C:\WINDOWS\system32\cmd.exe
Microsoft Windows XP [Version 5.1.2600]
(C) Copyright 1985-2001 Microsoft Corp.

Z:\>ping smtp.runbox.com

Pinging smtp.runbox.com [87.238.52.70] with 32 bytes of data:

Reply from 87.238.52.70: bytes=32 time=181ms TTL=43
Request timed out.
Reply from 87.238.52.70: bytes=32 time=194ms TTL=43
Reply from 87.238.52.70: bytes=32 time=199ms TTL=43

Ping statistics for 87.238.52.70:
    Packets: Sent = 4, Received = 3, Lost = 1 (25% loss),
Approximate round trip times in milli-seconds:
    Minimum = 181ms, Maximum = 199ms, Average = 191ms

Z:\>
```

Look at the line following your command entry, this will contain the IP address of the SMTP server. In this case, smtp.runbox.com is at IP address 87.238.52.70.

```
C:\WINDOWS\system32\cmd.exe
Microsoft Windows XP [Version 5.1.2600]
(C) Copyright 1985-2001 Microsoft Corp.

Z:\>ping pop.runbox.com

Pinging aibo.runbox.com [87.238.52.70] with 32 bytes of data:

Reply from 87.238.52.70: bytes=32 time=181ms TTL=43
Reply from 87.238.52.70: bytes=32 time=180ms TTL=43
Reply from 87.238.52.70: bytes=32 time=184ms TTL=43
Reply from 87.238.52.70: bytes=32 time=182ms TTL=43

Ping statistics for 87.238.52.70:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 180ms, Maximum = 184ms, Average = 181ms

Z:\>
```

Double-check the POP3 server for the same IP address. Same procedure, but use your pop3 server name in the ping statement.

TROUBLESHOOTING GENERAL EMAIL FAILURES

The following are some common problems encountered when configuring email settings. Double check each setting to ensure the correct information was entered.

1. Attempting to use the server name rather than the IP address in the SMTP field.
2. Using an incorrect IP address - determine the IP address from the procedure above.
3. Entering an invalid user. Make sure the user field matches the account. Also make sure the “From” field matches the user information exactly.
4. Inputting an incorrect password.
5. The mail service does not support SMTP
6. Your internet service provider does not allow access out of your network on TCP/IP port 25.

Troubleshooting Email SET Failures

The following table gives the number codes associated with failures received after tapping [SET] to set the SMTP:

0	Success
1	Invalid format for strSMTP
2	Invalid format for strFrom
3	Invalid format for strPOP3
4	Invalid format for strUser
5	Invalid format for strPassword
6	Invalid format for optNumTimeout
7	Wrong number of parameters
8	Error getting host IP address (invalid POP3 server)
9	Error connecting to POP3 server
10	Error sending username
11	Error sending password
12	SMTP server does not support selected authentication mode
13	Invalid SMTP username
14	Authentication failed

Table 4: SMTP error Codes, Set SMTP Function

Troubleshooting Email Send Failures

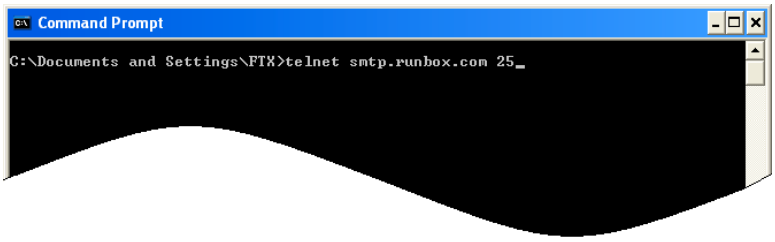
The following table gives the number codes associated with failures received after tapping [SEND] to do a test-run of the email addresses and the SMTP:

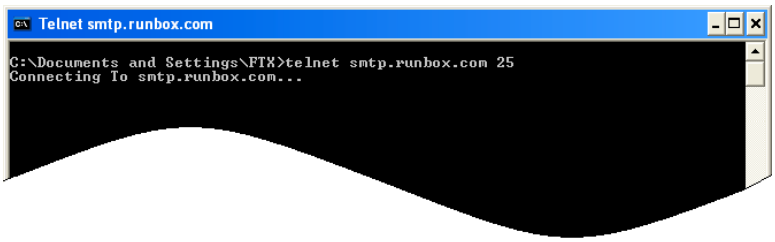
Value	Description
0	Success
1	Invalid format for parameter 1 (`Subject`)
2	Invalid format for parameter 2 (`Message`)
3	Invalid format for parameter 3 (`To`)
4	Wrong number of parameters
5	Start Socket error
6	Error getting host IP Address (i.e. invalid SMTP server)
7	Error connecting to SMTP server
8	Error sending HELO command (initialization)
9	Error sending MAIL command (sending FROM address)
10	Error sending RCPT command (sending TO address)
11	Error sending DATA (sending message)

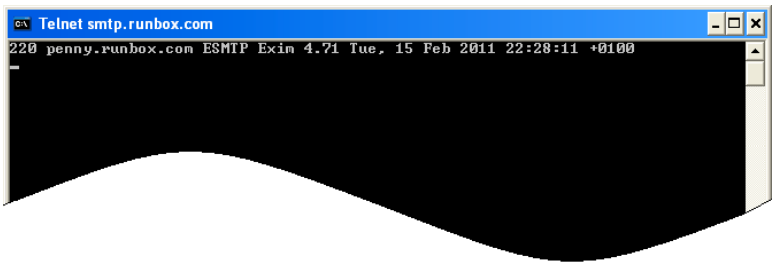
Table 5: SMTP Error Codes, Test Email Function

The following test can be used to check for access to the SMTP server:

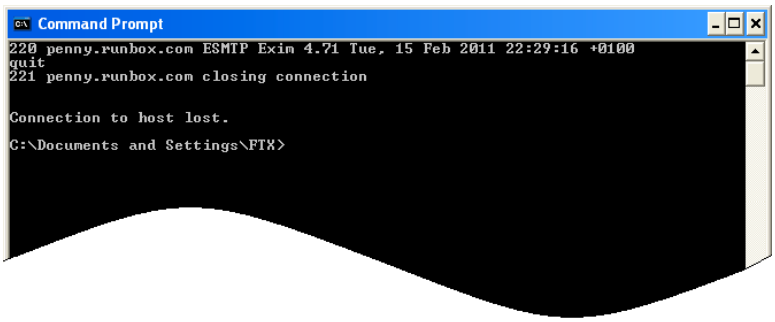
- Open a command window as in checking for the IP address above.
- Use Telnet to attempt to connect to smtp.runbox.com on port 25 (or your email servers name)



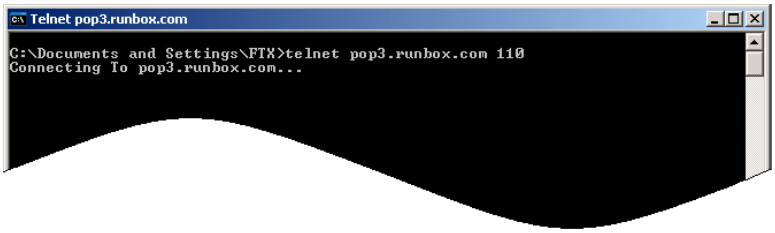


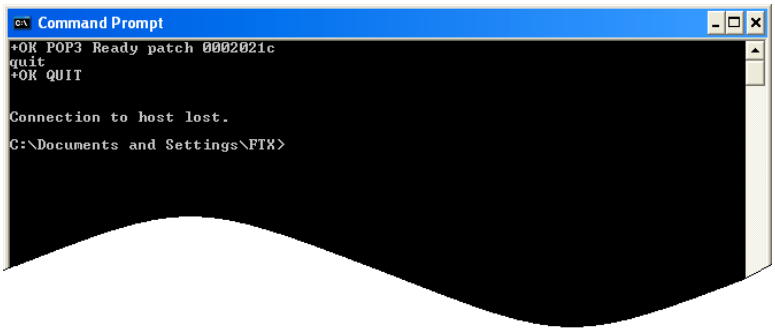


- If successful, be sure and type “quit” <enter>. It’s bad form to leave the server hanging though it will reset the session itself.



- If you are unable to connect, attempt to Telnet to the POP3 server on port 110.





Successful Telnet to the POP3 server but unsuccessful telnet to the smtp server is typical of a port 25 block by the ISP. They often block port 25 to prevent spammers from using home and unwary business accounts for spam generation. A call to your ISP will usually resolve the problem quickly. You may have to ask for advanced technical service as this scenario isn’t on the standard script for call-center type service.

Appendix G: Computer Setup and Determining the IP address of your pump station

In order to access your pump station and to integrate your pump and irrigation systems, you will need to install the software that came with your pump station. Note: Pace will integrate only with Toro Lynx irrigation systems at this time, though some level of interface is planned for other irrigation system controls at a future time. This is the CD called the Flowtronex Gateway. Place this CD in your CD ROM drive. The install program should start immediately but if not navigate to the CD Rom and run the “Setup.exe” program. This will lead you through the installation process. If you are integrating your irrigation and pump systems, be sure and select “Install Gateway”. By default the disk will install the ISSymbol control, required for web access to the pump station.

Connecting to the pump station after the hardware is installed is relatively easy. The first step is to connect your PC to the network. This simply means your PC will be connected to the LAN side of the router supplied by Flowtronex. Step 2 is to set the IP address of your PC. This will be the IP address set in the database settings page of the HMI in order to share information with the irrigation system controls (Toro Lynx). Note that these IP addresses do not need to match if you aren’t using the Gateway to interface with your irrigation system, in most cases you will not have to do any more than plug your computer in to your router using a CAT 5 ethernet cable.

If you plan to interface your pump station controls with your Irrigation controls, then a fixed IP address for your PC is required to make sure the pump station is able to send data to the PC. To check/set your computers IP address, go to the Network and Sharing center (Control panel on Windows XP).

Click Local Area Connection.

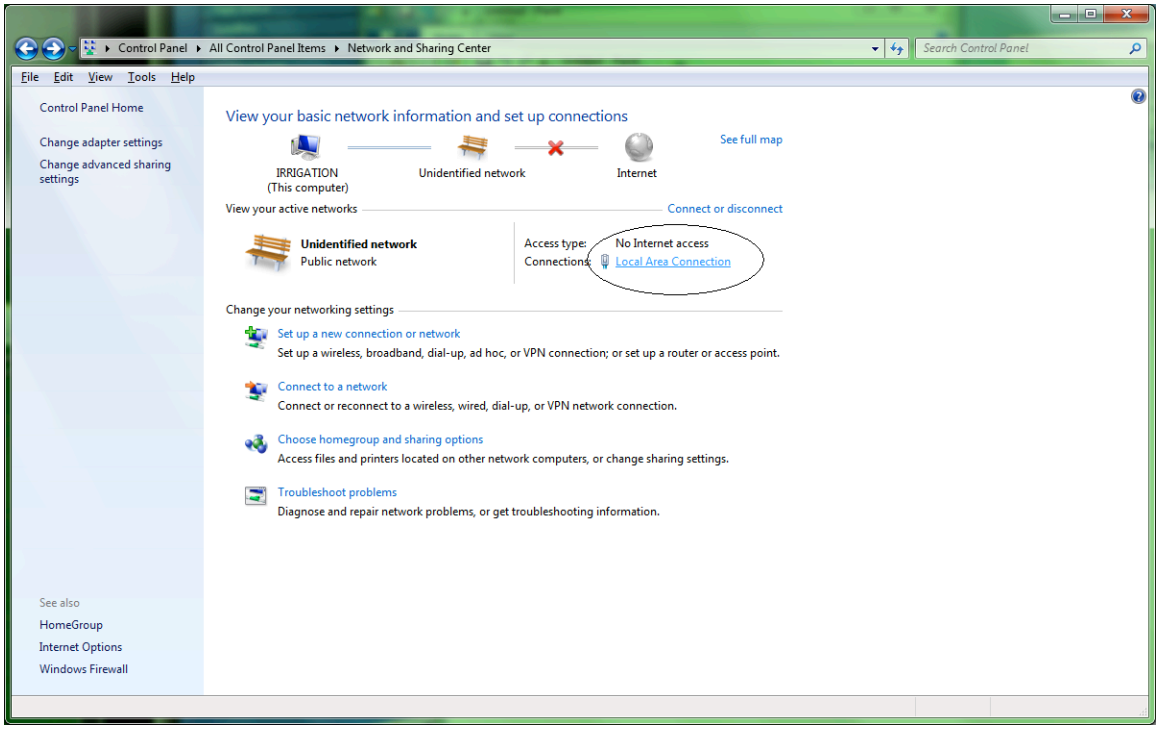
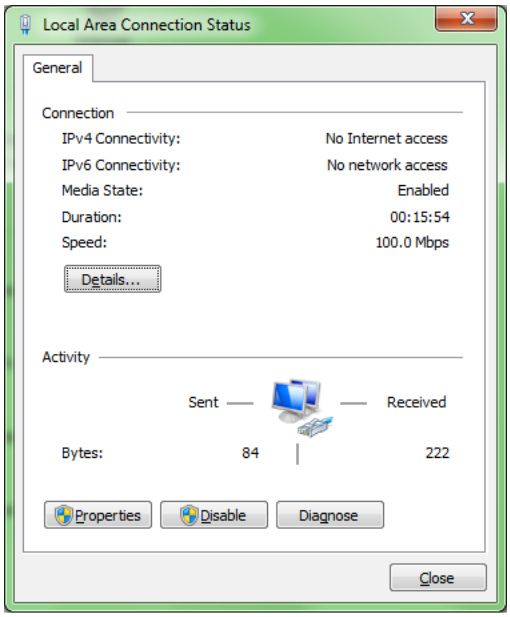
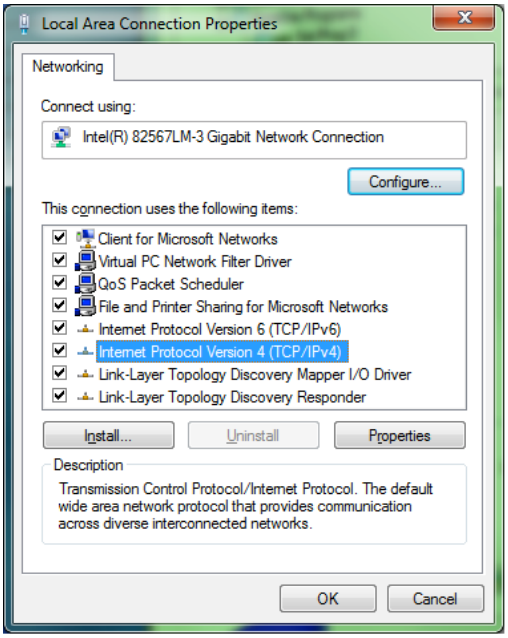


Figure 79: Computer Setup Options

Another window will come up. Select Properties:

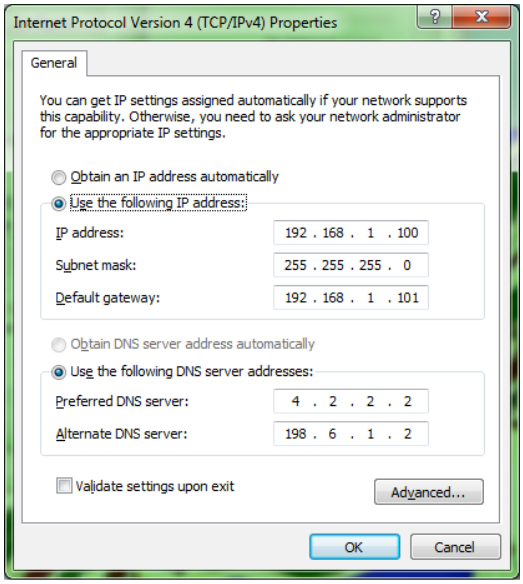


Highlight Internet Protocol (TCP/IP). If there are two entries, one for v6 and one for v4, select v4 as shown. Then select Properties.



Select “Use the following IP address”

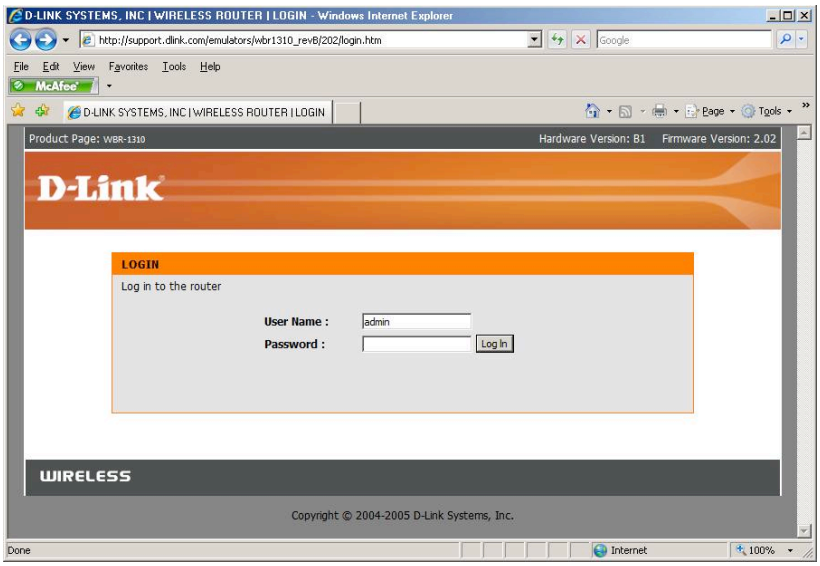
Check with your IT department or internet service provider for proper DNS server settings. These should be no different than your settings before installing the router.



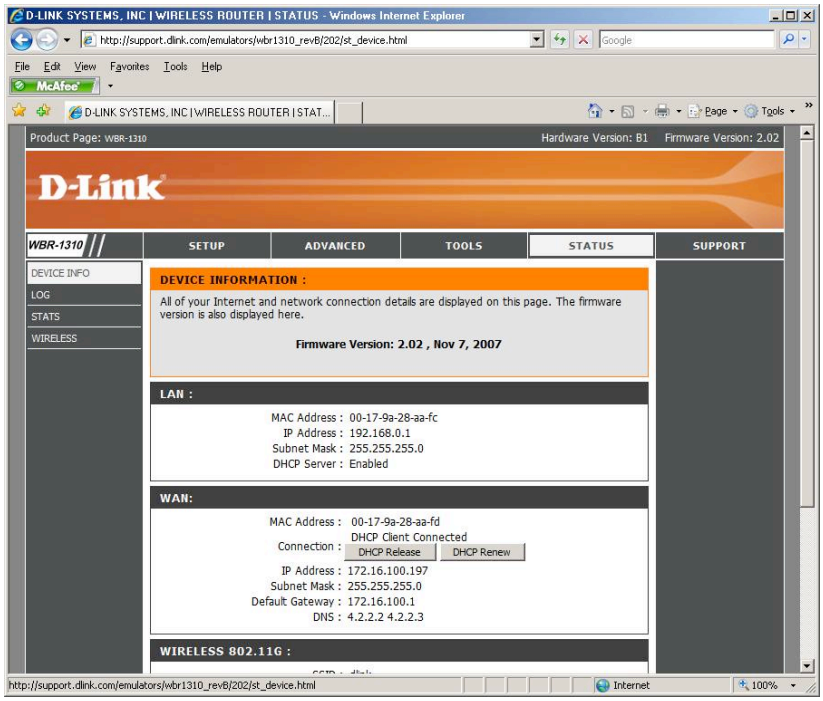
DETERMINING THE IP ADDRESS:

Determining the IP address to use to communicate with your pump station remotely can be as easy as asking your IT professional, or somewhat more complicated, requiring you to access your routers status page. Chances are if you have an IT department, they will have to be involved in setting up your router and should be able to provide you with an IP address. They will need to provide a path for port 80 to the router provided by Flowtronex. This router is already set up to port forward the request to the pump station.

If you are connected directly to the internet through a cable or DSL modem, you can find your IP address by accessing the routers status page. With the Ethernet cable connected between your PC and the router, open your internet browser and type in the address http://192.168.1.1. The login page for the router should appear. Use the user name “admin”, the password has been left blank, simply click “Log in”.



Select the “Status” page from the menu at the top of the screen. Scroll down the page to the “WAN” status to see the IP address assigned by your Internet service provider.



Please note, if your network is more complicated than a simple connection through a cable or DSL modem, please consult your IT department. The procedure outlined above can only supply the IP address of the router, and therefore the IP address of your PC, with reference to the network the router is connected to. If additional routers separate your PC from the outside network, your IT department will need to provide the correct IP address, and open ports to allow you access to your pump station information. If this becomes problematic, it is still possible to use the PC access services used for servicing your irrigation control computer to access your pump station information. In most cases, your pump station can still send email out of the network as required.

Appendix H – General Networking and Router Configuration Discussion:

Regarding the requirement for a fixed IP address: This is not a requirement of the Flowtronex Pace control system. This is required so the user attempting to access the system remotely can find the machine on the internet. Without a fixed IP address, the computer is at one of 4,228,250,625 theoretically possible addresses, though usually addresses are assigned within a specific range of a few thousand. The internet service provider typically assigned an IP address dynamically when the computer connects. The dynamic IP address won't affect messaging out, only accessing the station from the outside in. There are for-pay services for keeping track of your IP address via domain name, though these also come at a cost.

There are also often complications related to getting access to the router through any on-site networks. There tend to be one or two routers between the pump station router and "the internet", and each of those routers has to "pass through" or "forward" messages to the pump station router. This is a configuration issue for the routers in the chain and while not a complicated setup, communicating with and getting approval from local IT departments can be difficult.

On most systems, we have a single pump station the user needs to connect to remotely. If port 80 messages can be sent to our router, the user can access his pump station.
For example: Lets say their router is set up to pass requests to it (say it's 76.199.123.234) directly to the pump station router. The user types in:http://76.199.123.234

Their router forwards the message: http://192.168.1.1:80 along with the request data. The pump station router passes through port 80 traffic to 192.168.1.15 on port 80.
The HMI responds with a web connection. Anything that comes in to their router requesting data from port 80, get's "routed" to the pump station router on port 80, and the pump station router routes it to the HMI.

In another example, the IT router already passes traffic to another web server on port 80, so we can't use port 80. To work around this problem, IT can set their router up to pass port 81 traffic to us on port 80. We still route port 80 traffic to the HMI on port 80 at 192.168.1.15. Again, the web page on the HMI works, though the user will need to access the page by typing in: http://76.199.123.234:81 (The IP addresses used in these examples are fictitious, except for the "pump station router" which has its LAN side IP address set to 192.168.1.1, and all equipment on the LAN side of the router is in the 192.168.1.X range.

If there are two or more HMIs on site, the site router would have to pass multiple ports to our router, normally 80,81,82,83. We would then route port 80 traffic to 192.168.1.15, 81 to 192.168.1.16, 82 to 192.168.1.17, etc. They would just have to set their routing table up to give us all messages for port 80 to us at port 80, all messages for port 81 to us at port 81, etc. This idea can cascade to several routers. Also, in order for Flowtronex to remotely configure the router, port 8080 is used, but no routing is provided in the pump station router since the router itself provides the service (the router user name and password are labeled on the back of the router).

	Router 1	Router 2	Pump Station Router
WAN	76.199.50.60	10.92.168.10	192.168.0.12
LAN	10.92.168.1	192.168.0.1	192.168.1.1
Port Forwarding	80->10.92.168.10:80	80->192.168.0.12:80	80->192.168.1.15:80
	8080->10.92.168.10:8080	8080->192.168.0.12:8080	None (Router Configuration)

The user would access his station by requesting a web page at http://76.199.50.60 (default port is 80 for HTTP). Note how the pump station router, the last in the line, redirects the port requests to specific device (IP address) at the same port (80). All other routers are just passing along the message, keeping the port #s essentially intact. That doesn't have to be the case though, due to requirements of the IT department, or because some web server may be located at some level in the network, the network may have to look like this:

	Router 1	Router 2	Pump Station Router
WAN	76.199.50.60	10.92.168.10	192.168.0.12
LAN	10.92.168.1	192.168.0.1	192.168.1.1
Port Forwarding	2000->10.92.168.10:2000	2000->192.168.0.12:80	80->192.168.1.15:80
	2010->10.92.168.10:2010	2010->192.168.0.12:8080	None (Router Configuration)

The user would access his station by requesting a web page at http://76.199.50.60:2000 (The ":2000" specifies the browser to request the data at port 2000 rather than the default port 80). Note that the port # gets reset to 80 before the call to our router. In this case, no change of the pump station router settings would be required. But we could, as follows.

	Router 1	Router 2	Pump Station Router
WAN	76.199.50.60	10.92.168.10	192.168.0.12
LAN	10.92.168.1	192.168.0.1	192.168.1.1
Port Forwarding	2000->10.92.168.10:2000	2000->192.168.0.12:2000	2000->192.168.1.15:80
	2010->10.92.168.10:2010	2010->192.168.0.12:8080	None (Router Configuration)

When multiple pump stations are on the site, more than one port will need to be opened to be able to access all of the stations, either simultaneously or one at a time. Flowtronex sets up each HMI in a range. The first HMI is at IP address 192.168.1.15. The second is at 192.168.1.16. The third is at 192.168.1.17, and so on. In the previous example, now with three HMIs to access:

	Router 1	Router 2	Pump Station Router
WAN	76.199.50.60	10.92.168.10	192.168.0.12
LAN	10.92.168.1	192.168.0.1	192.168.1.1
Port Forwarding	2000->10.92.168.10:2000	2000->192.168.0.12:2000	2000->192.168.1.15:80
	2001->10.92.168.10:2001	2001->192.168.0.12:2001	2001->192.168.1.16:80
	2002->10.92.168.10:2002	2002->192.168.0.12:2002	2002->192.168.1.17:80
	2010->10.92.168.10:2010	2010->192.168.0.12:8080	None (Router Configuration)

The user would access Station 1 by requesting a web page at http://76.199.50.60:2000, Station 2 is located at http://76.199.50.60:2001, Station 3 is located at http://76.199.50.60:2002.

Generally, the WAN port of the pump station router is connected directly to the cable or DSL modem, so the complex routing configuration is not required. The pump station router is usually configured as follows:

	Pump Station Router
WAN	76.199.50.60 (Supplied by internet service provider)
LAN	192.168.1.1
Port Forwarding	80->192.168.1.15:80
	81->192.168.1.16:80
	82->192.168.1.17:80

Flowtronex is also capable of accessing the HMI and PLC in the pump station for diagnostic and programming purposes, with the aid of personnel onsite. This requires access to additional ports in the same way. Normally Flowtronex disables these ports in the pump station router to provide extra security, but can enable and disable this port forwarding for service. To support this capability, the IT department would need to provide a pathway into our router. Flowtronex will map the final port forwarding in the pump station router as required, so all the IT department would need to do is map through two unused ports to our router. The first example above is recreated below as an example.

	Router 1	Router 2	Pump Station Router
WAN	76.199.50.60	10.92.168.10	192.168.0.12
LAN	10.92.168.1	192.168.0.1	192.168.1.1
Port Forwarding	80->10.92.168.10:80	80->192.168.0.12:80	80->192.168.1.15:80
	8080->10.92.168.10:8080	8080->192.168.0.12:8080	None (Router Configuration)
	9000->10.92.168.10:9000	9000->192.168.0.12:9000	Programming:Not routed until needed
	9001->10.92.168.10:9000	9001->192.168.0.12:9001	Programming:Not routed until needed

Flowtronex will access the router configuration and port-forward as needed for the specific case, then after programming is complete, disable the port forwarding for security.

One problem encountered occasionally is having the same IP address range on BOTH sides of a router. That confuses the router. The Flowtronex pump station routers LAN side is set up at 192.168.1.x with a subnet mask of 255.255.255.0. That means all addresses 192.168.1.x are assumed to be inside the network. If the router's WAN side is assigned the address of 192.168.1.129, this will cause problems because the pump station router doesn't know where its LAN side ends (address wise) and where it begins. In that case, the pump station router will have to be configured with a subnet mask to 15 and restrict our internal addresses to use only the lower 4 bits for addressing. That could be a problem if there are devices on the network addressed higher than 192.168.1.15 (i.e. auxiliary equipment, power monitors, etc). In such cases, it may be required that we set the IP addresses in the equipment to another domain altogether (192.168.200.x for example). This is a non-trivial operation.

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