
XLS™ Integrated Pump Controller

HUMAN MACHINE INTERFACE (HMI) FOR THE TECHNOFORCE™ BOOSTER SYSTEM
USER GUIDE



Bell & Gossett
a xylem brand

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For additional questions, contact your local
Bell & Gossett Representative.

Introduction

This manual is written for booster station owners and is a basic overview to the XLS HMI (Human Machine Interface). For more detailed start-up/service please contact your local Bell and Gossett Representative. 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 TechnoForce Booster 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 XLS is a modular and scalable architecture that is used by the HMI (Human Machine Interface) to control a station's pumps. It handles a variety of changing conditions to operate the booster station using a touch panel display.

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 rated enclosure. The communication exchanges are made over Ethernet. The PLC is responsible for the real-time control of the system. 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.

Typical Pumping Operation

Several common control variables including flow, pressure, and level can be used for operating a booster 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 pumps, 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.

Other configurations are also possible. Consult your Bell & Gossett Representative for proper operation of your system.

Touch-Screen Panel Operation

This XLS HMI device manual describes the operation of the touch-panel display, located on the enclosure door of the control unit of the booster 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.

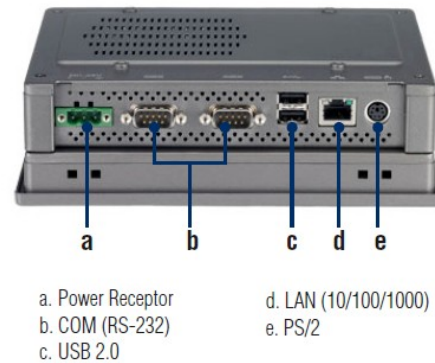


Figure 1: Connection for USB Keyboard (c).

System Boot Up

Once the station is installed and field wiring is complete, the system is ready to start. Upon engaging power the control will start up and the HMI will boot. Once the boot up sequence is complete the user will see the station information screen.



Figure 2: Start-Up Screen

Home Screen

Once the startup screen clears the HMI will display the home screen for the configured station.

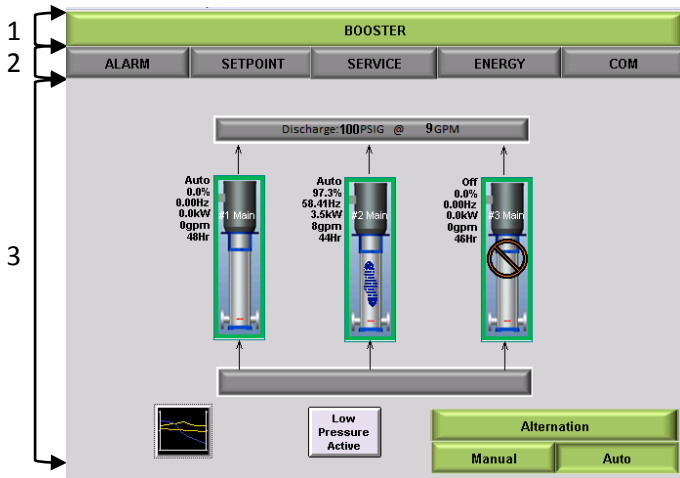


Figure 3: Basic Booster Home Screen

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

1. **The Header/Home Tab**, located at the top of the screen, will display the active system and will allow navigation back to the home screen at any point.
2. **The Navigation Bars**, located just below the home tab, 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.
3. **The Main Window**, located in the center of the screen, displays one or more panes of information about the booster station. Depending on which screen is active will depend on the information that is available to view or edit.

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. The default Supervisor password is "1234". This password should be changed upon the first log in. **Ensure you do not lose this password as there is no way to recover if lost.**

Note: Some values require you to set the "Enable Writes" 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 [SERVICE] from the Home Screen.

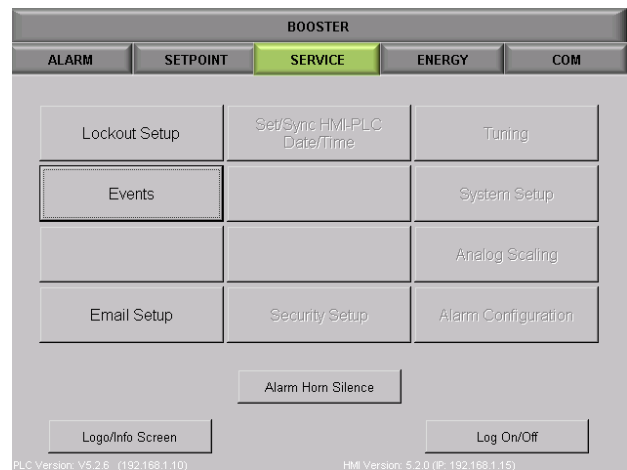


Figure 4: Guest Service Screen

Note that when logged in as a Guest certain boxes are disabled, shown in **Figure 4**.

When logged in as a Supervisor more options will be made available as shown in **Figure 5**.

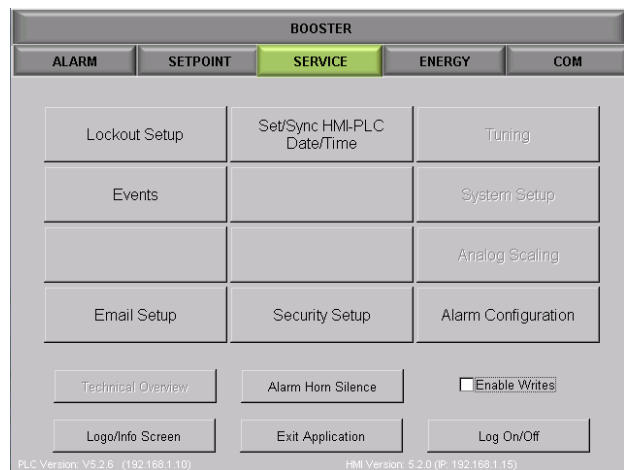


Figure 5: Supervisor Service Screen

Only qualified Bell and Gossett Service Reps will have access to the complete system parameters.

Tap [Log on/off] from the Service Screen to change User type.

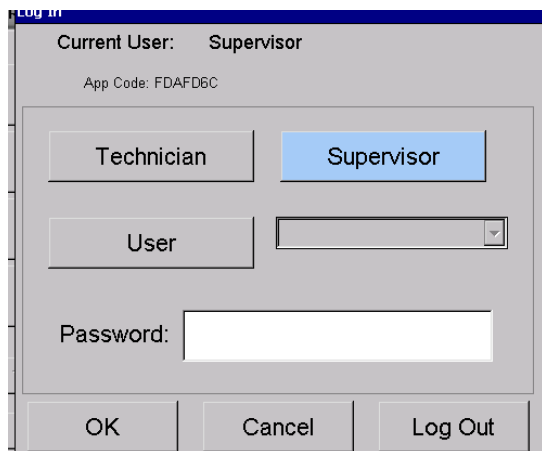


Figure 6: Log in Screen

To log in as a Supervisor, tap [Supervisor], and then tap on the empty Password field to enter the Supervisor password. This will bring up an enhanced screen shown in **Figure 7**. The default Supervisor password is "1234". This password should be changed upon the first log in. **Ensure you do not lose this password as there is no way to recover if lost**

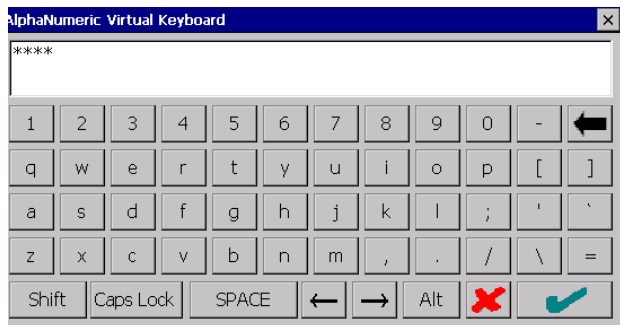


Figure 7: Log In Keypad

Enter your password and Tap  to log in, or  to exit without logging in.

Once back to the Log In screen tap [OK] to log in or [Cancel] to abort. If Log in was successful the Service Screen should appear as in **Figure 5**.

Tap [BOOSTER] to return to the Home Screen

Home Screen Navigation

The Booster home screen has been designed to mimic the look of the configured booster and to allow for quick visual cues for ease of navigation.

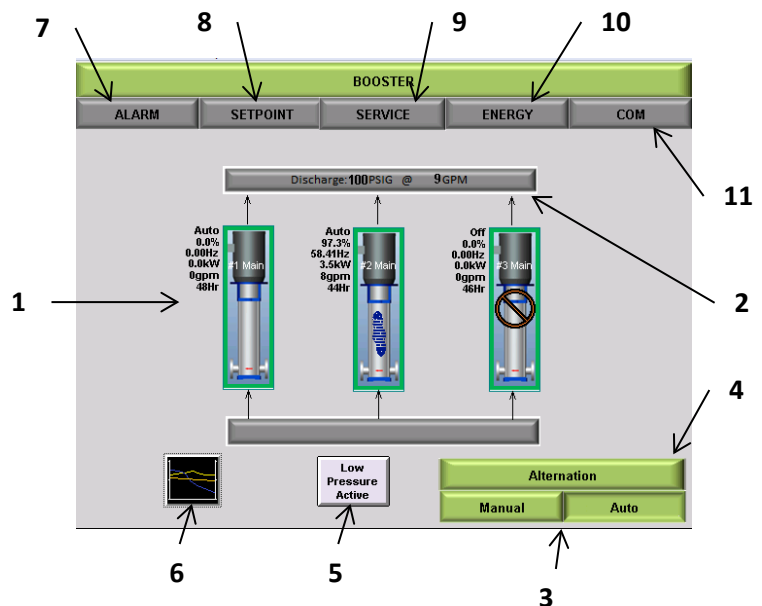


Figure 8: Home Screen Navigation

The Home screen has various buttons and information blocks detailed below.

1. Pump Status
2. Station Discharge Status
3. Modes of Operation
4. Alternation Set-up
5. Low Pressure Override
6. System View
7. Alarm Tab
8. Setpoint Tab
9. Service Tab
10. Energy Tab
11. Communications Tab

PUMP STATUS

The Individual pumps for each will have multiple means of status display both visually and with data.

1. Visual Pump Symbols:

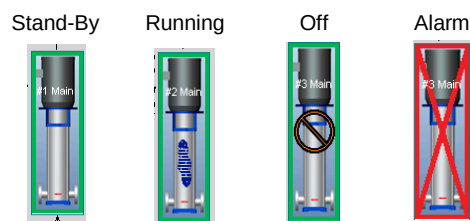


Figure 9: Pump Symbols



- a. By tapping , in either Idle or Auto Modes, an enhanced screen shown in **Figure 10** will appear to set individual pump status.

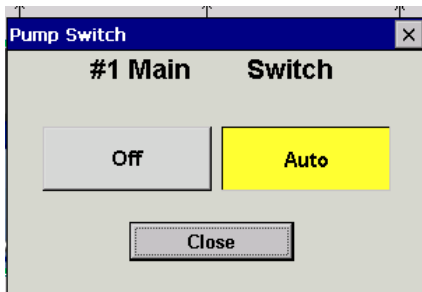


Figure 10: Pump Switch Screen

2. Pump Status Detail:

Auto	- Status
97.3%	- Percent Speed
58.41Hz	- Hertz
3.5kW	- kW
8gpm	- Flow Rate
44Hr	- Total runtime

Figure 11: Pump Detail



- a. By tapping , an enhanced screen shown in **Figure 12** will appear with more detailed information.

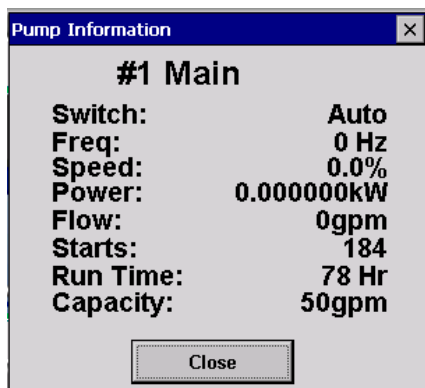


Figure 12: Pump Information

STATION DISCHARGE STATUS

The station discharge status bar will display the current discharge conditions for the station.



Figure 13: Station Discharge Status

MODES OF OPERATION

The HMI will display various modes of operation with dedicated screens. These modes of operation can be accessed through the interface on the home screen.

1. **IDLE MODE** will be active when the unit is not in [MANUAL] or [AUTO] and the pumps will not be allowed run.

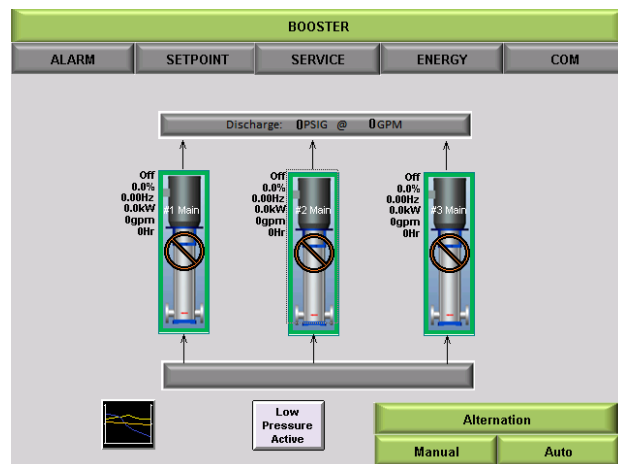


Figure 14: Basic Booster Idle Screen

2. **Auto Mode** is activated /deactivated by tapping [AUTO]. To enter or exit this mode of operation simply tap [AUTO] from the IDLE screen.
*Details on setting up the station for proper AUTO operation are detailed in the startup procedure.
3. **Manual Mode** is activated/deactivated by tapping [MANUAL] from the home screen. When activated, a dedicated screen will appear as shown in **Figure 15** to allow manual operation of individual pumps.

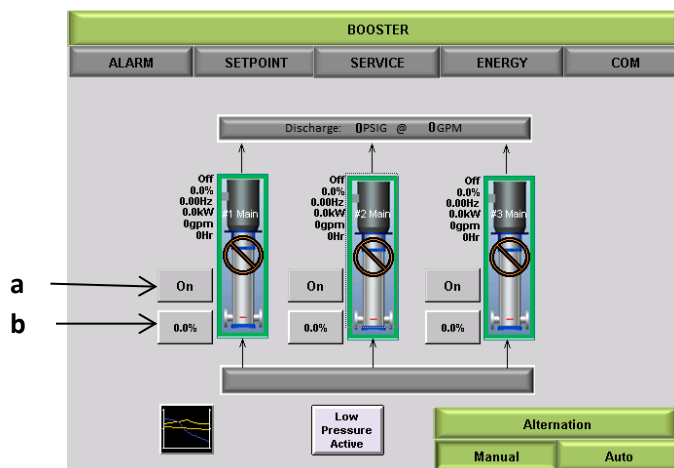


Figure 15: Basic Booster Manual Screen

- a. [ON], allows for the manual ability to turn on/off the pump.

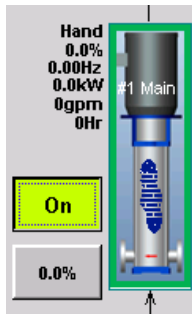


Figure 16: Manual on/off

- b. The PERCENT SPEED displays the current set speed.

By tapping , an Enhanced Screen shown in Figure 17 will appear and allow for manual control of the pump speed and status.

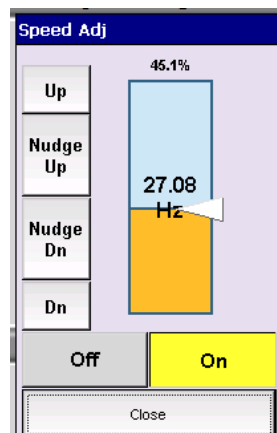


Figure 17: Manual Pump Control Screen

ALTERNATION SET UP

The default alternation sequence is set from the factory to alternate the pumps every time a pump is turned off by the system. The control will automatically select the pump with the lowest number of run-hours every time a pump is staged on/off.

By tapping [ALTERNATION] an enhanced screen shown in Figure 18 will appear that allows the modification of the alternation sequence for the station.

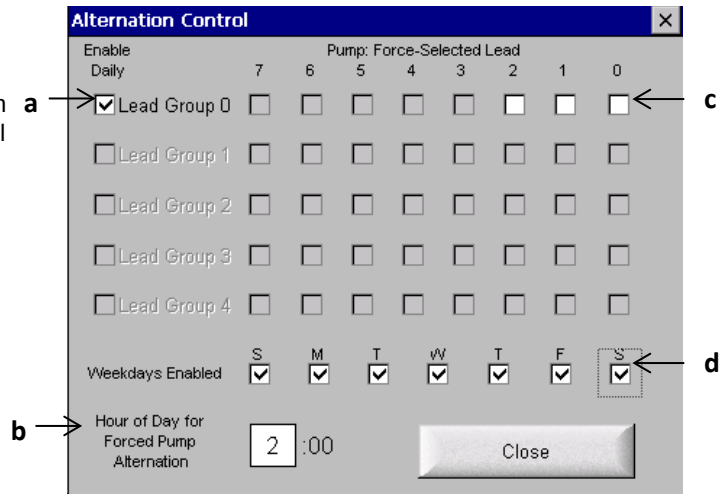


Figure 18: Default Alternation Screen

The Alternation screen will allow the user to force alternation of a given pump during a particular time of day.

- Enables forced alternation for given pump group based on scheduled parameters in remaining fields. Leaving this unchecked will disable the forced alternation based on time of day. The pumps will still alternate as they turn on and off due to demand.
- Sets the time for forcing alternation.
- This section will default to the "unchecked" position as shown. By "checking" one of these boxes, you will be forcing that pump to be the lead pump when alternation occurs. **Only one box needs to be checked.** If multiple boxes are checked then the first checked pump from the right will always be the lead pump.
- Sets the day in which the system will force alternation

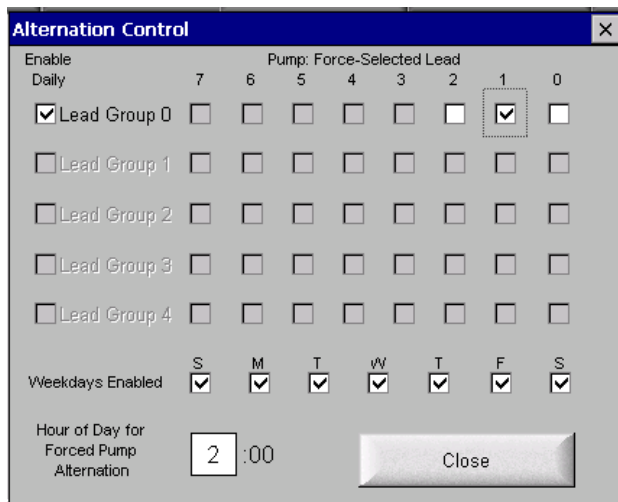


Figure 19: Example Alternation Screen

In the above example alternation will occur normally anytime the pumps are turned off. However, alternation will be **forced** daily at 2:00 a.m. with pump 1 established as the lead.

SYSTEM VIEW & TRENDS

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



Figure 20: Trends Screen

You can turn on and off logged channels on the viewer by tapping any of the values 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.

- 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 under [Time Period]. 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.

- User SP field**

By tapping in the "User SP" from the System View you can adjust the system Normal Set Point.

- Time Period**

By tapping [Time Period] from the System View an enhanced screen allows you to set a date and duration for viewing system information.

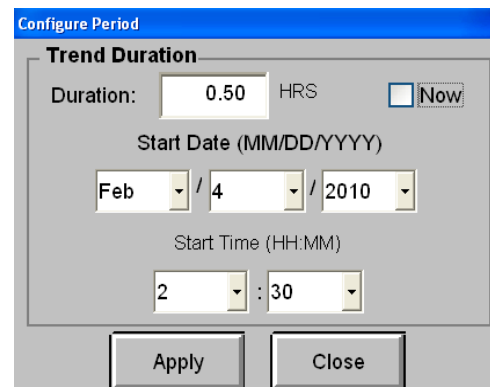


Figure 21: Configure Period

- Configure Data**

By tapping [Configure Data] for the System View menu will bring up an enhanced screen that will allow you to change way the data is displayed on the trends screen.

	Max		
☒ Pressure	250	psi	100.0%
☒ Station Flow	3000	gpm	100.0%
☒ Speed	100	%	100.0%
☒ High Zone	20	gpm	100.0%
☒ Low Zone	0	gpm	100.0%
☒ City Fill	0	gpm	100.0%
☒ Well Total	0	gpm	100.0%
☒ Well Dwnstr	0	gpm	100.0%
☒ Well Lakefill	4	gpm	100.0%
☐ VFD 1 Pwr	37	kW	100.0%
☐ Power	300	kW	300
☐ Demand (Lynx)			

Channels Close

Figure 22: 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.

ALARMS

The [ALARMS] tab will take you to the Alarms detail screen.

The interface shows a tabbed menu at the top with 'ALARM' selected. Below the tabs is a table with columns 'Active Time' and 'Message'. At the bottom, there is a date range 'Period: 03/03/2014 to 03/03/2014', a dropdown menu currently showing 'Critical - Current', an 'Ack All' button, and a 'Period' button. Annotations: 'a' points to the table, 'b' points to the dropdown menu, 'c' points to the 'Ack All' button, and 'd' points to the 'Period' button.

Figure 23: Alarms Home Screen

- The Alarm history field will display particular alarms based on the drop down selection detail in (b). The time of the alarm and the type of alarm will be displayed.
- Drop down selection that will allow you to sort alarms
 - Critical – Current (current day)
 - Critical – History
 - Non-Critical
- The [Ack All] button will clear any alarms that are currently active.
- Tapping [Period], available in 'Critical – History' and "Non-Critical" modes, will open an enhanced screen shown in **Figure 24** to allow for the display of only alarms during a given range.

Period

Start Date (MM/DD/YYYY)

Jan / 1 / 2014

End Date (MM/DD/YYYY)

Mar / 21 / 2014

Apply Close

Figure 24: Period Screen

If an alarm is active the Home screen will also display various visual warnings to alert the system status

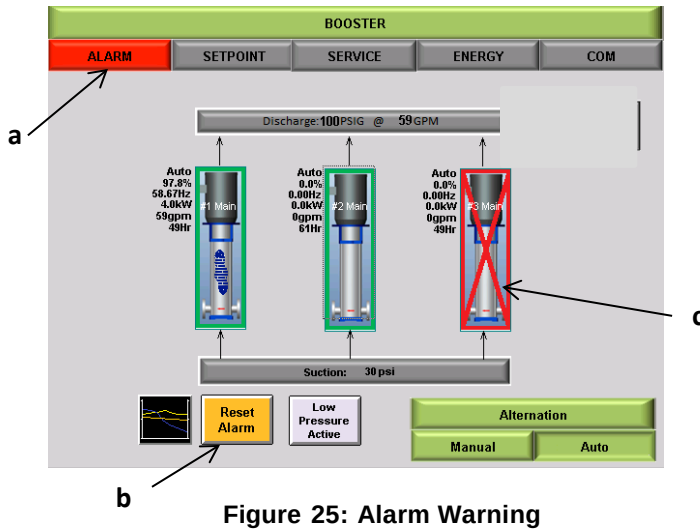


Figure 25: Alarm Warning

- The [ALARM] will turn red to alert that there is an active alarm.
- [Reset Alarm] will flash from yellow to red to indicate there is an active alarm. By tapping [Reset Alarm], the alarm will be acknowledged.
- The pump status will show an alarm state

SETPOINTS

The [SETPOINTS] tab will take you to the Setpoint detail screen. From this screen you will be able to view the station setpoints along with the current values of certain parameters.

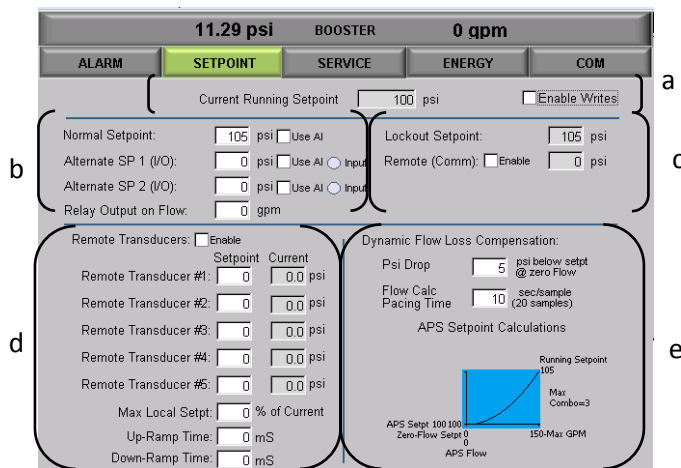


Figure 26: Setpoint Home Screen

- This portion of the screen displays the current running set point of the station and the "enable writes" check box. By checking this box any changes made while in this screen will be saved.

By leaving it unchecked no changes can be made.



Figure 27: Setpoint Detail A

- This portion of the screen will display the current set points being used by the system. When tapping in the numbered area an enhanced keypad will appear that will allow you to change the current value.

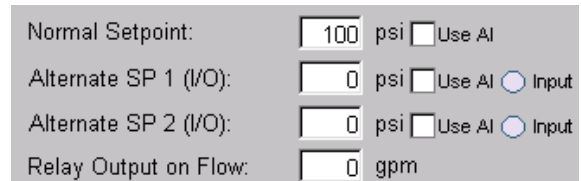


Figure 28: Setpoint Detail B

If factory configured, checking the "Use AI" check box will allow control by a factory configured Analog Input. This input is separate from the settings for remote transducers or BMS override. If you do not have an external AI configured, these boxes should remain unchecked.

The "Input" indicator will be active if that current input is on.

- "Lockout Setpoint" will display what the Lockout system has identified as the required set point.

"Remote (Comm)" enable is the setpoint being communicated by the remote communication system. The enable box **must** be checked in order for the remote communication system to adjust the system set point.

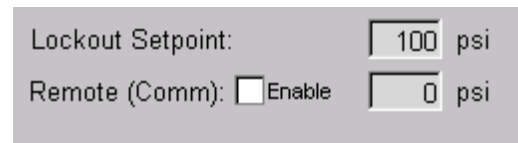


Figure 29: Setpoint Detail C

- This portion of the screen will display the Remote Transducer Settings. The remote transducers are enabled in the System Setup - Control Options section. If you have configured/enabled the remote transducers the "Current" box will display a value. If not it will show 0.0. By checking the enable box the system will use the configured remote transducers.

Remote Transducers: ☒ Enable

	Setpoint	Current
Remote Transducer #1:	60	62.5 psi
Remote Transducer #2:	0	0.0 psi
Remote Transducer #3:	0	0.0 psi
Remote Transducer #4:	0	0.0 psi
Remote Transducer #5:	0	0.0 psi

Max Local Setpt: 110 % of Current

Up-Ramp Time: 5000 mS

Down-Ramp Time: 5000 mS

Figure 30: Setpoint Detail D

- e. This portion of the screen displays the Dynamic Flow Compensation set up.

“Psi Drop” is the setpoint for the calculated building losses in the system.

“Flow Calc Pacing Time” is the setpoint for the rate at which the “Current Running Setpoint” will change due to changes in system flow.

The graph is a representation of system curve and the cross hairs will display where the station is currently operating.

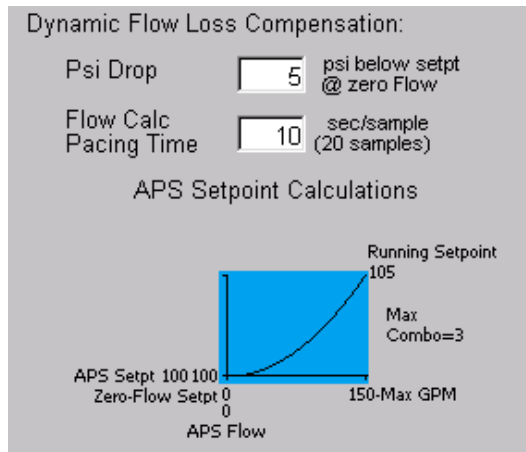


Figure 31: Setpoint Detail E

SERVICE

The [SERVICE] tab will take you to the Service detail screen. From this screen you will be able to access all of the setup parameters for the station detailed in this section.

BOOSTER

ALARM SETPOINT **SERVICE** ENERGY COM

Lockout Setup	Set/Sync HMI-PLC Date/Time	Tuning
Events		System Setup
		Analog Scaling
Email Setup	Security Setup	Alarm Configuration
Technical Overview	Alarm Horn Silence	☐ Enable Writes
Logo/Info Screen	Exit Application	Log On/Off

PLC Version: V5.2.6 (192.168.1.10) HMI Version: 5.2.0 (IP: 192.168.1.15)

Figure 32: Service Home Screen

1. [Lockout Setup]

Tap [Lockout Setup] from the SERVICE Menu. The Lockout Setup will allow the station setpoints to be scheduled during certain periods. An example of using this parameter would be for scheduling operation during “unoccupied” periods when demand will be less.

BOOSTER

ALARM SETPOINT **SERVICE** ENERGY COM

Lockout 1-6	Lockout 7-12	Lockout 13-14
Lockout 02	Lockout 03	Lockout 04
Day: None	Day: None	Day: None
Str Time: 0:00	Str Time: 0:00	Str Time: 0:00
Duration: 00:00	Duration: 00:30	Duration: 00:00
Combo: 0	Combo: 0	Combo: 0
SP: 0	SP: 0	SP: 0
Speed: 0	Speed: 0	Speed: 0
Lockout 05	Lockout 06	Lockout 07
Day: None	Day: None	Day: None
Str Time: 0:00	Str Time: 0:00	Str Time: 0:00
Duration: 00:00	Duration: 00:00	Duration: 00:00
Combo: 0	Combo: 0	Combo: 0
SP: 0	SP: 0	SP: 0
Speed: 0	Speed: 0	Speed: 0

Back

Figure 33: Lockout Screen

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.

Figure 34: Individual Lockout Setup

The screen shown in Figure 34 sets up a lockout for Sunday beginning at 6:00 AM. The duration is set to be 12 hours. Thus this lockout will end at 6:00 PM on Sunday. The animated display gives an indication about time.

Figure 35: Parameter Tab in Lockout Setup

The Parameter tab enables a user to define Combo number, maximum pressure, and maximum speed in RPM

2. [Events]

By tapping [Events] you will be taken to the Events home screen shown in **Figure 39**. This page will detail any event that has happened within the given period.

Figure 36: Event Setup

By tapping [Period] you will be able to adjust the range to show only information required.

Tapping [< Back] will take you back to the Service Home Screen.

3. [Email Setup]

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 POP3 and SMTP servers will usually have the same address. Enter this value in both boxes. Sometimes the values are different so separate boxes have been provided.

To: Enter the email address where the alarm messages will be sent 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 where “phonenumbers” is the 10 digit phone number of the user.

T-Mobile:

phonenumbers@tmomail.net

Virgin Mobile:

phonenumbers@vmobl.com

Cingular:

phonenumbers@cingularme.com

Sprint:

phonenumbers@messaging.sprintpcs.com

Verizon:

phonenumbers@vtext.com

Nextel:

phonenumbers@messaging.nextel.com

US Cellular:

phonenumbers@email.uscc.net

SunCom:

phonenumbers@tms.suncom.com

Powertel:

phonenumbers@ptel.net

AT&T:

phonenumbers@txt.att.net

Alltel:

phonenumbers@message.alltel.com

Metro PCS:

phonenumbers@MyMetroPcs.com

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: Xlem1234

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 37: Email Settings

Occasionally, 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.

4. [Set/Sync HMI-PLC Date/Time]

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

Figure 38: Set/Sync Screen

This screen allows the date and time to be set, and synchronized for the PLC and HMI. To manually set the date check “Change Date/Time”. Note the Date and Time boxes will be changed to editable fields. To allow for Daylight Savings Time please check the appropriate box.

Tap [Set Date] to synchronize HMI & PLC date and time. You will get a pop up message shown below, hit [OK].

Figure 39: Sync Pop-up Detail

To adjust the totalizers tap [Totalizers]. In the new pop up you will be able to adjust the time/date when the system will totalize.

Figure 40: Clear/Update Totalizers

Use the available cells to enter the date and time. Tap [Set Date/Time] 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.

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.

5. [Security Setup]

Tap [Security Setup] from the SERVICE Menu.

Figure 41: Security Setup Home Screen

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.

From this screen you will also be able to assign Users to the station by tapping [Setting User].

Figure 42: User Setup

Enter the desired User Name and password and tap [Apply]. The User will now be available in the User dropdown.

6. [Alarm Configuration]

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

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

Alarm	Enable	Auto Reset	Delay (s)	Set Point	Time to Reset (s)	Reset Tries
Low discharge pressure	☐	☐	300	15	0	0
High discharge pressure	☐	☒	60	15	180	3
Low level	☐	☒	5	0.0	180	3
General VFD Failure	☐	☒	3	---	180	3
Auxiliary Device Failure	☐	☐	0	---	0	0
Low Inlet Pressure	☐	☒	5	0.0	180	3
Phase Failure	☐	☒	3	---	180	3
Low Temperature	☐	☐	3	---	180	3
Loss of Prime	☐	☐	3	---	180	8
Analog System Failure	☐	☐	0	---	180	0

Figure 43: Alarm Configuration

ENERGY

The [ENERGY] tab will take you to the Power usage detail screen. From here you will be able to see the totalized values for Flow and KWh in tabular format.

Figure 44: Energy Home Screen

By tapping on the desired box a tabular screen will appear as shown in **Figure 45**.

Flow Total (GAL)	Current Total	Previous Total
Daily	137318	138943
Weekly	320205	219425
Monthly	9475789	0
Annual	9475789	0
Grand Total	9475789	0

Figure 45: Flow Totals Overview

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.

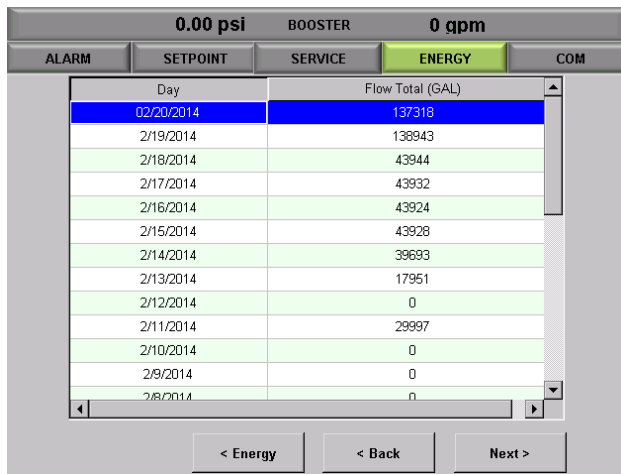


Figure 46: Daily Flow Totals Overview

COMMUNICATION

The [COM] tab will take you to the Communications setup screen where you can configure the available communications protocol.

Communications takes place by way of drivers installed on the HMI. Configuration of these drivers is done through the "COM" screen. Due to the nature of the files accessed by this screen, COM configuration cannot be done via web access to the controller.

Only one driver is available at a time. Initially, no drivers are selected. Use the checkbox to select which protocol to use, then press the button next to the checkbox to modify the parameters of the protocol.

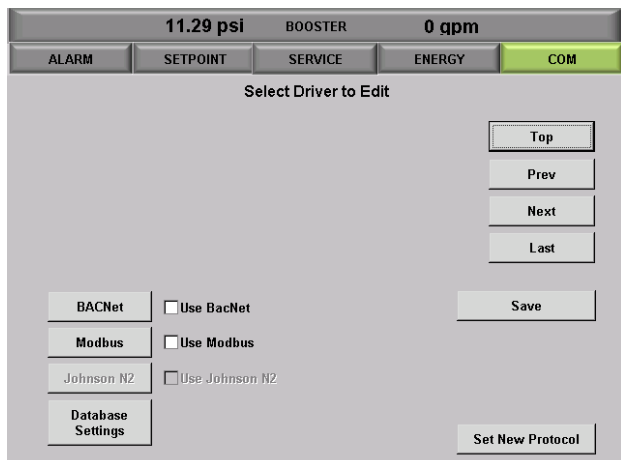


Figure 47: COM Home Screen

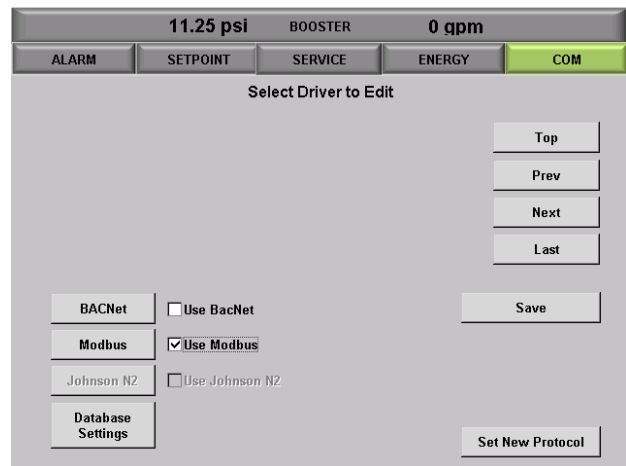


Figure 48: COM Protocol Selection



Figure 49: COM Protocol Selection

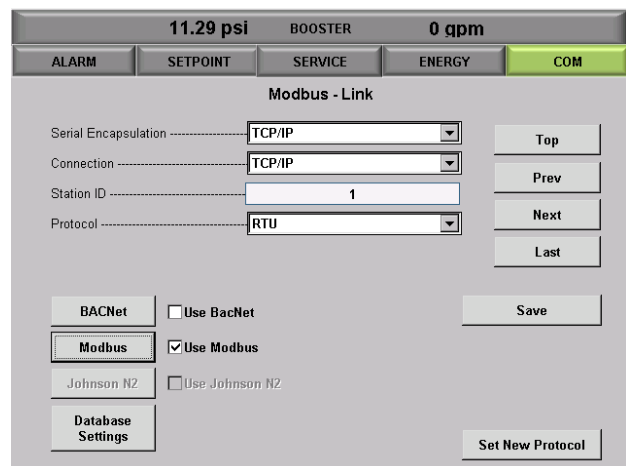


Figure 50: COM Protocol Selection

Protocol settings are then available for editing. Use the Top, Prev, Next and Last buttons to navigate among the pages of the properties for the protocol selected. Press Save for each page as changes are made. Once all the changes are made, press "Set New Protocol". The HMI will reboot to make the required changes. The station

will still operate during this process, but the HMI will not show pressure/flow etc., remote connection will be lost etc. However there will be no loss of pump operation.

Typical settings for Modbus TCP are as follows:

Page	Modbus - Link	
	Serial Encapsulation	TCP/IP
	Connection	TCP/IP
	Station ID	1
	Protocol	RTU
Page	Modbus - Modem	
	Configuration	Auto Detect
	Modem Identifier	2
		<As
	Phone Number	Required >
Page	Modbus - Modem Options	
	Enable incoming calls	No
	Auto Connect Enable	Yes
	Auto Connect Retry	
	Interval (s)	120
	Disconnect if call idle more than...	1
	Auto-Disconnect time (s)	120
Page	Modbus - Com Port	
	Com Port	COM2
	Baud	9600
	Data Bits	8
	Stop Bits	1
	Parity	None
Page	Modbus - TCP and UDP	
		192.168.1.1
	IP Address	5
	Port #	502
	Server Mode	Yes
Page	Modbus - Advanced - A	
	Use Transaction ID	Yes
	Word Type	Unsigned
	Protocol-Retries	0
	TX Buffer	512
	RX Buffer	512

	TimeOut-Start	1000
	TimeOut-End	0
	TimeOut-Interval Between Char	500
	TimeOut-Wait CTS	100
Page	Modbus - Advanced - C	
	Control RTS	No
	Verify CTS	No
	Disable DTR	No
	Enable IR	No

Table 1: Modbus TCP Settings

Char	500
TimeOut-Wait CTS	100

Page	BacNet - Advanced - C	
	Control RTS	No
	Verify CTS	No
	Disable DTR	No
	Enable IR	No

Table 2: BacNet Settings

ActiveX and IP Updates

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

Set Configuration: Set and save new web configurations.

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

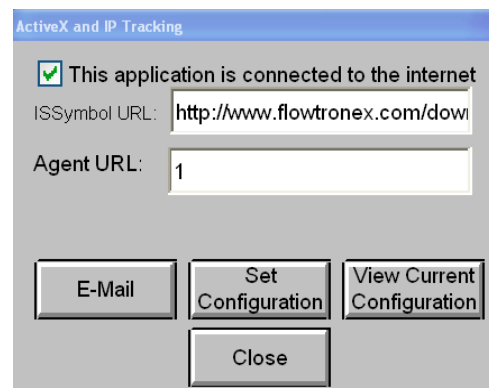


Figure 51: ActiveX and IP Updates

Tap [WinCE Remote Access] from the Options Setup Menu

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.

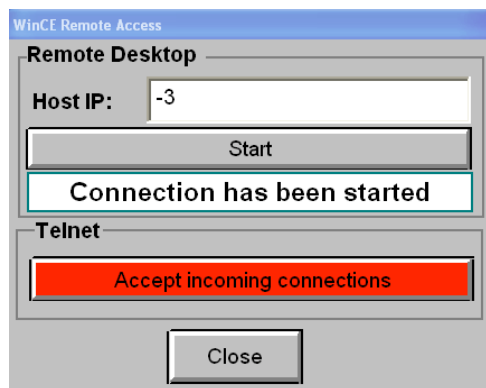


Figure 52: WinCE Remote Access

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 53: Web Reports Menu

Trend View

Select [Trend View] from the Web Reports Menu.

There are four key parts to the trends screen.

1 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. **2 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.

3 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.

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

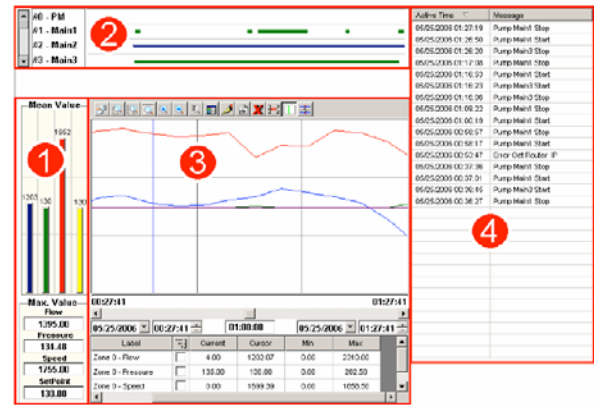


Figure 54: Trends View

Alarms Report

Select [Alarms Report] from the Web Reports Menu.

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

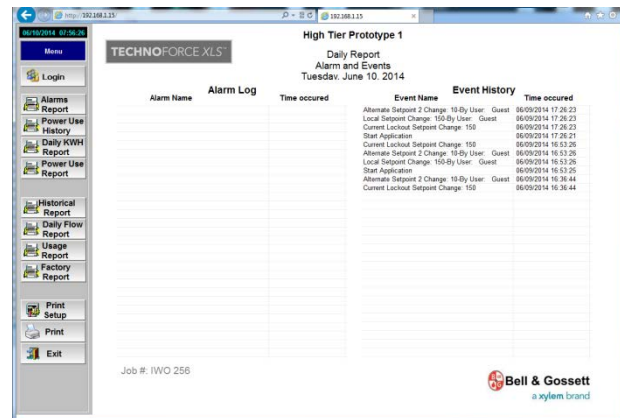


Figure 55: Alarms & Events

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].

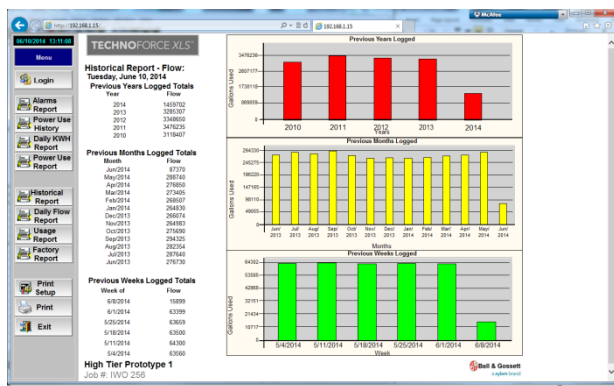


Figure 56: Historical Report

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.

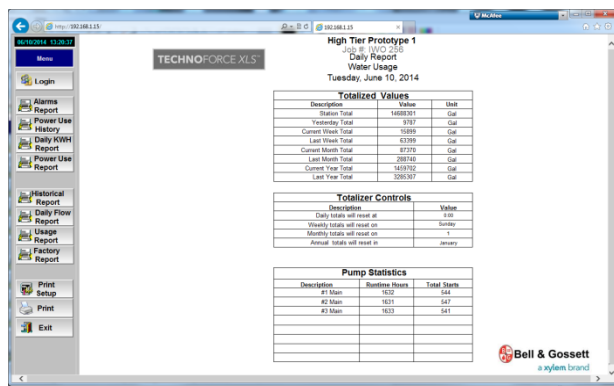


Figure 57: Usage Report

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.

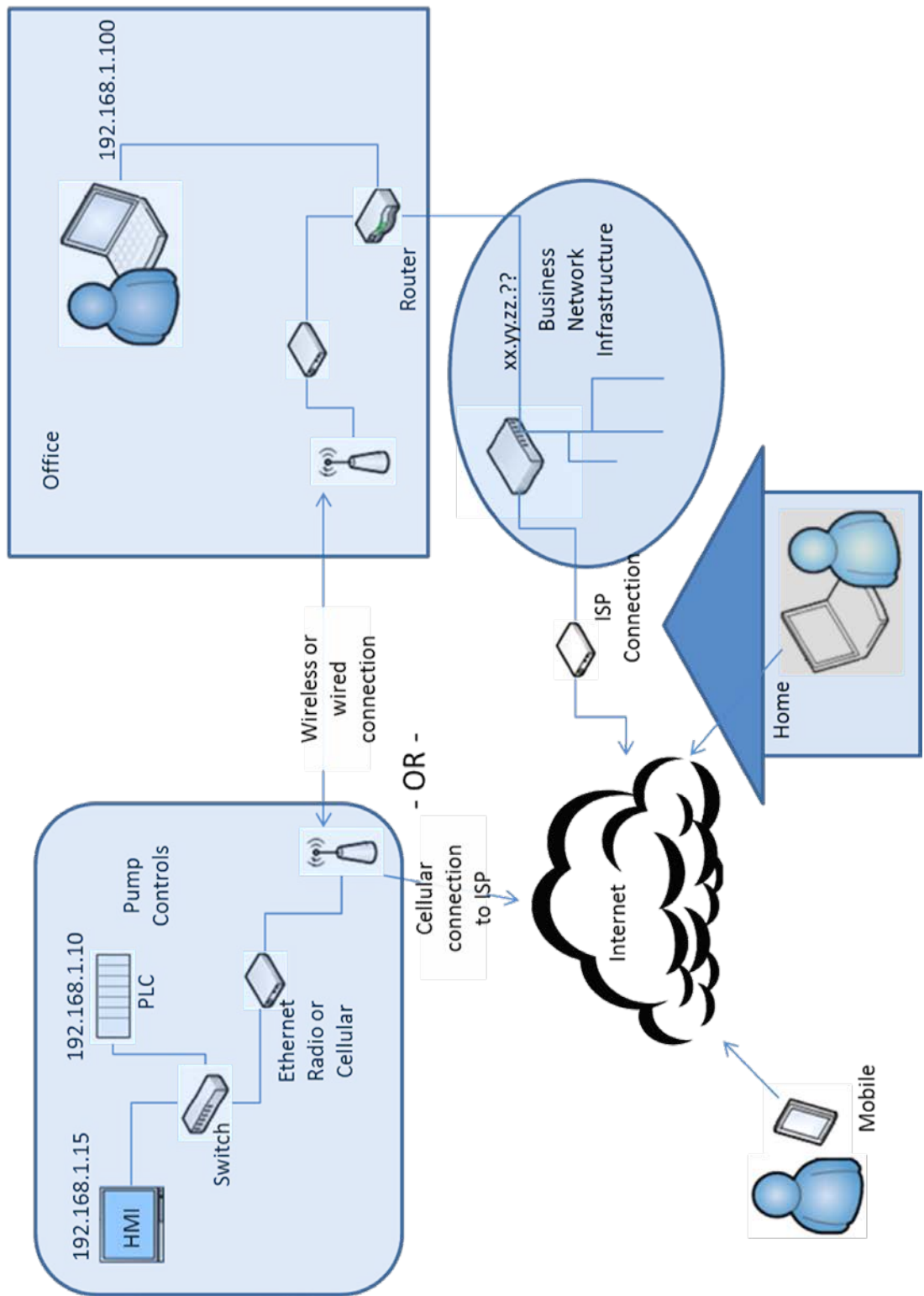
Across-the-line (XL)	Applying 100% of line voltage to a motor during startup and run. A simple large relay with a contact for each power phase (for 3 phase) is used to control the motor OFF/ON.
Analog	A signal that varies in some respect (voltage, current, frequency) in order to convey the value of some 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 – Networking Options

Typical Network Diagram



Appendix C–Typical Alarms Configuration

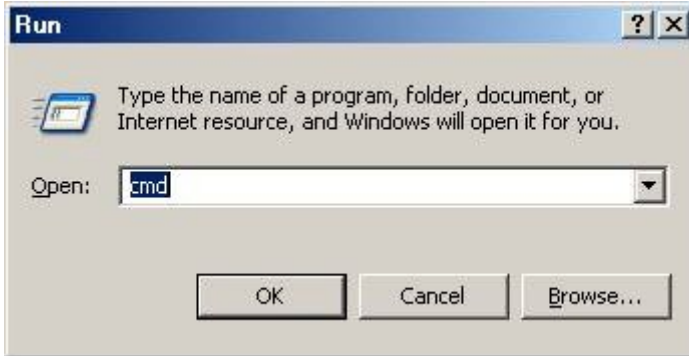
Alarm / Fault Name	Auto Reset Available	No. Reset Attempts	Type of Alarm	Alarm Delay (SEC)	Alarm SP (PSI)	Delay Time (SEC)
Low Discharge Pressure	No Auto Reset	N/A	Required	300	25	N/A
High Discharge Pressure	Auto Reset Allowed	3	Required	60	15	60
Low Level (in well or transfer pumps).	Auto Reset Allowed	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

Default Alarms / Faults

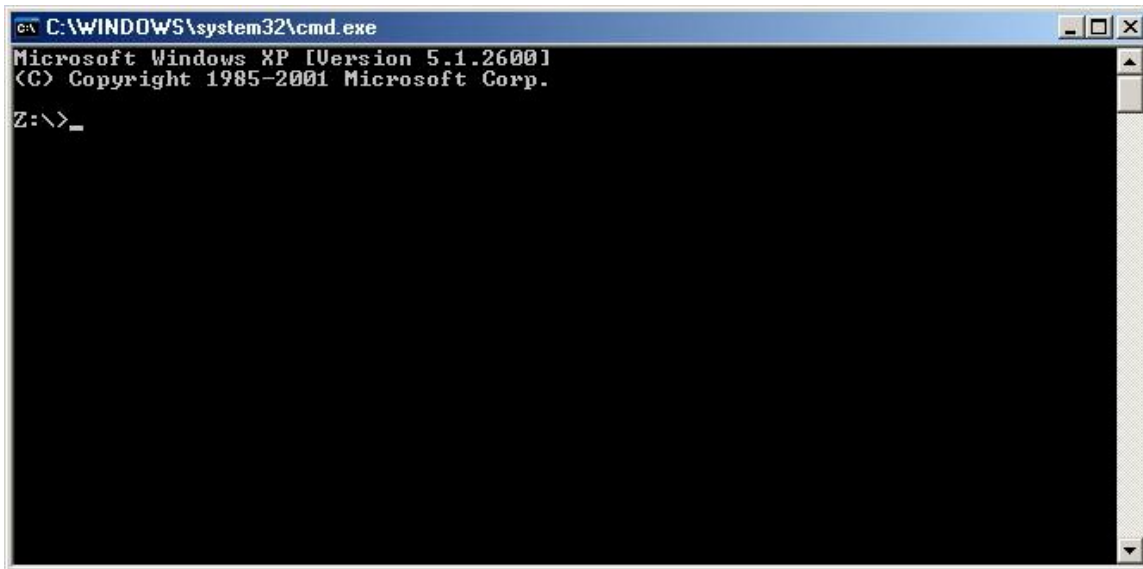
Appendix D – Email Troubleshooting

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

SMTP error Codes, Set SMTP Function

Troubleshooting Email Send Failures

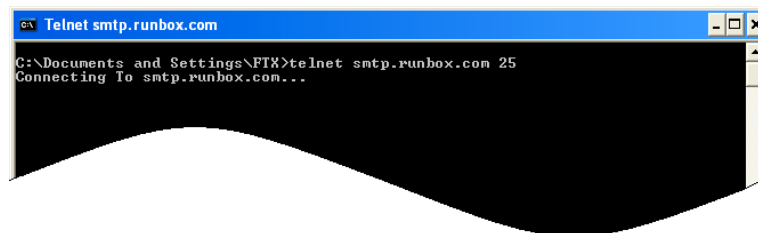
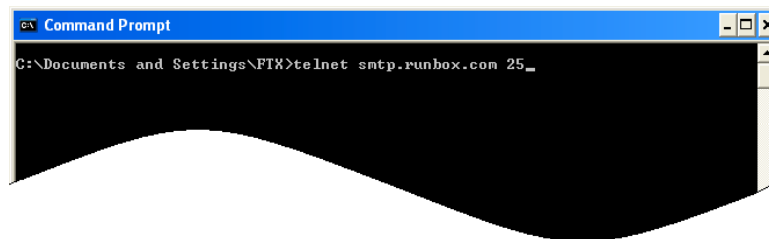
The following table gives the number codes associated with failures received after tapping [SEND] to do a test-run of the email addresses and the SMTP:

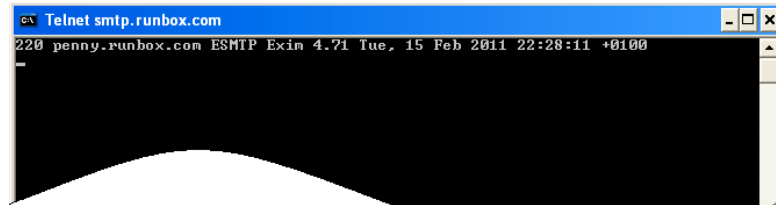
Value	Description
0	Success
1	Invalid format for parameter 1 (Subject)
2	Invalid format for parameter 2 (Message)
3	Invalid format for parameter 3 (To)
4	Wrong number of parameters
5	Start Socket error
6	Error getting host IP Address (i.e. invalid SMTP server)
7	Error connecting to SMTP server
8	Error 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)

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)



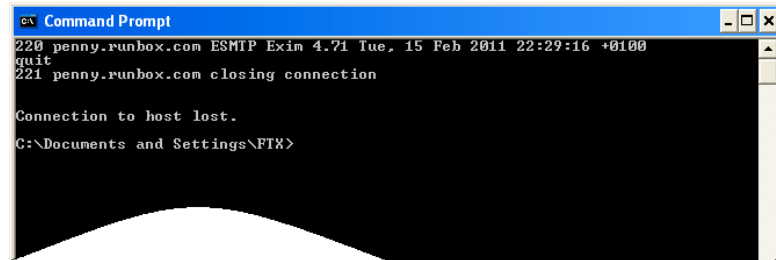
A screenshot of a Telnet window titled "Telnet smtp.runbox.com". The window shows a successful connection to the SMTP server. The text displayed is: "220 penny.runbox.com ESMTP Exim 4.71 Tue, 15 Feb 2011 22:28:11 +0100". The cursor is on a new line below the greeting.

```

C:\>telnet smtp.runbox.com
220 penny.runbox.com ESMTP Exim 4.71 Tue, 15 Feb 2011 22:28:11 +0100

```

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

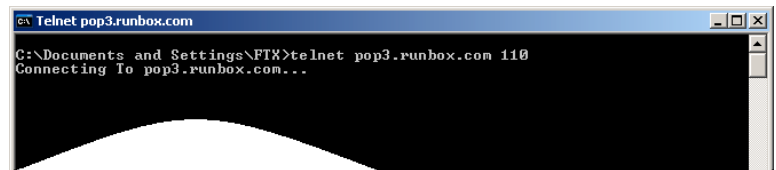
A screenshot of a Command Prompt window titled "Command Prompt". It shows the continuation of the Telnet session. The user has entered "quit", and the server responds with "221 penny.runbox.com closing connection". The prompt then shows "Connection to host lost." and the local path "C:\Documents and Settings\FTX>".

```

C:\>telnet smtp.runbox.com
220 penny.runbox.com ESMTP Exim 4.71 Tue, 15 Feb 2011 22:29:16 +0100
quit
221 penny.runbox.com closing connection
Connection to host lost.
C:\Documents and Settings\FTX>

```

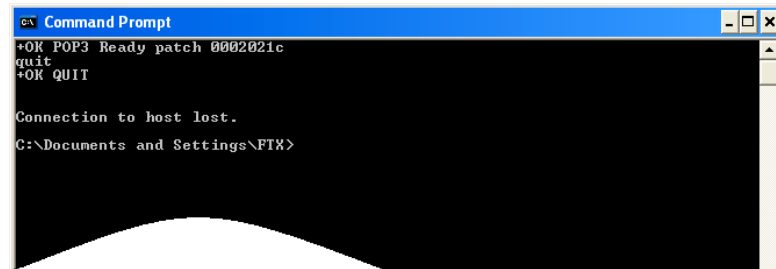
- If you are unable to connect, attempt to Telnet to the POP3 server on port 110.

A screenshot of a Telnet window titled "Telnet pop3.runbox.com". The window shows the attempt to connect to the POP3 server. The text displayed is: "C:\Documents and Settings\FTX>telnet pop3.runbox.com 110" and "Connecting To pop3.runbox.com...".

```

C:\Documents and Settings\FTX>telnet pop3.runbox.com 110
Connecting To pop3.runbox.com...

```

A screenshot of a Command Prompt window titled "Command Prompt". It shows the continuation of the Telnet session. The user has entered "quit", and the server responds with "+OK POP3 Ready patch 0002021c". The prompt then shows "Connection to host lost." and the local path "C:\Documents and Settings\FTX>".

```

C:\>telnet pop3.runbox.com 110
+OK POP3 Ready patch 0002021c
quit
+OK QUIT
Connection to host lost.
C:\Documents and Settings\FTX>

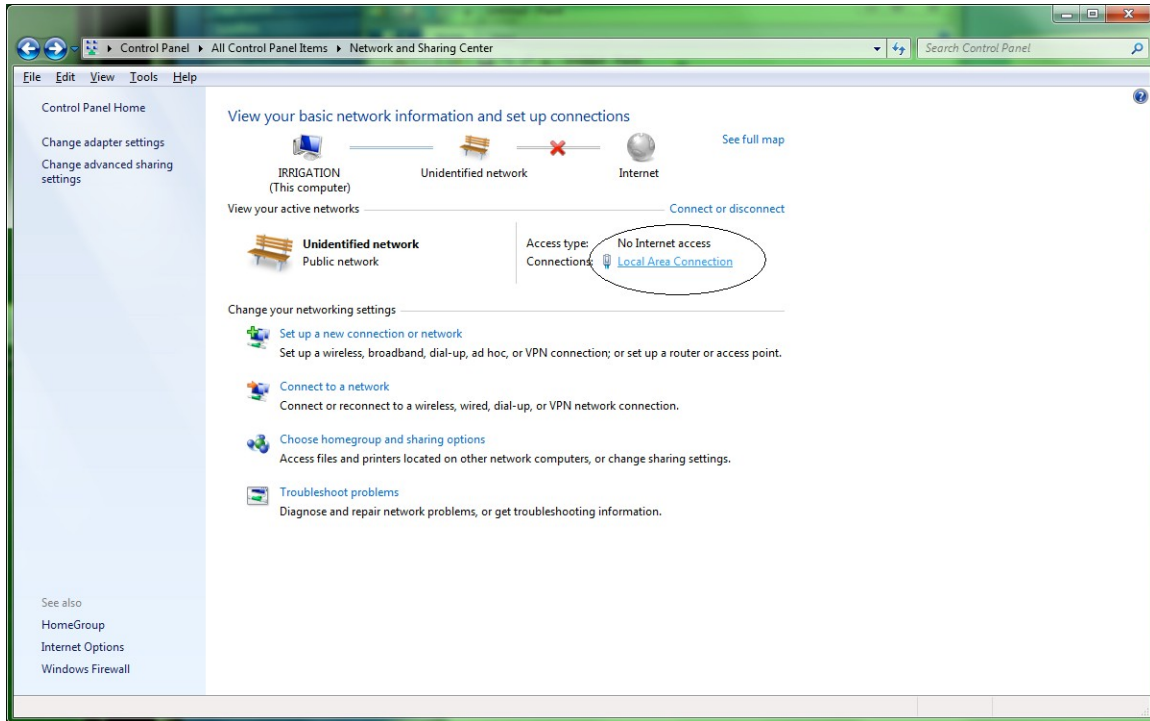
```

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

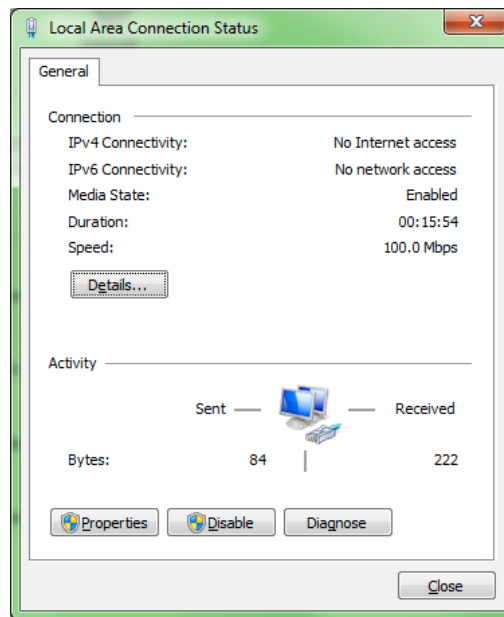
Connecting to the pump station after the hardware is installed is relatively easy. The first step is to connect your PC to the network. This simply means your PC will be connected to the LAN side of the router supplied by Bell & Gossett. Step 2 is to set the IP address of your PC.

Click Local Area Connection.

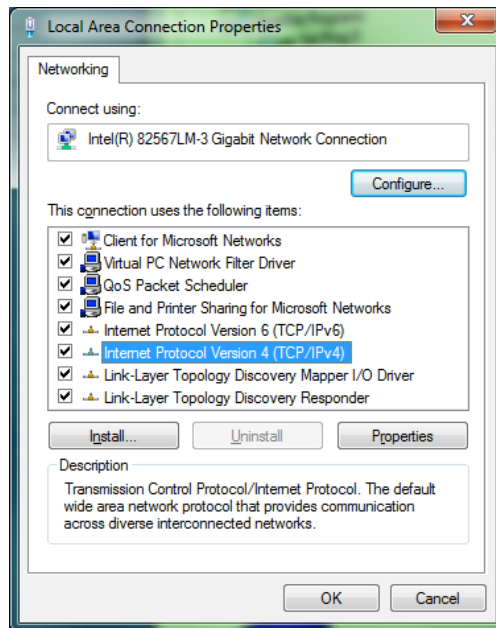


Computer Setup Options

Another window will come up. Select Properties:

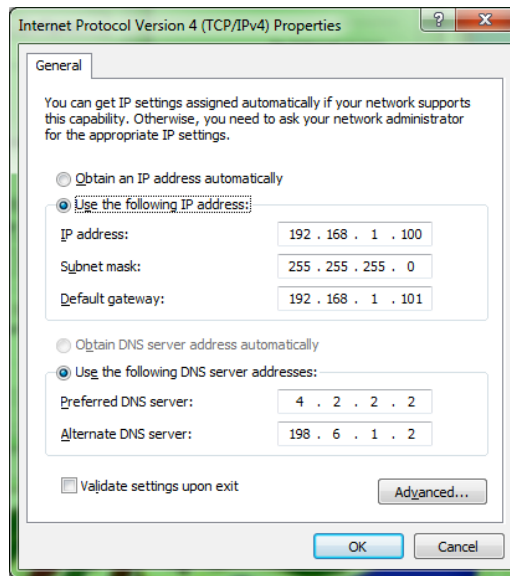


Highlight Internet Protocol (TCP/IP). If there are two entries, one for v6 and one for v4, select v4 as shown. Then select Properties.



Select “Use the following IP address”

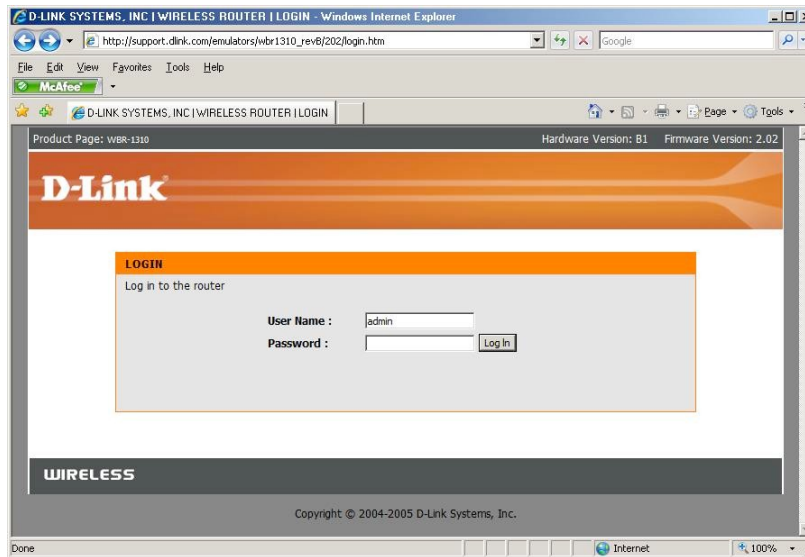
Check with your IT department or internet service provider for proper DNS server settings. These should be no different than your settings before installing the router.



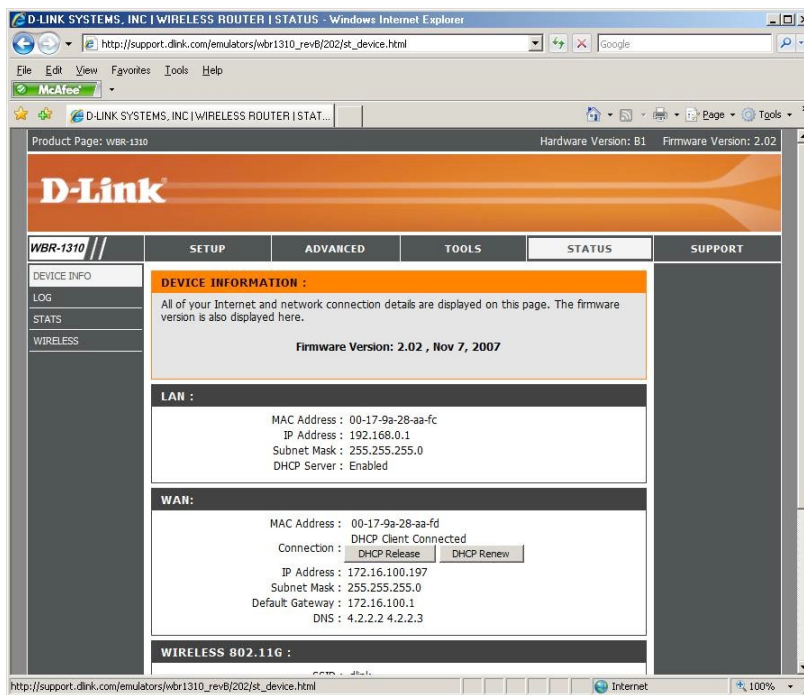
DETERMINING THE IP ADDRESS:

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 Bell & Gossett. 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 F – General Networking and Router Configuration Discussion:

Regarding the requirement for a fixed IP address: This is not a requirement of the Bell & Gossett 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: Let's 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, gets "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 Bell & Gossett 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. Bell & Gossett 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

Bell & Gossett 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 Bell & Gossett 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. Bell & Gossett 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

Bell & Gossett 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 Bell & Gossett 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.

WARRANTY INFORMATION

COMMERCIAL WARRANTY

Warranty. For goods sold to commercial buyers, Seller warrants the goods sold to Buyer hereunder (with the exception of membranes, seals, gaskets, elastomer materials, coatings and other "wear parts" or consumables all of which are not warranted except as otherwise provided in the quotation or sales form) will be (i) be built in accordance with the specifications referred to in the quotation or sales form, if such specifications are expressly made a part of this Agreement, and (ii) free from defects in material and workmanship for a period of one (1) year from the date of installation or eighteen (18) months from the date of shipment (which date of shipment shall not be greater than thirty (30) days after receipt of notice that the goods are ready to ship), whichever shall occur first, unless a longer period is specified in the product documentation (the "Warranty").

Except as otherwise required by law, Seller shall, at its option and at no cost to Buyer, either repair or replace any product which fails to conform with the Warranty provided Buyer gives written notice to Seller of any defects in material or workmanship within ten (10) days of the date when any defects or non-conformance are first manifest. Under either repair or replacement option, Seller shall not be obligated to remove or pay for the removal of the defective product or install or pay for the installation of the replaced or repaired product and Buyer shall be responsible for all other costs, including, but not limited to, service costs, shipping fees and expenses. Seller shall have sole discretion as to the method or means of repair or replacement. Buyer's failure to comply with Seller's repair or replacement directions shall terminate Seller's obligations under this Warranty and render the Warranty void. Any parts repaired or replaced under the Warranty are warranted only for the balance of the warranty period on the parts that were repaired or replaced. Seller shall have no warranty obligations to Buyer with respect to any product or parts of a product that have been: (a) repaired by third parties other than Seller or without Seller's written approval; (b) subject to misuse, misapplication, neglect, alteration, accident, or physical damage; (c) used in a manner contrary to Seller's instructions for installation, operation and maintenance; (d) damaged from ordinary wear and tear, corrosion, or chemical attack; (e) damaged due to abnormal conditions, vibration, failure to properly prime, or operation without flow; (f) damaged due to a defective power supply or improper electrical protection; or (g) damaged resulting from the use of accessory equipment not sold or approved by Seller. In any case of products not manufactured by Seller, there is no warranty from Seller; however, Seller will extend to Buyer any warranty received from Seller's supplier of such products.

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Warranty. For goods sold for personal, family or household purposes, Seller warrants the goods purchased hereunder (with the exception of membranes, seals, gaskets, elastomer materials, coatings and other "wear parts" or consumables all of which are not warranted except as otherwise provided in the quotation or sales form) will be free from defects in material and workmanship for a period of one (1) year from the date of installation or eighteen (18) months from the product date code, whichever shall occur first, unless a longer period is provided by law or is specified in the product documentation (the "Warranty").

Except as otherwise required by law, Seller shall, at its option and at no cost to Buyer, either repair or replace any product which fails to conform with the Warranty provided Buyer gives written notice to Seller of any defects in material or workmanship within ten (10) days of the date when any defects or non-conformance are first manifest. Under either repair or replacement option, Seller shall not be obligated to remove or pay for the removal of the defective product or install or pay for the installation of the replaced or repaired product and Buyer shall be responsible for all other costs, including, but not limited to, service costs, shipping fees and expenses. Seller shall have sole discretion as to the method or means of repair or replacement. Buyer's failure to comply with Seller's repair or replacement directions shall terminate Seller's obligations under this Warranty and render this Warranty void. Any parts repaired or replaced under the Warranty are warranted only for the balance of the warranty period on the parts that were repaired or replaced. The Warranty is conditioned on Buyer giving written notice to Seller of any defects in material or workmanship of warranted goods within ten (10) days of the date when any defects are first manifest.

Seller shall have no warranty obligations to Buyer with respect to any product or parts of a product that have been: (a) repaired by third parties other than Seller or without Seller's written approval; (b) subject to misuse, misapplication, neglect, alteration, accident, or physical damage; (c) used in a manner contrary to Seller's instructions for installation, operation and maintenance; (d) damaged from ordinary wear and tear, corrosion, or chemical attack; (e) damaged due to abnormal conditions, vibration, failure to properly prime, or operation without flow; (f) damaged due to a defective power supply or improper electrical protection; or (g) damaged resulting from the use of accessory equipment not sold or approved by Seller. In any case of products not manufactured by Seller, there is no warranty from Seller; however, Seller will extend to Buyer any warranty received from Seller's supplier of such products.

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Some states do not allow limitations on how long an implied warranty lasts, so the above limitation may not apply to you. Some states do not allow the exclusion or limitation of incidental or consequential damages, so the above exclusions may not apply to you. This warranty gives you specific legal rights, and you may also have other rights which may vary from state to state.

To make a warranty claim, check first with the dealer from whom you purchased the product or call the following number for the name and location of the nearest dealer providing warranty service. For Goulds Water Technology contact 315-568-7123. For all other products, contact 847-966-3700.

Xylem |'zīləm|

- 1) The tissue in plants that brings water upward from the roots;
- 2) a leading global water technology company.

We're 12,500 people unified in a common purpose: creating innovative solutions to meet our world's water needs. Developing new technologies that will improve the way water is used, conserved, and re-used in the future is central to our work. We move, treat, analyze, and return water to the environment, and we help people use water efficiently, in their homes, buildings, factories and farms. In more than 150 countries, we have strong, long-standing relationships with customers who know us for our powerful combination of leading product brands and applications expertise, backed by a legacy of innovation.

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