xylem
Let's Solve Water

INSTALLER: PLEASE LEAVE THIS MANUAL FOR THE OWNER'S USE.

AQUAFORCE e-MT
Pump Controller

VARIABLE SPEED PUMPING SYSTEMS

BUILT IN THE
USA
ENGINEERED,
ASSEMBLED & TESTED

GOULDS
WATER TECHNOLOGY

a **xylem** brand

Contents

1. Introduction and Safety

1.1 Introduction

1.1.0 Purpose of the manual

The purpose of this manual is to provide necessary information for:
- Installation
- Operation
- Maintenance

CAUTION:

Read this manual carefully before installing and using the product. Improper use of the product can cause personal injury and damage to property, and may void the warranty.

NOTICE:

Save this manual for future reference, and keep it readily available at the location of the unit.

The information contained in this manual is intended to assist operating personnel by providing information on the characteristics of the purchased equipment.

It does not relieve the user of the responsibility to adhere to local codes and ordinances and the use of accepted practices in the installation, operation and maintenance of this equipment.

Further information pertaining to the installation, operation, and maintenance of your AquaForce pump controller can be found in the IOMs for the associated equipment provided Maintenance section for a list of relevant manuals.

Equipment cannot operate well without proper care. To keep this unit at top efficiency, follow the recommended installation and servicing procedures outlined in this manual.

1.2 Safety

WARNING:

The operator must be aware of safety precautions to prevent physical injury.

Any pressure-containing device can explode, rupture, or discharge its contents if it is over-pressurized. Take all necessary measures to avoid over-pressurization.

Operating, installing, or maintaining the unit in any way that is not covered in this manual could cause death, serious personal injury, or damage to the equipment. This includes any modification to the equipment or use of parts not provided by Xylem. If there is a question regarding the intended use of the equipment, please contact Xylem representative before proceeding.

This manual clearly identifies accepted methods of disassembling units. These methods must be adhered to. Trapped liquid can rapidly expand and result in a violent explosion and injury. Never apply heat to impellers, propellers, or their retaining devices to aid in their removal.

Do not change the service application without the approval of an authorized Xylem representative.

1.3 Safety terminology and symbols

1.3.0 About safety messages
It is extremely important that you read, understand, and follow the safety messages and regulations carefully before handling the product. They are published to help prevent these hazards.

- Personal accidents and health problems
- Damage to the product
- Product malfunction

1.3.1 Hazard levels

Hazard Level	Indication
⚠ DANGER:	A hazardous situation which, if not avoided, will result in death or serious injury.
⚠ WARNING:	A hazardous situation which, if not avoided, could result in death or serious injury.
⚠ CAUTION:	A hazardous situation which, if not avoided, could result in minor or moderate injury.
NOTICE:	• A potential situation which, if not avoided, could result in undesirable conditions. • A practice not related to personal injury.

1.3.2 Hazard categories
Hazard categories can either fall under hazard levels or let specific symbols replace the ordinary hazard level symbols.

Electrical hazards are indicated by the following specific symbol.

Electrical Hazards

These are examples of other categories that can occur. They fall under the ordinary hazard levels and may use complementing symbols:

- Crush hazard
- Cutting hazard
- Arc flash hazard

1.4 Environmental safety

1.4.0 The work area
Always keep the station clean to avoid and/or discover emissions.

1.4.1 Waste and emissions regulation

Observe these safety regulations regarding waster and emissions:

- Appropriately dispose of all waste.
- Handle and dispose of the processed liquid in compliance with applicable environmental regulations.
- Clean up all spills in accordance with safety and environmental procedures.
- Report all environmental emissions to the appropriate authorities.

1.4.2 Electrical installation

For electrical installation recycling requirements, consult your local electric utility.

1.5 Recycling guidelines

Always follow local laws and regulations regarding recycling.

1.6 User safety

1.6.0 General safety rules

These safety rules apply:

- Always keep the work area clean.
- Pay attention to the risks presented by gas and vapors in the work area.
- Avoid all electrical dangers. Pay attention to the risks of electric shock or arc flash hazards.
- Always bear in mind the risk of drowning, electrical accidents, and burn injuries.

1.6.1 Safety equipment

Use safety equipment according to the company regulations. Use this safety equipment within the work area:

- Helmet
- Safety goggles
- Protective shoes
- Protective gloves
- Gas mask
- Hearing protection
- First-aid kit
- Safety devices

NOTICE:

Never operate a unit unless safety devices are installed. Also see specific information about safety devices in other chapters of this manual.

1.6.2 Electrical connections

Electrical connections must be made by certified electricians in compliance with all international, national, state, and local regulations. For more information about requirements, see sections dealing specifically with electrical connections.

1.6.3 Precautions during work

Observe these safety precautions when you work with the product or are in connection with the product:

- Never work alone.

- Always wear protective clothing and hand protection.
- Stay clear of suspended loads.
- Always lift the product by its lifting device.
- Beware of the risk of a sudden start if the product is used with an automatic level control.
- Beware of the starting jerk, which can be powerful.
- Rinse the components in water after you disassemble the pump.
- Do not exceed the maximum working pressure of the pump.
- Do not open any vent or drain valve or remove any plugs while the system is pressurized. Make sure that the pump is isolated from the system and that pressure is relieved before you disassemble the pump, remove plugs, or disconnect piping.
- Never operate a pump without a properly installed coupling guard.

1.6.4 Wash the skin and eyes

Do the following if chemicals or hazardous fluids have come into contact with your eyes or your skin:

If you need to wash your…	Then
Eyes	- Hold your eyelids apart forcibly with your fingers. - Rinse the eyes with eyewash or running water for at least 15 minutes. - Seek medical attention.
Skin	1. Remove contaminated clothing. 2. Wash the skin with soap and water for at least one minute. 3. Seek medical attentions, if required.

2. Transportation and Storage

2.1 Inspect the delivery

2.1.0 Inspect the package
1. Inspect the package for damaged or missing items upon delivery.
2. Note any damaged or missing items on the receipt and freight bill.
3. File a claim with the shipping company if anything is out of order.
   If the product has been picked up at a distributor, make a claim directly to the distributor.

2.1.1 Inspect the unit
1. Remove packing materials from the product.
   Dispose of all packing materials in accordance with local regulations.
2. Inspect the product to determine if any parts have been damaged or are missing.
3. If applicable, unfasten the product by removing any screws, bolts, or straps.
   For your personal safety, be careful when you handle nails and straps.
4. Contact your sales representative if anything is out of order.

2.2 Transportation guidelines

2.2.0 Lifting methods

WARNING:

- Assembled units and their components are heavy. Failure to properly lift and support this equipment can result in serious physical injury and/or equipment damage. Lift equipment only at the specifically identified lifting points. Lifting devices such as eyebolts, slings, and spreaders must be rated, selected, and used for the entire load being lifted.
- Crush hazard. The unit and the components can be heavy. Use proper lifting methods and wear steel-toed shoes at all times.
- Care should be taken to prevent damage due to dropping or jolting when moving the controller. Transportation damage should be brought to the carrier's attention immediately upon receipt.

2.3 Storage guidelines

2.3.0 Storage location
The product must be stored in a covered and dry location protected from extreme cold, heat, dirt, and vibrations.

NOTICE:

- Protect the product against humidity, heat sources, and mechanical damage.
- Do not place heavy weights on the packed products.

2.3.1 Long-term storage
If the controller is stored for more than 6 months, these requirements apply:

- Store in a covered and dry location.
- Store the unit free from heat, dirt, and vibrations.
- Recommended storage includes but not limited to a tarp over the unit.

Extended storage of VFDs may require special attention prior to start-up. See manufacturer's IOM for details.

3. Product Description

3.1 General description
3.1.0 Description

The controller is a specific purpose programmable pump controller. This provides:
* Optimum pump control without the cost of general purpose control hardware.
* Software dedicated and established for the unit.
* Unique analog input protection of other members of the control family. In the event of a short circuit condition, the current limit circuitry prevents failure of the analog input components.

NOTICE:

* Your controller should have a safety instruction decal. If the decal is missing or illegible, contact your representative for a replacement.

Warning: This product can expose you to chemicals including Lead, which is known to the State of California to cause cancer and birth defects or other reproductive harm. For more information go to: www.P65Warnings.ca.gov.

3.2 Operational limits
3.2.0 Temperature and ventilation

All electrical equipment is susceptible to failure if operated in ambient temperatures outside of its rating. The OPERATING temperature range for this unit is 0 to 40°C. The relative humidity should not exceed 90% non-condensing. The unit should not be operated outside these extremes.

3.3 Nameplate information
3.3.0 Important information for ordering

Every pump station has a nameplate that provides information about the pump station. The pump station nameplate is located on the inside of the control enclosure door.

When ordering spare parts, be prepared to identify the nameplate information when contacting the factory.

* Model
* Size
* Serial number
* Item numbers of the required parts

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Model Number	
Serial Number	
Station Voltage	
Enclosure Type UL/NEMA	
System FLA	
Largest Motor HP	
SCCR	
Station Flow	
Pump Boost	
Date Code	
Assembled in Dallas, Texas, U.S.A.	

Model Number	The manufacturer's number to indicate the particular type of product which has been acquired.
Serial Number	A set of characters that uniquely identifies a single unit and can be used for traceability and warranty purposes.
Station Voltage	The rated voltage at which the station has been designed for. Should match the application site supply voltage.
Enclosure Type UL/NEMA	The designated UL/NEMA rating of the electrical enclosures.
System FLA	The full-load-amperage at which the station can operate.
Largest Motor HP	The rated HP for the largest Pump in the system.
SCCR	"Short-Circuit Current Rating". Represents the maximum level of short-circuit current that a component or assembly can withstand.
Largest Motor HP	The rated HP for the largest Pump in the system.
Station Flow	The designed duty point, in GPM, LPH, etc.
Pump Boost	The difference between the input side of the pump station and the output side of the pump station.
Date Code	Marking of products to indicate their date of manufacture.

3.4 Main parts and functions

3.4.0 Input voltage

The VFD and AquaForce e-MT Pump Controller can be set up to operate across a broad range of voltages. It was factory set to operate on the voltage shown on the nameplate. Check the VFD nameplate for the proper input and output voltages before wiring the VFD.

The voltage tolerance is +10/-5% and phase to phase voltage must not have an imbalance greater than 5 VAC.

3.4.1 Ground connections

A grounding terminal is provided for a dedicated ground wire connection. All provisions of the National Electrical Code and local codes must be followed.

WARNING:

• Conduit grounds are not adequate. A separate ground wire must be attached to the ground lug provided in the enclosure to avoid potential safety hazards.

3.4.2 Power wiring

Power wire types and sizes must be selected based upon conformance with the National Electrical Code and all local codes and restrictions. In addition, only copper (Cu) wire rated for 75°C (minimum) may be used for the power connections. Refer to the input current as listed on the nameplate affixed to the enclosure door when sizing wire.

3.4.3 Output/motor disconnect

It is necessary that any device which can disconnect the motor from the output of the VFD be interlocked to the emergency shutdown circuits of the VFD. This will provide an orderly shutdown if the disconnecting device is open circuited while the VFD is in operation. Failure to provide this interlock may result in damaged components due to improper installation.

CAUTION:

- Metal filings can create electrical short circuits. Do not drill, saw, file or perform any operation on the VFD conduit entry plate while attached to the VFD.

3.4.4 Analog signals

Shielded cable (#22 AWG, Belden type 8762, Alpha #2411, or equal) should be installed for all D.C. control wiring. The shield must be terminated in the Controller panel. Do not connect the shield at the other end of the cable! Insulate the shield so that no electrical connection is made at the other end of the cable. A twisted pair of #22 AWG conductors (Belden 8442 or equal) can be used in place of shielded cable. The cable length must be limited to 5,000 feet for #22 AWG wire.

3.4.5 Field connection diagrams

Refer to the pump Installation, Operation, and Maintenance Manual for specific details unique to the pump.

Refer to the flow sensor/transmitter Installation, Operation, and Maintenance manual for specific details unique to the flow sensor/transmitter.

Job specific wiring and dimensional drawings and typical field connection diagram should be reviewed prior to unit installation and operation.

3.5 Glossary of terms

- **VFD** — Variable Frequency drive; converts a constant power input into a variable power output for the motor; a device for controlling motor speed.
- **Alternation** — Process of determining which pump will serve as lead pump and which pump will serve as lag pump.
- **Destage** — To turn off a lag pump.
- **EOC** — End of curve; point at which a pump is staged or destaged.
- **Lag pump** — Standby pump which activates only when lead pump alone cannot efficiently provide sufficient pressure or flow rate.
- **Lead pump** — Duty pump which runs continuously until a standby pump is required.
- **OIP** — Operator Interface Panel.
- **PID** — Proportional Integral Derivative; 3 variables required for error control.
- **PV (Process Variable)** — Signal generated by a sensor which is set up to control the system.
- **Proof timer** — Minimum time period before controller acknowledges an input; time period for which a signal must be stable before it is accepted by the controller as a sustained and valid signal.
- **RTC** — Real time clock.
- **Stage** — To start a lag pump.
- **SP** — Set point.
- **UV** — Under voltage
- **OV** — Over voltage
- **OC** — Over current

4. Installation

4.1 Field connections

4.1.0 Diagrams

Review the wiring diagrams and dimensional drawings before you install and operate the unit.

4.1.1 Electrical precautions

WARNING:

- Prevent electrical shocks. Disconnect the power supply before beginning installation. FAILURE TO FOLLOW THESE INSTRUCTIONS COULD RESULT IN SERIOUS PERSONAL INJURY, DEATH AND/OR PROPERTY DAMAGE.

- Each motor must have a properly sized drive. Ground fault protection should be sized properly. Refer to local electrical codes for sizing and selection.

- Refer to the motor manufacturer's IOM for specific installation information.

- Motor can start automatically. Keep hands away from output shaft until motor is completely stopped and input power is removed from the motor control panel. Lockout main power switch while working near motor shaft.

- The use of motor disconnect switches is acceptable. Consult the factory for proper interlocking with variable frequency drives.

- Motor control equipment and electronic controls are connected to hazardous line voltages. When servicing electronic controls, there will be exposed components at or above line potential. Extreme care should be taken to protect against shock. Stand on an insulating pad and make it a habit to use only one hand when checking components. Always use accurate test meters when checking electrical components. Always work with another person in case of an emergency. Disconnect power when performing maintenance. Be sure equipment is properly grounded. Wear safety glasses whenever working on electronic control or rotating equipment.

DANGER:

- Troubleshooting live control panels exposes personnel to hazardous voltages. Electrical troubleshooting must only be done by a qualified electrician. FAILURE TO FOLLOW THESE INSTRUCTIONS COULD RESULT IN SERIOUS PERSONAL INJURY, DEATH, AND/OR PROPERTY DAMAGE.

4.2 Earth (ground connections)

WARNING:

- Conduit grounds are not adequate. A separate ground wire must be attached to the ground lug provided in the enclosure to avoid potential safety hazards. Failure to follow these instructions could result in serious personal injury or death, property damage.

A grounding terminal is provided for a dedicated earth (ground) wire connection. You must follow all provisions of the National Electrical Codes and local codes.

4.3 Sensor and control wiring

The following sections are based on the installation of standard AquaForce product. Because of customized software and hardware, the installing contractor should base all wiring connections on the wiring diagrams that accompany each controller. These sections are meant to complement, not replace, those wiring diagrams.

Differential pressure switches are installed to sense the increase in pressure between the pump suction and discharge gauge taps and are used to determine whether a pump is running. Each switch should be wired from the normally closed contact.

To control variable frequency drives it is necessary to wire RS485 with each VFD.

With certain bypass and control methods it is necessary to disable the adjustable frequency drive from running. This is accomplished by wiring from the terminals to each VFD's interlock terminals. Should this wiring be required, any jumpers which may be found on the VFD's interlock terminals should be removed.

The control family may be provided with the capability to accept many analog inputs. Typically all analog inputs must be 4-20mA and powered by the 24VDC power supply in the controller. All shields must be grounded in the controller only to prevent ground loops and improper signals.

Hardwire communications refers to the capability of the Controller to communicate with an energy management system. Standard communication features are listed below:

Remote Start/Stop – Remove the jumper from Terminal 200 and install a switch as indicated on the wiring diagram. CLOSED CONTACT of this switch will provide the start signal.

Remote Alarm Indication – A digital output rated 5 AMPs at 240V is supplied. This output closes to indicate an alarm condition exists.

User Configurable I/O – The Controller comes equipped with the capability to define the operation of any unused input or output signal. Refer to section 5.5.10.

4.4 Pump package location guidelines

WARNING:

- Assembled units and their components are heavy. Failure to properly lift and support this equipment can result in serious physical injury and/or equipment damage. Lift equipment only at the specifically identified lifting points. Lifting devices such as eyebolts, slings, and spreaders must be rated, selected, and used for the entire load being lifted.

Guideline	Explanation
Make sure that the space around the pump package is sufficient.	This facilitates ventilation, inspection, maintenance, and service.
If you require lifting equipment such as hoist or tackle, make sure that there is enough space above the pump package.	This makes it easier to properly use the lifting equipment and safely remove and relocate the components to a safe location.

Protect the unit from weather and water damage due to rain, flooding, and freezing temperatures.	This is applicable if nothing else is specified.
Do not install and operate the equipment in closed systems unless the system is constructed with properly-sized safety devices and control devices.	Acceptable devices: • Pressure relief valves • Compression tanks • Pressure controls • Temperature controls • Flow controls If the system does not include these devices, consult the engineer or architect in charge before you operate the pump.
Take into consideration the occurrence of unwanted noise and vibration.	The best pump location for noise and vibration absorption is on a concrete floor with subsoil underneath.

4.5 System piping and unit installation – final checklist

1. Check that the unit base is properly leveled, grouted and secured.
2. Check that all lubrication points are properly lubricated per motor manufacturer's instructions.
3. Check that the shut-off valves to the transmitters open.
4. Check that the shut-off valves to the pump suction open.
5. Check that the shut-off valves to the discharge line open.
6. Check that the piping is properly supported to prevent strains on the unit.
7. Check that the system, including pumps and valving, are purged of debris and air.

> **CAUTION:**
> • Seal damage may occur. Do not run pumps dry. Fill and vent the pump volute prior to operation. FAILURE TO FOLLOW THESE INSTRUCTIONS COULD RESULT IN PROPERTY DAMAGE AND/OR MODERATE PERSONAL INJURY.

4.6 Electrical wiring and control settings – final checklist

1. Check the unit nameplate or motor terminal connection to ensure the feeder line voltage corresponds to the unit voltage

> **WARNING:**
> Electrical shock hazard. Inspect all electrical connections prior to powering the unit. Wiring connections must be made by a qualified electrician in accordance with all applicable codes, ordinances, and good practices. FAILURE TO FOLLOW THESE INSTRUCTIONS COULD RESULT IN SERIOUS PERSONAL INJURY, DEATH, AND/OR PROPERTY DAMAGE.

2. Check that feeder wires are correctly sized for the load.
3. Check that the fuses are correctly sized. They must not exceed 1.75 times the full load current of the motor. Usual sizing is 1.15 to 1.5 times the full load current.

DANGER:

- High voltage 3 phase power can kill. Disconnect and lockout power prior to servicing. FAILURE TO FOLLOW THESE INSTRUCTIONS COULD RESULT IN SERIOUS PERSONAL INJURY, DEATH, AND/OR PROPERTY DAMAGE.

WARNING:

- Conduit grounds are not adequate. A separate ground wire must be attached to the ground lug provided in the enclosure to avoid potential safety hazards. FAILURE TO FOLLOW THESE INSTRUCTIONS COULD RESULT IN SERIOUS PERSONAL INJURY, DEATH, AND/OR PROPERTY DAMAGE.

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4. Check that the unit is properly grounded.
5. Make sure all the power terminals in the control panel have been tightened.

4.7 IO

4.7.0 Analog Inputs

The AquaForce e-MT Pump Controller is equipped with 3 analog input channels. The analog inputs must provide a 4-20mA signal. Typically, analog inputs will be powered by the 24V power supply within the panel. For analog inputs which source their own power, consult factory.

Shielded 22 AWG cable should be installed for all analog input wiring. The shield must be terminated in the AquaForce e-MT Pump Controller. Do not connect the shield at the other end of the cable! Insulate the shield so that no electrical connection is made at the other end of the cable. A twisted pair of #22 AWG conductors can be used in place of shielded cable. The cable length must be limited to 2,500 feet for #22 AWG wire.

4.7.1 Digital Inputs

The AquaForce e-MT Pump Controller is equipped with (8) 24VDC digital input channels. This signal voltage must be obtained from the 24VDC power supply mounted to the subpanel. It is not recommended that other power sources be used without factory approval. All digital inputs are automatically assigned based on Table 1. See the typical wiring diagram in Appendix.

Table 1: Digital Inputs Functionalities

Functionality	DI #	Description
Start/Stop Sw	1	Remote contact can be used to start/stop the system.
Optional DI	2-8	User can select the function of optional input in IO setup, see section 5.5.10.1.

4.7.2 Digital Output Module

The AquaForce e-MT Pump Controller is equipped with (2) 24VDC digital output and (2) Relay Output channels. The Relay output consists of 1 normally open and 1 normally closed contact for each relay output rated at 5A at 240V. Customer connections are made directly to the terminals mounted on the digital output module. Refer to section 5.5.10.2 for optional digital output setup.

5. Operation and Setpoint

5.1 General Terms for Navigation of System

To operate and to navigate this system, user has to consider several points as explained in details below:

1) Once user completely powers up the system, the **Home** screen will be displayed.
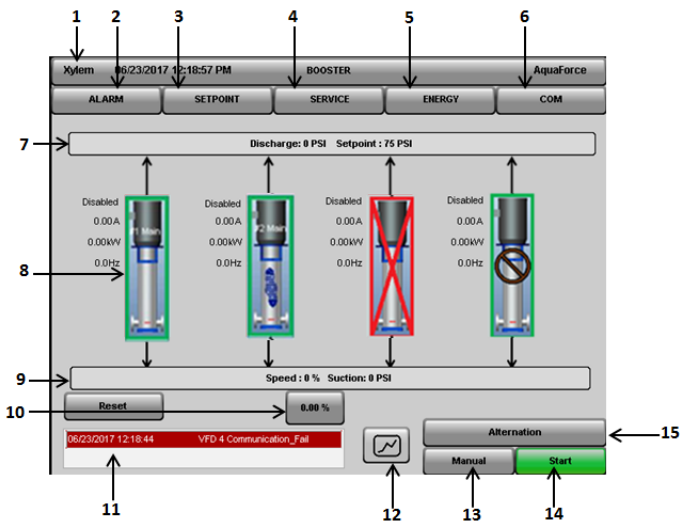
Figure 5.1.1 – Home Screen

The Home screen has various buttons and information blocks as shown above and listed below.

1. Home Tab
2. Alarm Screen Navigation button
3. Setpoint Screen Navigation button
4. Service Screen Navigation button
5. Energy Screen Navigation button
6. Com Screen Navigation button
7. Discharge Bar
8. Pump Status
9. Suction Bar
10. Pump Speed Control Button in Manual Mode
11. Alarm Status Screen
12. Trend Screen Navigation button
13. System Mode of Operation
14. System Start/Stop
15. Manual Alternation

2) Menu Tab shown below is common global Tab which will appear on all screens.

Figure 5.1.2 – Global Header – Common for all Screens

3) At any point when user clicks on the Home Tab, it will navigate to the home screen.

Figure 5.1.3 – Global Header - Home Tab

4) Discharge Bar - The Station Discharge bar is located above the Pump. As shown in Figure 5.1.4, this bar shows Discharge pressure, Pressure, and Setpoint value. It also shows Flow and Monitoring Pressure values if respective sensor is setup. On tapping Discharge bar, PV Information Screen pops up as shown in figure 5.1.5.

Figure 5.1.4 – Discharge Bar
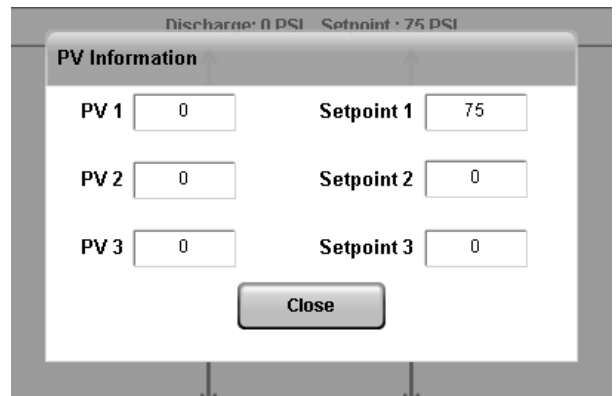
Figure 5.1.5 – PV Information

5) Suction Bar - The Station Suction bar is located below the Pump as shown in Figure 5.1.6. This bar shows Suction pressure and % Speed of System. It also shows Pump running sequence when the system is in Auto mode.
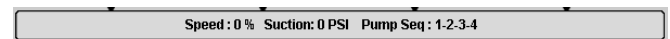
Figure 5.1.6 – Suction Bar

6) On the Home screen, visualization of pumps will be animated as per their current status.

Figure 5.1.7 – Pump Status

- **Stand-By:** Pump is in standby while in Auto mode.
- **Running:** Pump is running either in Auto/Manual mode.
- **Off:** Pump is not running.
- **Pump/VFD Fail:** Pump and/or VFD has a failure and is not running.

Also, refer to point 8 for more detail on pump status.

7) On the Home screen, there are buttons for system start/stop, automatic or manual operation mode selection, and manual pump sequence alternation.

Figure 5.1.8 – Start/Stop, Auto/Manual & Alternation Buttons

- **Operation Mode (Automatic / Manual):** It shows the current state of operation mode. (i.e. If it is showing manual, then at present, the system is in manual mode.) User can change the mode using this button. When system is running, operation mode cannot be changed.

  These modes of operation can be accessed through the interface button [**Automatic/Manual**] on the home screen.

  The available two modes of operation are described below.

 1. **Automatic Mode**: Tap on [**manual**] button shown in Figure 5.1.1 (13). The system will enter into auto mode and the text on [**Manual**] Button will change to [**Automatic**] and it will be highlighted as shown in Figure 5.1.9

Figure 5.1.9 – System Mode Change Button in Auto Mode

2. **Manual Mode**: Tap on [**Automatic**] button. The system will enter into manual mode and the text on [**Automatic**] Button will change to [**Manual**] as shown in Figure 5.1.10.

Figure 5.1.10 – System Mode Change Button in Manual Mode

To start system at any point of time, tap [**Start**] button. When the system is running, the text on [**Start**] button will change to [**Stop**] and Auto/Manual Button will be disabled.

In manual mode, the button for manual Speed control of pump becomes visible as shown in Figure 5.1.1 (10).

Text on this button displays the current set Speed of the system. On tapping [0.00%] button, a Speed bar appears as shown in Figure 5.1.11. Speed can be controlled using speed bar in Manual mode.
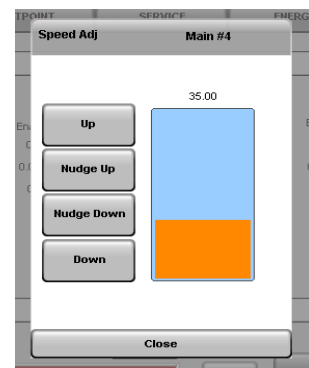
Figure 5.1.11– Pop up Screen for setting speed of system in manual mode

- **System Start/Stop:** It shows the command which can be performed by using this button (i.e. If it is showing "Start" then user can use this button to start the system and if it shows "Stop" then user can use this button to stop.). This button is shown in Figure 5.1.1 (14).
- **Manual Alternation:** This button can be used to alternate pump sequence in automatic operation mode. When alternation method is selected on pump run hour base, this button gets disabled. This button is shown in Figure 5.1.1 (15).

8) Use pump bitmap to enhance as shown below for individual pump start/stop (enable/disable) page. In the event operation mode is changed to Auto, all pumps are forced to an enabled status. For manual mode, all pumps are forced to disabled. Below table shows the possible Pump status that could be showing in each case:

Pump	Auto	Manual
Enable	1. Running 2. Off 3. Fail 4. Standby	1. Running 2. Fail
Disable	1. Off 2. Fail	1. Off 2. Fail
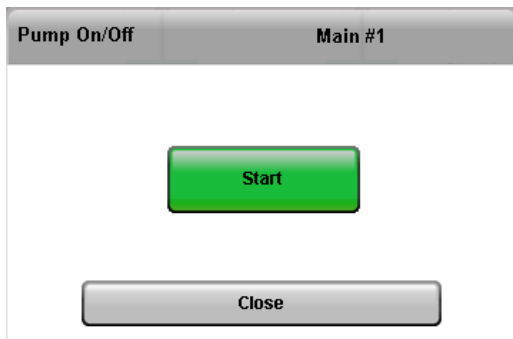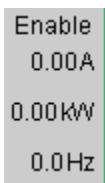
Figure 5.1.12 – Pump On/Off control
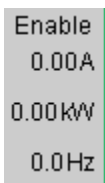
9) Click [ ] to enhance detail pump information page as shown below.
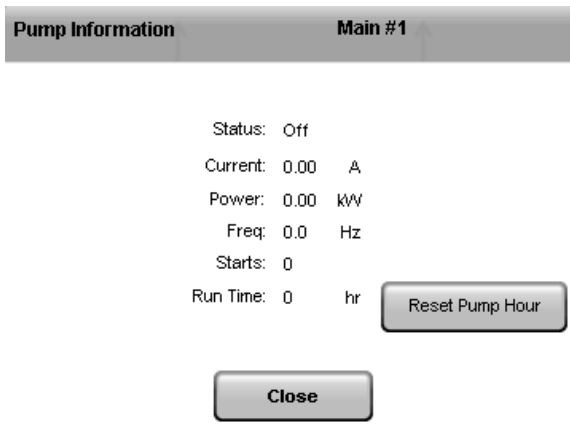
Figure 5.1.13 – Pump Information

10) If system has had any alarm, the last occurred alarm appears in alarm bar. To see list of current and history of alarms, user can touch alarm bar or alarm button as shown in below figure. On alarm screen, it shows all active alarms. If alarms are acknowledged, then it shows in blue otherwise it shows in red.
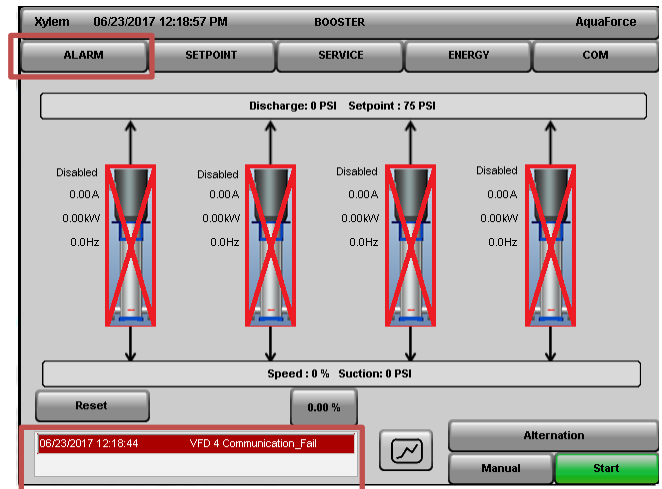
Figure 5.1.14 – Alarm bar and Button

11) On the main screen, [ ] trend button can be used to navigate to trend page, which shows the trend of parameters like Pressure, Power, Setpoint, Speed, and Flow set time interval. Individual parameters, Minimum and Maximum boundaries, can be set. Refer to section 5.8 for more detailed information.

12) To get the access for all setup parameters and menu, the user needs to login as a technician from Service→Log On/Off Tab. Supervisor and Guest user (Default user) will have limited access. Supervisor Default Password = 1234.

13) To set the required parameters and configuration, user is required to click on service tab and from dropdown menu user can navigate to the setup screens.

14) The system considers the page change as a confirmation for saving the parameter change, except where it has been asked for confirmation.

15) User can use the (Previous ◄ & Next ►), Tabs to change the screens under the same menu.

16) Select required functions /type /value from the dropdown menu. Controller does not allow any further HMI action until dropdown menu is expanded (i.e. if user has not selected any value after opening the dropdown menu, it will not allow access to other functions.).

17) Two types of keypads are available to enter data into any system parameter. They are as follows:

1. Numeric Keypad: If only numeric data is to be entered into any parameter then Numeric Keypad will pop up upon tapping the required parameter. Numeric Keypad is shown in Figure 5.1.15.

To enter any Numeric Data, Tap on the numbers shown and then tap ↵ to enter the data or tap ⊗ to cancel the entered data.

Figure 5.1.15 – Numeric Keypad

2. Alpha Numeric Keypad: This keypad will pop up when alphabets as well as Numeric input is accepted by any Parameter. Alpha Numeric Keypad is shown in Figure 5.1.16.

To enter any Alpha Numeric Data, Tap on the Alphabetic Characters and Numbers shown and then tap ↵ to enter the data or tap ⊗ to cancel the entered data.

Figure 5.1.16 – Alpha Numeric Keypad

5.2 User Types

There are different types of users recognized by the system:

1. **Guest**: Only operation screens are accessible in view-only mode. **Users are logged in as a Guest by default.**
2. **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. Note: Factory can be contacted to provide a temporary password in case user forgets the password.
3. **Technician:** All setup and operation screens are accessible. Technicians must log-in using a password. The default technician password will be provided to the certified installer at the time of installation.

5.2.1 Touch Panel Log In

Tap [**SERVICE**] from the Home Screen.

Figure 5.2.2 – Guest Service Screen

Note that when logged in as a Guest certain boxes are disabled, as shown in **Figure 5.2.2**.

When logged in as a Supervisor more options will be made available, as shown in **Figure 5.2.3.**

In order to enable all of these parameters, user has to be logged in as Technician.
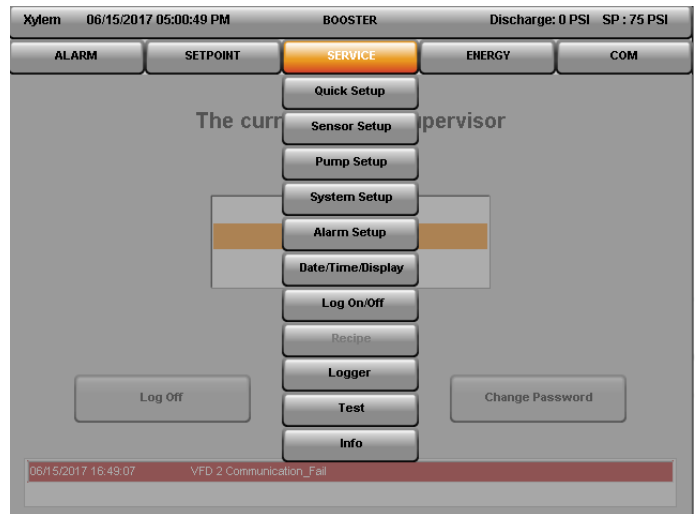
Figure 5.2.3 – Supervisor Service Screen

Tap [**Log On/Off**] from the Service Screen to change User type. It will navigate to Login Screen, as shown in **Figure 5.2.4**.
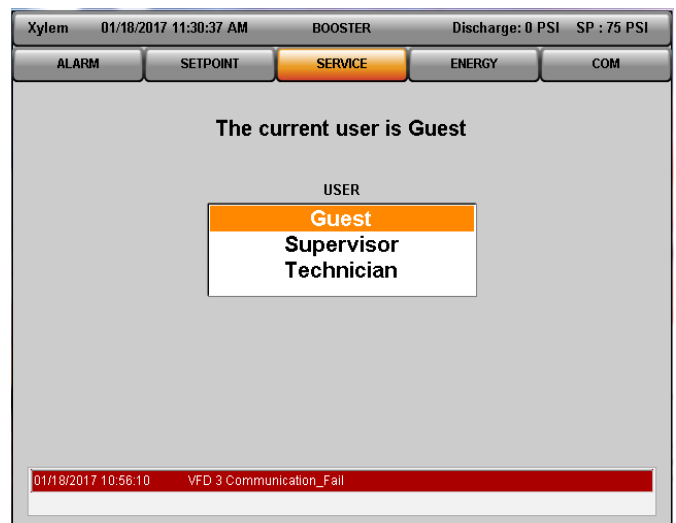
Figure 5.2.4 – Login Screen

To log in as a Technician, tap [**Technician**], and then tap on the empty [**Password**] field to enter the Technician password. This will bring up an enhanced screen shown in **Figure 5.2.5**.
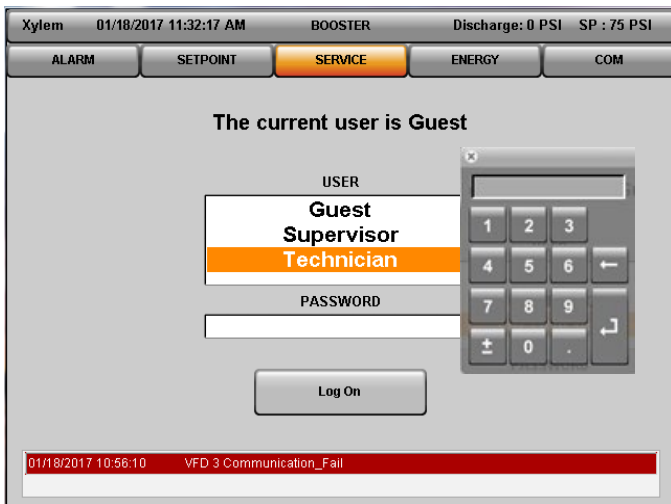
Figure 5.2.5 – Login keypad

Figure 5.2.7 – Technician Service Screen

Enter your password and Tap

 To login,

Or

 To cancel.

If wrong password is entered, it will generate the message as shown in **Figure 5.2.6**.

Figure 5.2.6 – Incorrect Password

After entering the correct Password on Log On screen tap on [**Log ON**] or [**Cancel**] to abort.
If Log in is successful, the Service Screen should appear as in Figure 5.2.7.

The same procedure can be followed to login as Supervisor. Make sure to log out before leaving system unattended.

Tap [**Home Tab**] to return to the Home Screen

5.3 Alarm / Events
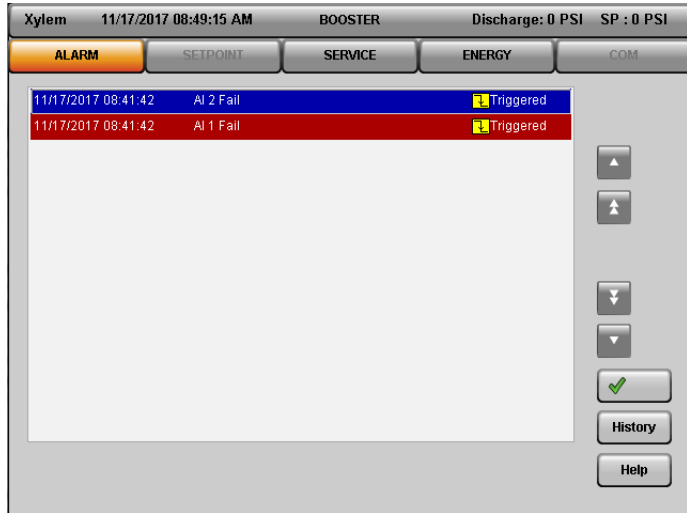
Figure 5.3.1 – Alarm Page
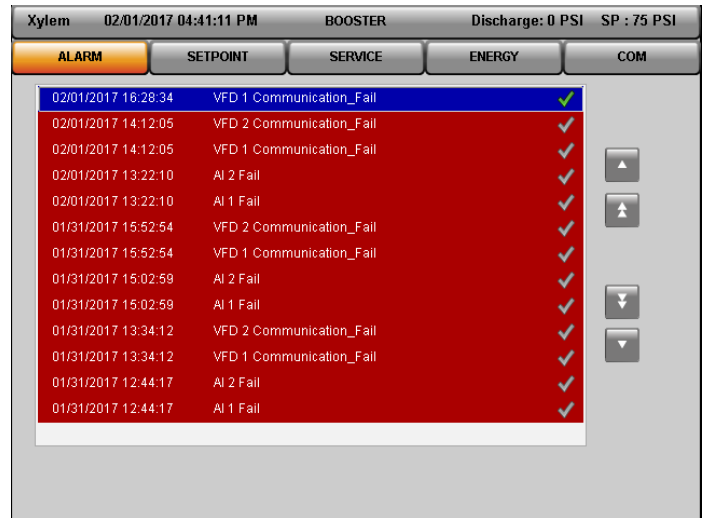
Figure 5.3.2 – Historical Alarm Page

When **[Alarm]** button is tapped, Alarm Page appears as shown in Figure 5.3.1.

On this page list of current alarm with date and time stamp is available. There is a Color code to identify the Status of Alarm.

If the Alarm is highlighted in RED, then the alarm is Active and not acknowledged.

If the Alarm is highlighted in BLUE, then the Alarm is Active and acknowledged.

Alarms can be acknowledged by tapping [button] button on **[Alarm]** page.

The Alarms which are no longer active will disappear automatically from [**Alarm**] page. Those alarms can be found in [**Historical Alarm**] page as shown in Figure 5.3.2. To open Historical alarm page, tap on [**History**] button available on [**Alarm**] page.

Upon tapping [Help] button on Alarm screen, it navigates to Alarm Help page. On this page, there is a list of all Alarms with Help Text for each Alarm. The alarms which are active are shown in Red.

Refer Figure 5.3.3 and Figure 5.3.4 for details.
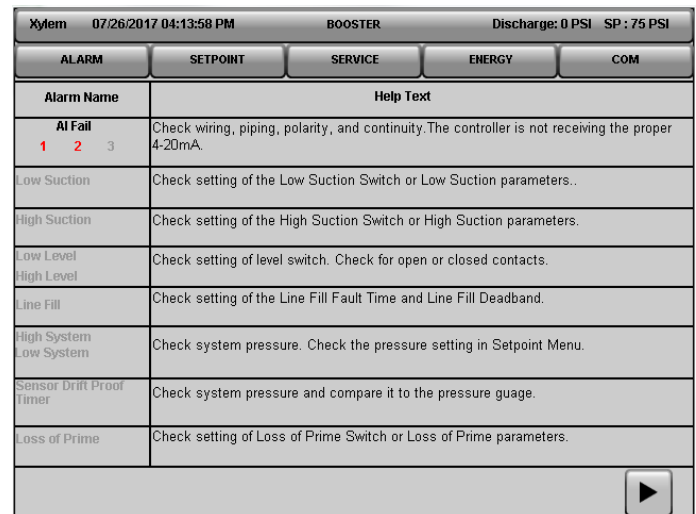
Figure 5.3.3 – Alarm Help Page-1
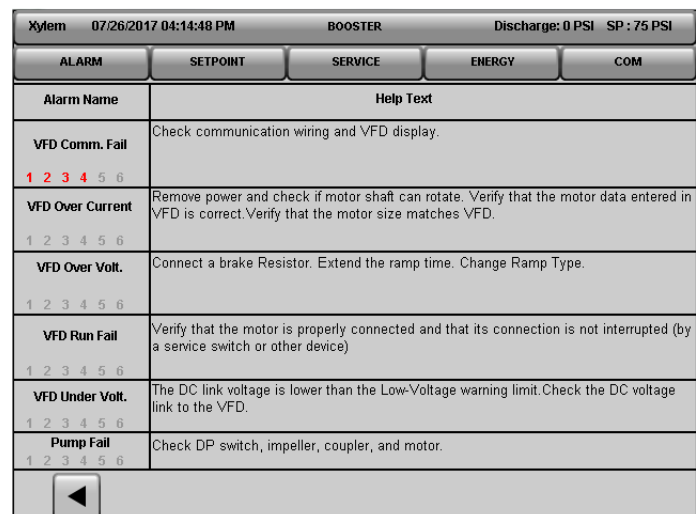
Figure 5.3.4 – Alarm Help Page-2

Refer below table for more detail of each Alarm. Refer section 6.13 for additional information of troubleshooting.

Help Screen Alarm	Help/Help Screen Display	Detailed Description
AI (Analog Input) Fail	Check Wiring, Piping, Polarity, Continuity. The Controller is not receiving the proper 4-20mA.	Check Wiring, Piping, Polarity, Continuity. The Controller is not receiving the proper 4-20mA.
Low Suction	Check Setting of the Low suction switch or Low suction settings.	Check for open or closed contacts and low suction settings, refer to wire diagram for proper connection
High Suction	Check setting of the High Suction switch" or high suction settings.	Check for open or closed contacts and high suction settings, refer to wire diagram for proper connection
Low Level High Level	Check setting of level switch. Check for open or closed contacts.	Check for open or closed contacts, refer to wire diagram for proper connection.
Line fill	Check setting of Line fill fault time and line fill deadband.	Check setting of Line fill fault time and line fill deadband.
High System Low System	Check system pressure. Check the pressure setting in Setpoint Menu.	Check system pressure. Check the pressure setting in Setpoint Menu.
Sensor Drift proof timer	Check system pressure and compare it with pressure gauge.	"Check wiring of both sensors, and compare the pressure reading of both sensors with pressure gauge "
Loss of Prime	Check Loss of Prime Switch or Check Loss of Prime Setting.	Check Loss of Prime Switch or Check Loss of Prime Setting.
Pump Fail	Check DP switch, impeller, coupler, motor	The controller is receiving a closed signal from the differential pressure switch for pump number X after it has been given a start command
VFD Comm. Fail	Check communication wiring, and VFD display	The controller is not receiving a closed run signal from VFD number X after it has been given a start command or communication failure or VFD fault
VFD Over Current	Remove Power & Check if motor shaft can be turned. Check that the motor data entered is correct. Check if motor size matches VFD.	Remove Power & Check if motor shaft can be turned. Check that the motor data entered is correct. Check if motor size matches VFD.
VFD Over Volt.	Connect a brake Resistor. Extend the Ramp time. Change Ramp Type in VFD.	Connect a brake Resistor. Extend the Ramp time. Change Ramp Type in VFD.
VFD Run Fail	Check if the motor is connected and the connection is not interrupted (by a service switch or other Device)	Check if the motor is connected and the connection is not interrupted (by a service switch or other Device)
VFD Under Volt	The DC link voltage in VFD is lower than Low-Voltage warning limit. Check the DC Voltage link to VFD.	The DC link voltage in VFD is lower than Low-Voltage warning limit. Check the DC Voltage link to VFD.

5.4 Setpoint

Sections under [**Setpoint**] tab are as follows:

5.4 1 Setpoint

Setpoints can be modified for the transmitter configured as the system pressure.
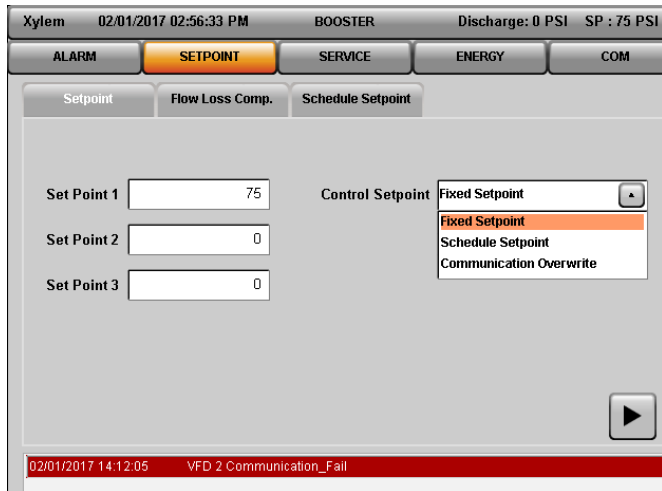
Figure 5.4.1 – Setpoint Configuration Page

Three Control Setpoint options are available as shown in Figure 5.1.

- **Fixed Setpoint** –When Fixed Setpoint is selected as Control Setpoint option, then Setpoint is considered from the value in Set Point 1, Set Point 2 and Set Point 3 as shown in figure 5.4.1.
- **Schedule Setpoint** - When Schedule Setpoint is selected as Control Setpoint option, then Setpoint is considered from Setpoint value(s) entered on Schedule Setpoint page as shown in Figure 5.4.4.
- **Communication Overwrite** – When Communication Overwrite is the Control Setpoint option then the Setpoint is over written by BMS communication.

Each Setpoint value is assigned to a respective system sensor. For example, Setpoint 1 is assigned to AI1 system sensor and so on. Multiple Setpoints can be used when it is required to control multiple zones. In case of multiple zones, system will control the zone which is having maximum error.

5.4.2 Flow Loss Compensation

This energy savings feature allows user to compensate for the friction losses of system. As flow increases, the pressure losses due to friction in the system will increase accordingly. This feature will allow controller to modify the setpoint in real time based on the speed changes to compensate system friction loss. The controller logs the real time setpoint changes. Figure 5.4.2 shows how this function works with setup parameters using an example of a three pump system.
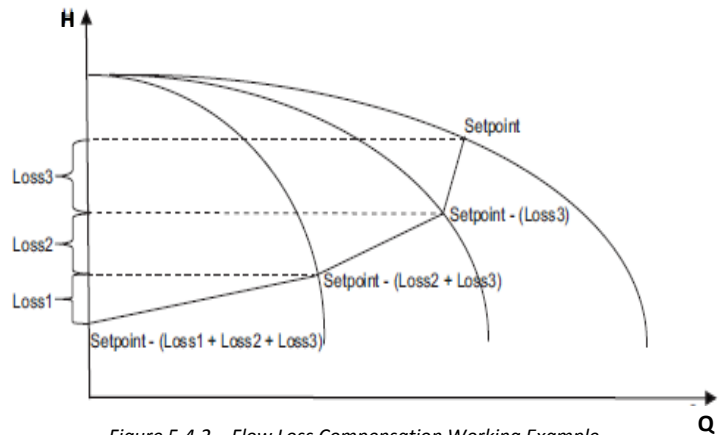
Figure 5.4.2 – Flow Loss Compensation Working Example
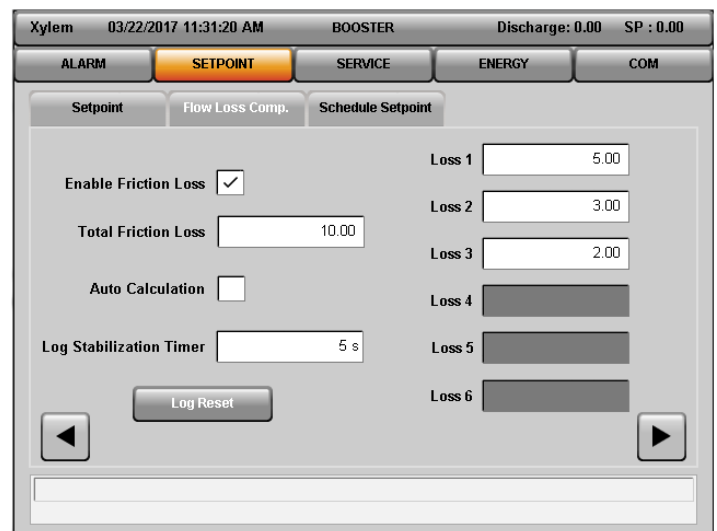
Figure 5.4.3 – Flow Loss Compensation Page

As Shown in Figure 5.4.3, The Friction Loss Compensation Page contains following parameters:

- **Enable Friction Loss** – Check the checkbox to enable friction loss compensation.

- **Total Friction Loss** – Total friction loss of the system in PSI. System Syzer tool from the Xylem website can be used to estimate friction loss.
- **Auto Calculation** – Check the checkbox to calculate Loss1 thru 6 values automatically. Summation of Loss1 thru 6 will be equal to total friction loss if calculated using this parameter. Value of Loss1 to 6 can be also overwritten as required.
- **Log Stabilization Timer** – Time in seconds for which new setpoint must stabilize to log.

- **Loss 1** – The max loss in PSI that will be compensated for one pump.

  This value will be used to adjust the setpoint when one pump is running.

- **Loss 2** – The max loss in PSI that will be compensated for two pumps.

  This value will be used to adjust the setpoint when two pumps are running. This value will get subtracted from the setpoint as a fixed value when less than two pumps are running.

- **Loss 3** – The max loss in PSI that will be compensated for three pumps.

  This value will be used to adjust the setpoint when three pumps are running. This value will get subtracted from the setpoint as a fixed value when less than three pumps are running.

- **Loss 4** – The max loss in PSI that will be compensated for four pumps.

  This value will be used to adjust the setpoint when four pumps are running. This value will get subtracted from the setpoint as a fixed value when less than four pumps are running.

- **Loss 5** – The max loss in PSI that will be compensated for five pumps.

  This value will be used to adjust the setpoint when five pumps are running. This value will get subtracted from the setpoint as a fixed value when less than five pumps are running.

- **Loss 6** – The max loss in PSI that will be compensated for six pumps.

  This value will be used to adjust the setpoint when six pumps are running. This value will get subtracted from the setpoint as a fixed value when less than six pumps are running.

5.4.3 Schedule Setpoint
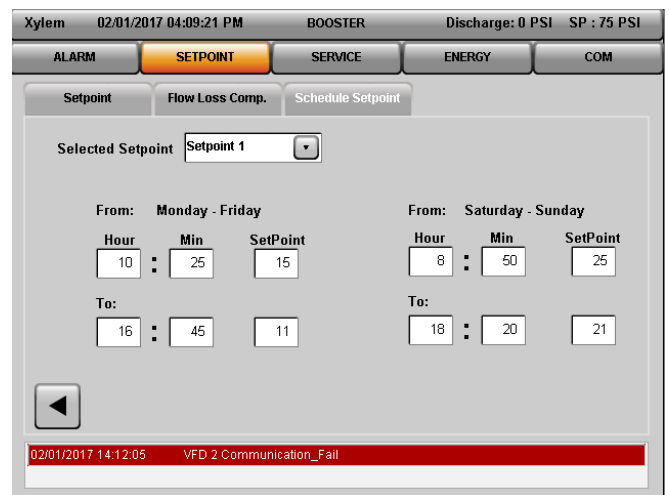
Figure 5.4.4 – Scheduled Setpoint Page

When Schedule Setpoint is selected as Control Setpoint option, then Setpoint is considered from Setpoint value(s) entered on Schedule Setpoint page as shown in Figure 5.4.4.

Two different Setpoint values can be scheduled for Setpoint 1, Setpoint 2 and Setpoint 3 from Monday to Friday and similarly for Saturday and Sunday.

Each individual Setpoint can be selected from the dropdown list for Selected Setpoint.

5.5 Service

[**Service**] Button has multiple Sections under it. Tap on [**Service**] button and the drop down list of multiple sections available under [**Service**] button appears as shown in Figure 5.5.1
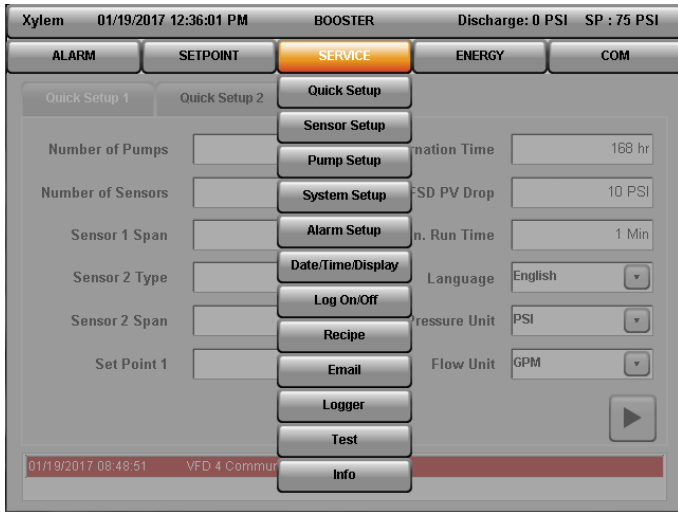
Figure 5.5.1 – Service button Drop down list

Each section under [**Service**] button is explained in detail below.

5.5.1 Quick Setup

Navigate to **Quick Setup** Screen under **Service Tab** as shown in Figure 5.5.2 and Figure 5.5.3.

Quick Setup screens are mainly designed for giving quick access to the parameters which are required most and least required setup. For more settings, user can check respective setup under service.
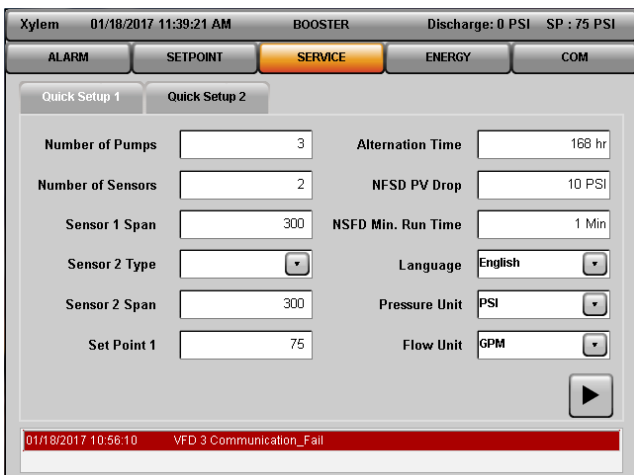
Figure 5.5.2 – Quick Setup 1
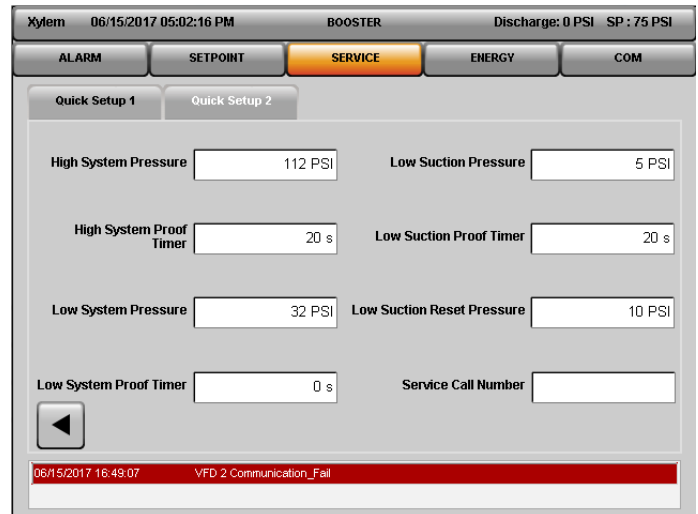
Figure 5.5.3 – Quick Setup 2

On Quick Setup 1 screen, it is considered that sensor 1 (or AI 1) is connected with discharge sensor as default. User need to set only span if in case it is different from default. Selection of sensor 2 (AI 2) type is limited to suction & redundant sensor from this screen. For other options, go to the sensor setup under service.

Quick setup 2 screen covers protection functions. High system pressure threshold must be above the set point and low system threshold must be below setpoint in order to work properly. Set the non-zero value in the respective protection's proof timer to enable.

5.5.2 Sensor Setup

[**Sensor Setup**] Screen is as shown in figure 5.5.4. This screen is used to setup the available sensors.

Select the sensor from list of available sensor. Once the sensor is selected, configure the sensor Type, Span, Zero, Active Sensor Number, Drift Threshold, and Drift Pr Timer from Sensor Settings available on the right side of [**Sensor Setup**] Page.

- **Type**: User can select any one of the sensor type from list of available Sensor type. Available sensor types are System Discharge, Suction, Redundant, Flow and Pressure.
- **Span**: Define Span limit of Sensor.
- **Zero**: Define Zero limit of Sensor.

If Sensor Type is Redundant, then the following options are enabled

- **Active Sensor Number**: Enter the active system pressure sensor number.

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- **Drift Threshold:** Pressure difference limit between the active and redundant pressure sensor in %.
- **Drift Pr Timer:** Proof timer prior to warning when exceeding the drift threshold limit, in seconds.
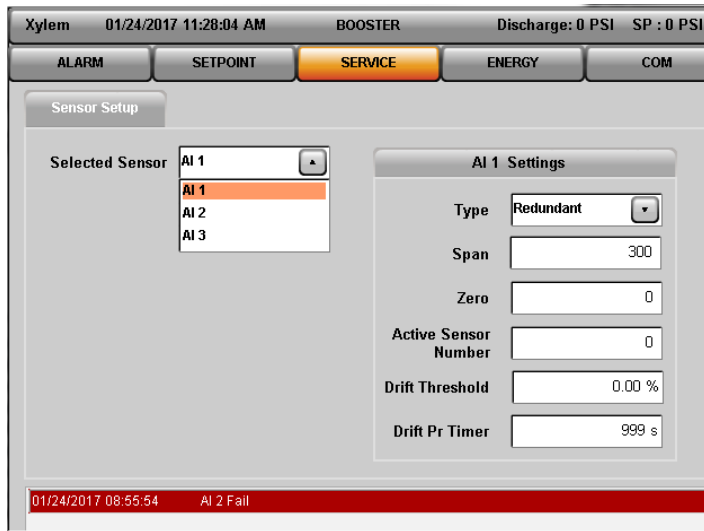
Figure 5.5.4 – Sensor Setup Screen

5.5.3 Pump Setup

Pump Setup contains two sections.

5.5.3.1 Pump Setup

Define total number of Pumps in this section and number of Standby Pumps in this section.
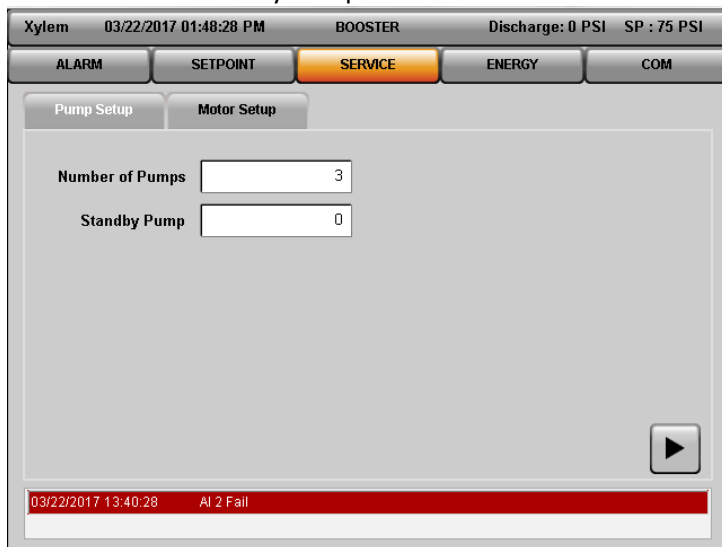
Figure 5.5.5 – Pump Setup

5.5.3.2 Motor Setup

Configure Motor setup as per Ratings on Motor Name Plate. Check the checkbox of Same pump/motor size if all motors are identical.
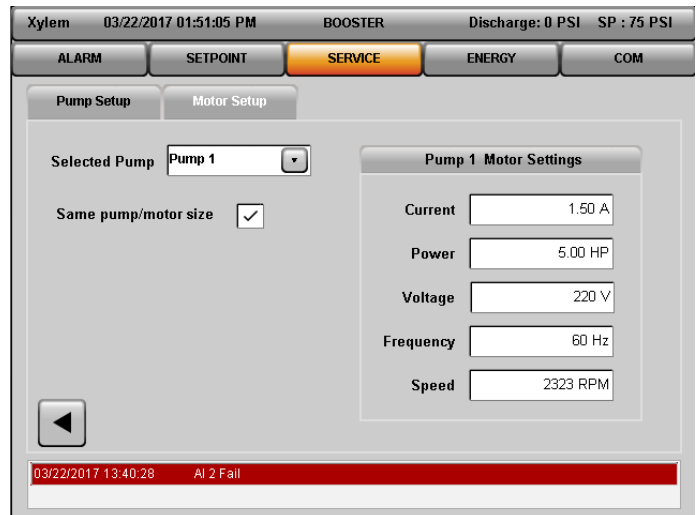
Figure 5.5.6 – Motor Setup

5.5.4 System Setup

Sections under System Setup are:

- Stage/Destage
- Speed Control
- Exercise/Alternation
- No Flow Shutdown
- Line Fill
- Optional IO

These sections are explained later.

5.5.5 Stage/Destage

Sections under [**Stage/Destage**] are:

5.5.5.1 PV Stage/ Destage

[**PV Stage/Destage**] controls staging and destaging of pumps based on Speed and Process Variable (Pressure).
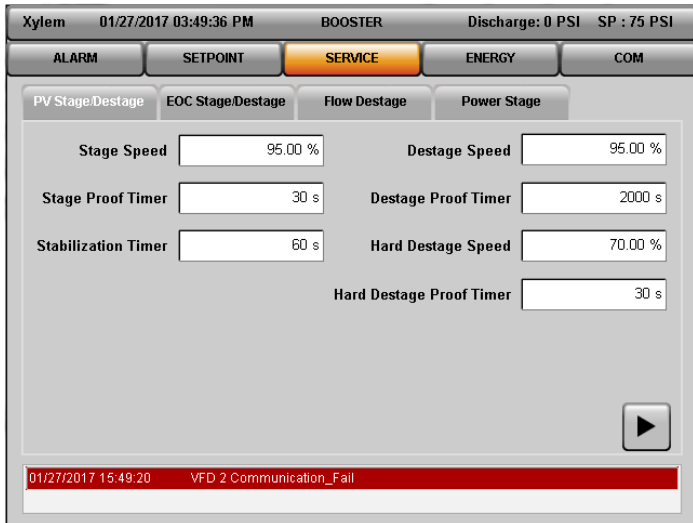
Figure 5.5.7 – PV Stage/ Destage

Figure 5.5.8 – EOC Stage/ Destage

Following parameter needs to be configured in [**PV Stage/Destage**] Section:

- **Stage Speed** - The maximum speed at which the lead pump will operate prior to starting a lag pump, %.
- **Stage Proof Timer** - Proof timer prior to starting lag pump, seconds.
- **Stabilization Timer** - Staging stabilization time delay prior to calculating destage value, seconds.
- **Destage Speed** - Enter the percentage of the stabilized speed at which the lag pump will stop, %.
- **Destage Proof Timer** - Proof timer prior to stopping lag pump, seconds.
- **Hard Destage Speed** - The lowest speed at which parallel pumps will operate prior to destaging the lag pump, %. It must be greater or equal to minimum frequency.
- **Hard Destage Proof Timer** - The proof timer prior to destaging the lag pump when operating below the Hard destage speed, seconds.

5.5.5.2 EOC Stage/ Destage

[**EOC (End of Curve) Stage/Destage**] controls staging and destaging of pumps based on Flow (Flow meter required).

Following parameter needs to be configured in [**EOC Stage/Destage**] Section:

- **Pump Max Flow -** The maximum allowable flow in GPM prior to starting a lag pump. A value of 0 disables this function.
- **Stage Proof Timer -** Proof timer prior to end of curve staging, seconds.
- **Destage Flow -** Enter the percent of stabilized flow at which the lag pump is destaged, %.
- **Destage Proof Timer -** Proof timer prior to destaging lag pump, seconds

5.5.5.3 Flow Stage/ Destage

[**Flow Stage/Destage**] controls staging and destaging of pumps based on Flow (Flow meter required).
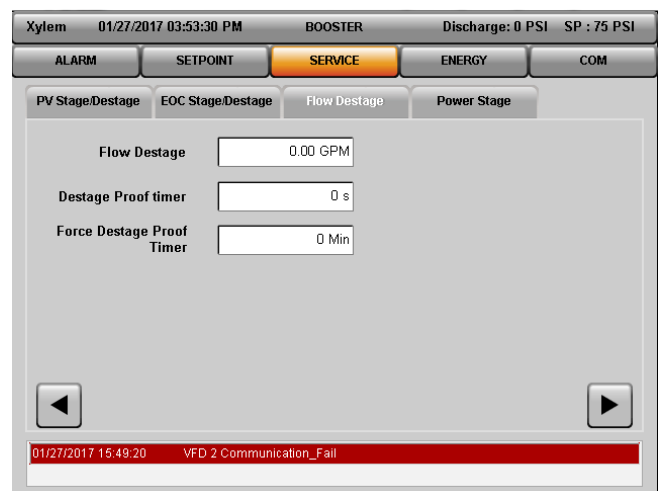
Figure 5.5.9 – Flow Destage

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Following parameter needs to be configured in [**Flow Stage/Destage**] Section:

- **Flow Destage -** The total flow above which the lag pump will be forced to destage. A value of "0" disables this function.
- **Destage Proof Timer -** Proof timer prior to Flow destaging lag pump, in seconds
- **Force Destage Proof Timer** - The time after which the lag pump will be forced to destage. A value of "0" disables this function.

5.5.5.4 Power Stage

There is a checkbox to Enable/Disable Power Destage. If this checkbox is checked, the Controller reads the Motor Current. If the current is above the motor current rating, Staging starts. After certain time delay, Controller again checks if the motor current is in limit. If not then next lag pump will be staged. This process will be continued until motor current is in range.
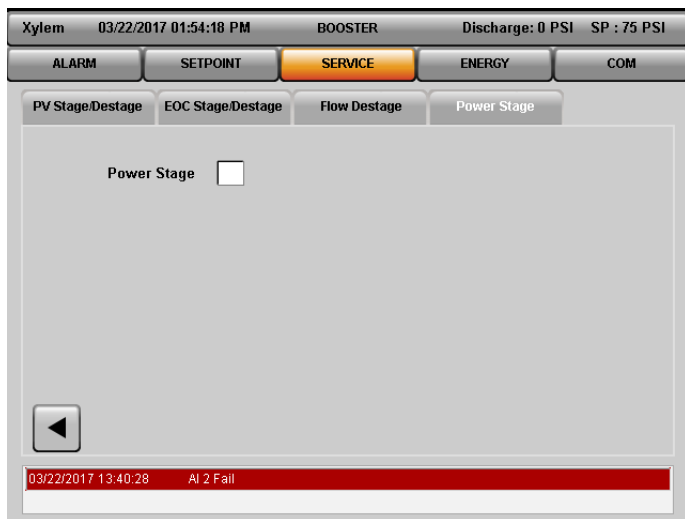
Figure 5.5.10 – Power Stage

5.5.6 Speed Control

Sections under [**Speed Control**] are:

5.5.6.1 VFD Setup

[**VFD Setup**] is used to configure the VFD (Variable Frequency Drive).
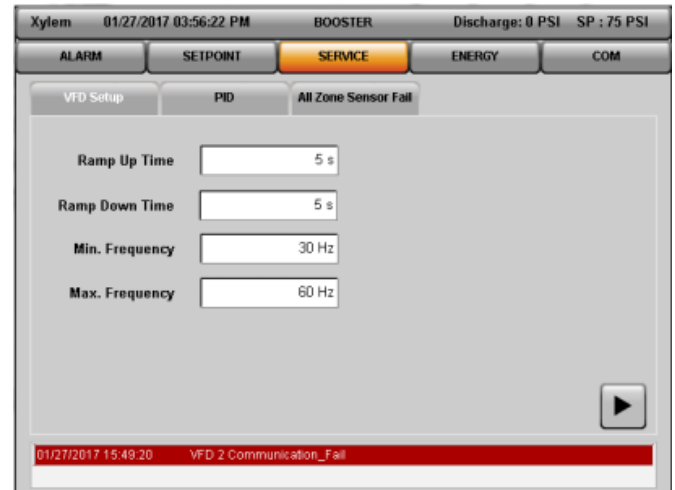
Figure 5.5.11 – VFD Control

Following parameter needs to be configured in [**VFD Setup**] Section:

- **Ramp Up Time -** Drive acceleration time in seconds from zero to maximum frequency ramp up.
- **Ramp Down Time -** Drive deceleration time in seconds from maximum to zero frequency ramp down.
- **Minimum Frequency –** Enter the minimum limit for the drive output frequency
- **Maximum Frequency –** Enter the maximum limit for the drive output frequency

5.5.6.2 PID Setup

Set up [**PID**] Parameters for Automatic Controlling of Pump Speed through VFD Output.
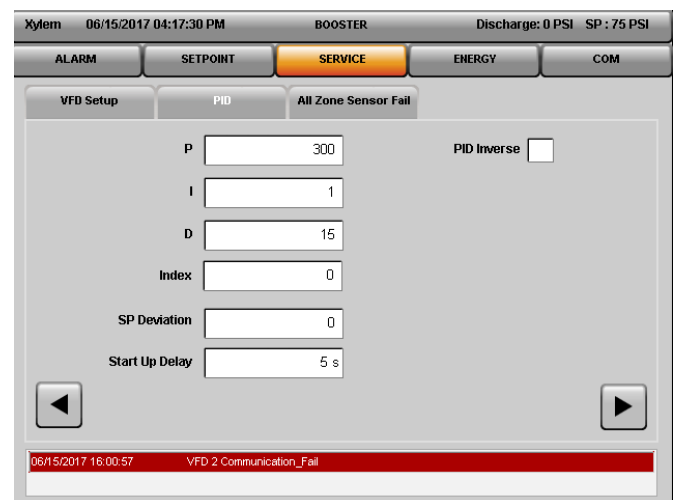
Figure 5.5.12 – PID Setup

Following parameter needs to be configured in [**PID**] Section:

- **P –** Set the Proportional value for PID Control.
- **I –** Set the Integration value for PID Control.
- **D –** Set the Derivative value for PID Control.
- **Index –** Enter a value to buffer the response of the PID while operating in the dead band defined in [**SP Deviation**].

  Index = 1 (no impact)

  Index = 999 (maximum buffer)

- **SP Deviation –** Enter the value for the number of PV units at which a dead band will be created around the set point. The PID will be modified within the dead band per the index setting below.
- **Start Up Delay –** Enter the delay required to start the Pump.

Check the [PID **Inverse**] checkbox to inverse the PID calculation.

5.5.6.3 All Zone Sensor Fail

Set up [**All Zone Sensor Fail**] Parameters for running pumps at a definite speed in case all zone sensors have failed.
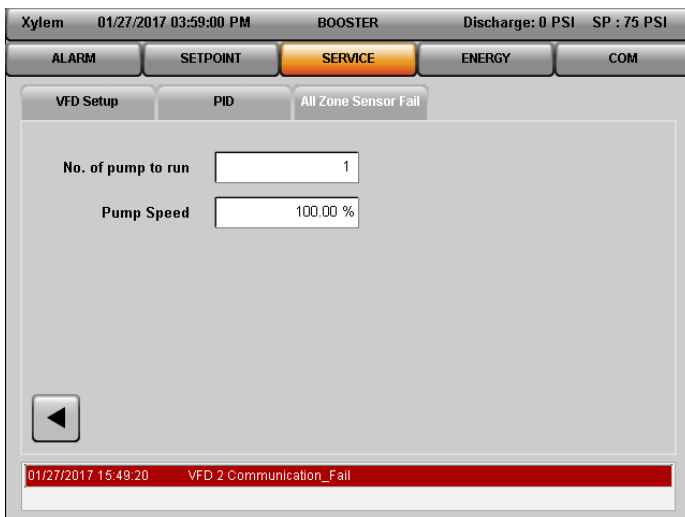
Figure 5.5.13 – All Zone Sensor Fail

Following parameters need to be configured in [**All Zone Sensor Fail**] Section:

- **No of Pumps to run –** Enter the number of pumps that should operate at the defined [**Pump Speed**] speed in the event that all system sensors fail.

- **Pump Speed –** Enter the % speed for the drive(s) to operate at in the event that all system sensors fail.

5.5.7 Exercise/Alternation

Sections under [**Exercise/Alternation**] are:

5.5.7.1 Exercise
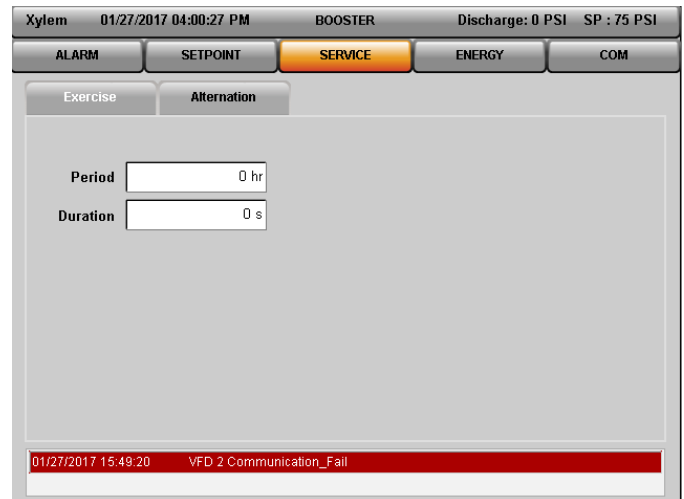
Figure 5.5.14 – Pump Exercise

Configure the below mentioned parameters for automatic exercising of the pump.

- **Period -** Amount of time between automatic exercising of the pumps, in seconds. A value of 0 disables pump exercising.
- **Duration -** Amount of time pumps will be exercised. All pumps which have not run in the last period will be exercised simultaneously.

Pump exercising will ensure that no pumps go for long periods of time without running. Note that automatic alternation can also provide this functionality. Pump exercising will only occur when the system is started and in automatic operation. All pumps which need exercising will exercise on startup.

5.5.7.2 Alternation

Four different options are available for Automatic Alternation of Pump Sequence. User can enable any one of the available four Alternation methods to alter the pump sequence.

The four methods for Automatic Alternation are shown in Figure 5.5.15 and the methods are:

---

1 Timed: In this method, Alternation can be time based. Check the Enable checkbox in Timed Section on Alternation Screen as shown in Figure 5.5.15 to select this method. User needs to also enter Alternation Period [Hours], time after which Alternation needs to start and Alternation Duration [Seconds], time for which running lead pump remains ON during alternation.

2 Daily: Check the Enable checkbox in Daily Section on Alternation Screen as shown in Figure 5.5.15 to select this method. In this method, user needs to enter [**Hour**] and [**Minute**] of the day when alternation needs to start.

3 Weekly: Check the Enable checkbox in Weekly Section on Alternation Screen as shown in Figure 5.5.15 to select this method. In this method, user needs to enter [**Hour**], [**Minute**] and [**Day**] of the week when alternation needs to start.

4 Monthly: Check the Enable checkbox in Monthly Section on Alternation Screen as shown in Figure 5.5.15 to select this method. In this method, user needs to enter [**Hour**], [**Minute**] and [**Day**] of the Month when alternation needs to start.
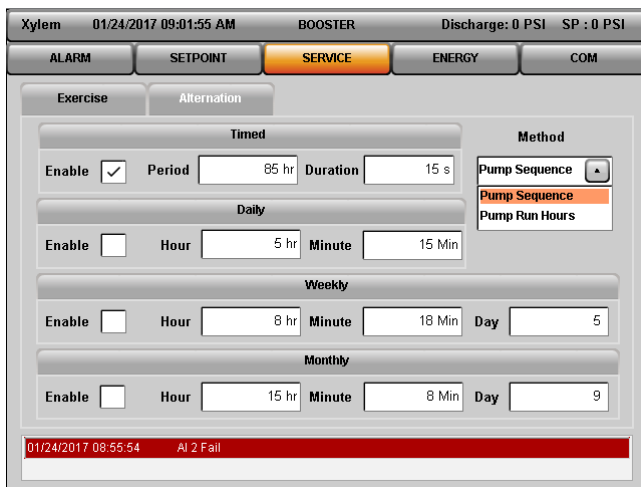
Figure 5.5.15 – Alternation Screen

There are two method options to select the new Pump running sequence after alternation

a. [**Pump Sequence**] – The Pump sequence will be based on pump number order. The next pump in sequence will become the lead pump after alternation. Alternation event will be based on time in hours, daily, weekly, monthly, manual or through communication.

b. [**Pump Run Hours**]- The pump sequence will be based on pump run hour, from lowest to highest run hour. The pump with the lowest run time will become the lead pump after alternation. This option does not depend on type of alternation method selected. Alternation event will occur only when system is restarting after all pumps have stopped.

NOTE: Enter the Alternation Day of Week (1= Monday to 7=Sunday) on which the pumps will be alternated.

Enter the Alternation Time in 24Hr format (range being 0:00-23:59).

5.5.8 No Flow Shutdown
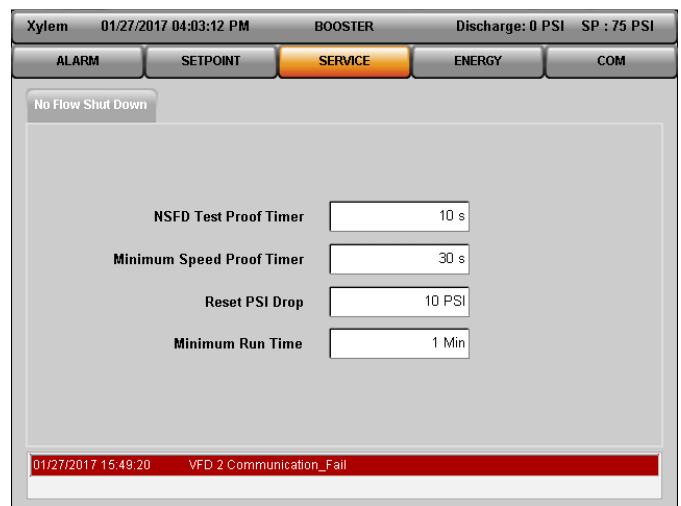
Figure 5.5.16 – No Flow Shut Down

The [**No Flow Shut Down]** menu is displayed below:

- **NFSD Test Proof Timer -** The amount of time, in seconds, the controller will run the system while the PV is greater than SP.

A value of 0 will disable this alarm.

- **Minimum Speed Proof Timer** - The amount of time, in seconds, the system will run at minimum speed before shutting off.

- **Reset PSI Drop** - The value the PV variable needs to be less than the SP by in order to restart the system.

- **Minimum Run Time** - The minimum amount of time, in minutes, that the system will run once it shuts down from a no flow condition and restarts.

5.5.9 Line Fill

To enable Line Fill, Check the [**Enable Line Fill**] checkbox available on [**Line Fill**] Screen.
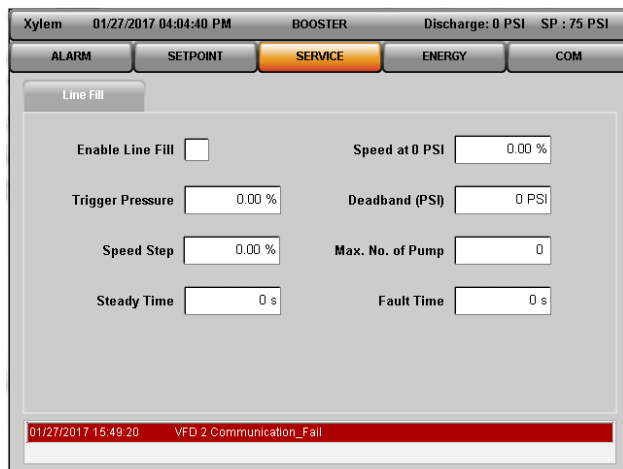
Figure 5.5.17 – Line Fill

Parameters Available on [**Line Fill**] Screen are:

- **Trigger Pressure** – Line Fill Mode will be triggered below this Pressure Setpoint, when system is starting up in Auto Mode. Set pressure is % of Setpoint.

- **Speed Step** – Enter the % Speed for VFD to increase speed in each step.

- **Steady Time** – Enter the time for Pressure to remain steady before the system jumps to next step.

- **Speed at 0 PSI** – Speed of Pump at zero PSI.

- **Deadband (PSI)** – Enter the pressure range for which pressure can be considered as Steady. Choose the value of pressure variation which can be considered as steady for the system.

- **Max No. of Pumps** – Maximum number of Pumps allowed to run during Line Fill operation.

- **Fault Time** – Enter the time after which System is considered as faulty, when Pressure is not steady.

NOTE: Steady Time must be less than Fault Time.

5.5.10 Optional IO

The options available under I/O configuration are dependent on system setup. Complete all previous setup screens, specifically pumps and sensors prior to completing the following.

5.5.10.1 Digital Input
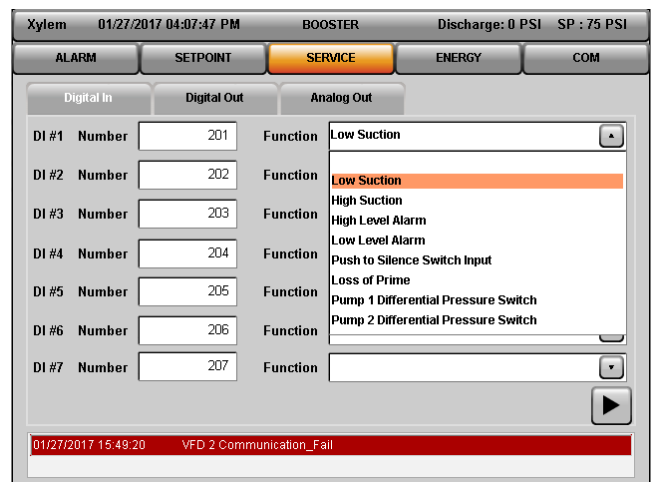
Figure 5.5.18 – Optional DI

Screen for optional [**Digital In**] is shown in Figure 5.5.18. On left hand side, there are numbers from 201 to 207. These are terminal numbers. Select the desired function against the terminal number wired in control panel. Refer to control wiring diagram for wiring details.

Optional DI can be configured for the following types of functions:

1. **Low Suction** – DI can be configured for optional low suction switch under function as shown in Figure 5.5.18. Also, it is required to select low Suction Source as Digital Input in Section [**Low/High Suction**] under [**Alarm Setup**] in order to activate low suction protection based on low suction switch, as shown in Figure 5.5.19. Low suction alarm will get detected on active high signal.

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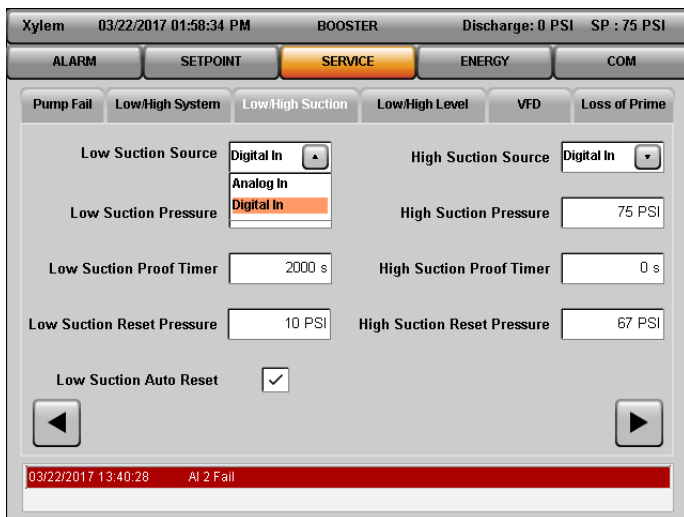
Figure 5.5.19 – Low/High Suction Alarm Configured as DI
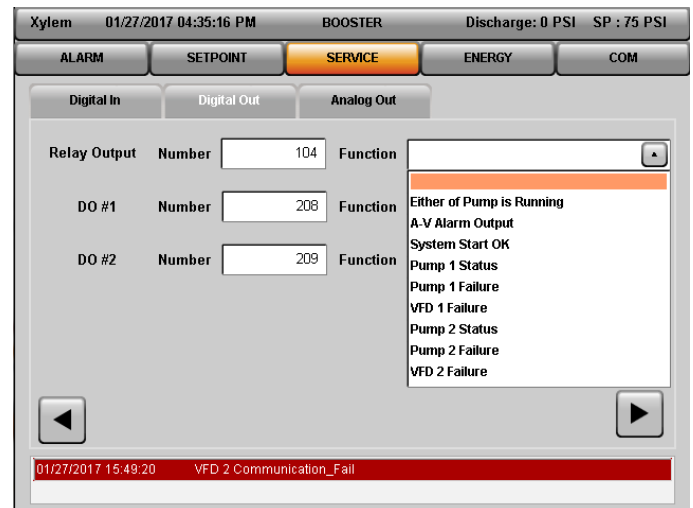
2. **High Suction** – DI can be configured for optional high suction switch under function as shown in Figure 5.5.18. Also, it is required to select High Suction Source as Digital Input in section [**Low/High Suction**] under [**Alarm Setup**] in order to activate high suction protection based on high suction switch, as shown in Figure 5.5.19. High suction alarm will get detected on active high signal.
3. **High Level Alarm** – DI can be configured for optional high level switch under function as shown in Figure 5.5.18. High level alarm will get detected on active high signal.
4. **Low Level Alarm** – DI can be configured for optional low level switch under function as shown in Figure 5.5.18. Low level alarm will get detected on active high signal.
5. **Push to Silence Switch Input** – DI can be configured for optional Push to Silence Switch under function as shown in Figure 5.5.18. This optional DI can be used to Silence horn by forcing optional DO alarm output signal to low.
6. **Loss of Prime** – DI can be configured for optional Loss of Prime switch under function as shown in Figure 5.5.18. Loss of Prime alarm will get detected on active high signal.
7. **Pump X Differential Pressure Switch** – Differential pressure switch can be configured as optional DI for the desired pump as shown in Figure 5.5.18. NOTE: X is the Pump number**.**

5.5.10.2 Digital Output

Figure 5.5.20 – Optional DO

Screen for optional [**Digital Out**] is shown in Figure 5.5.20. On left hand side, there are Terminal numbers 104, 208 and 209. Terminal 104 can be configured for Relay Output. Terminals 208 and 209 can be configured for DO output. Select the desired function against the terminal number wired in control panel. Refer to control wiring diagram for wiring details.

Optional DO can be configured for the following types of functions:

1. **Either of Pumps is Running** – DO will be active high when either of pumps is running or at least one pump is running.
2. **Alarm Output** – Alarm can be configured as Optional DO. This can be used for connecting to Horn as well and can be silenced by configuring optional DI for Push to Silence function.
3. **System Start OK** – DO can be configured to know if the System Start is OK.
4. **Pump X Status** –DO can be configured to know respective pump's running Pump Status. NOTE: X is the Pump number.
5. **Pump X Failure** –DO can be configured to know respective pump's failure. NOTE: X is the Pump number.
6. **VFD X Failure** –DO can be configured to know respective VFD's failure. NOTE: X is the Pump number.

5.5.10.3 Analog Output
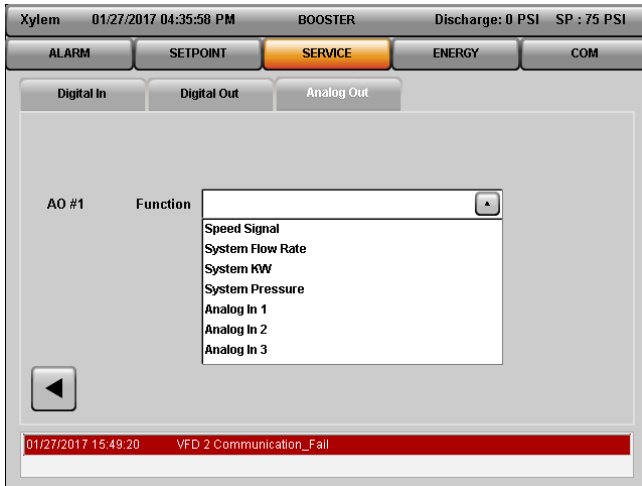
Figure 5.5.21 – Optional AO

Screen for optional [**Analog Out**] is shown in Figure 5.5.21. Select the desired function for AO #1. Refer to control wiring diagram for wiring details.

Optional AO can be configured for the following types of functions:

1. **Speed Signal** – AO can be configured to know System Speed at which pumps are running.
2. **System Flow Rate** - AO can be configured to know the Flow rate of the system.
3. **System KW** - AO can be configured to know the total KW currently consumed by VFD.
4. **System Pressure** - AO can be configured to know the System discharge Pressure.
5. **Analog In X** –AO can be configured to read respective AI signal. NOTE: X is the AI number.

5.5.11 Alarm Setup

Sections under [**Alarm Setup**] are:

5.5.11.1 Pump Fail
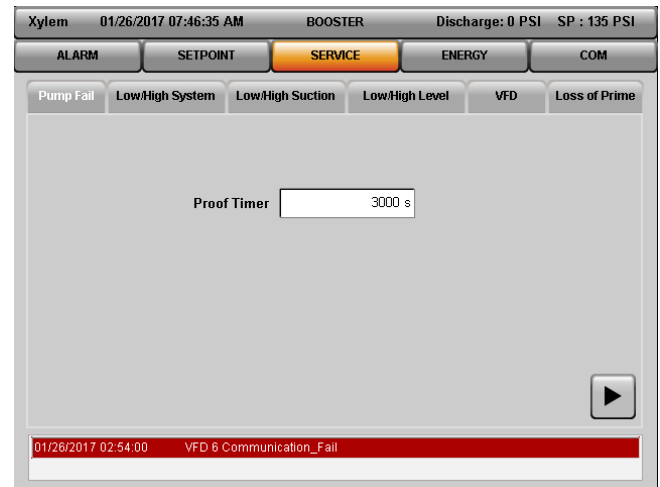
Figure 5.5.22 – Alarm Setup page for Pump Fail

Setup up the **[Pump Fail]** alarm by configuring the following parameters:

- **Proof Timer -** Proof timer prior to triggering a pump fail alarm after receiving a continuous high signal from a DP switch, in seconds.
  A value of 0 will disable this alarm.

5.5.11.2 Low/High System
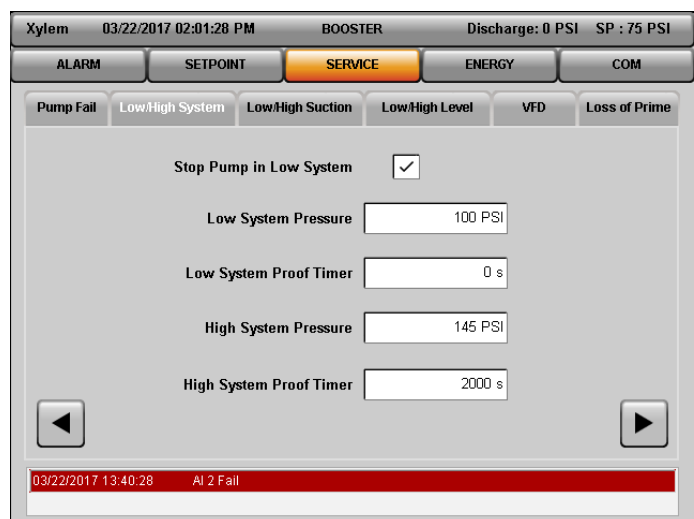
Figure 5.5.23 – Alarm Setup page for Low/High System Pressure

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Setup up the **[Low/High System]** alarm by configuring the following parameters:

- **Stop Pump in Low System** – Check this checkbox if Pump needs to be stopped when System Pressure is Low.
- **Low System Pressure** – Set the Pressure below which an alarm will be activated.
- **Low System Proof Timer** - The proof timer prior to triggering an alarm, in seconds. A value of 0 disables this alarm.
- **High System Pressure** – Set the Pressure above which an alarm will be activated.
- **High System Proof Timer** - The proof timer prior to triggering an alarm, in seconds. A value of 0 disables this alarm.

5.5.11.3 Low/High Suction
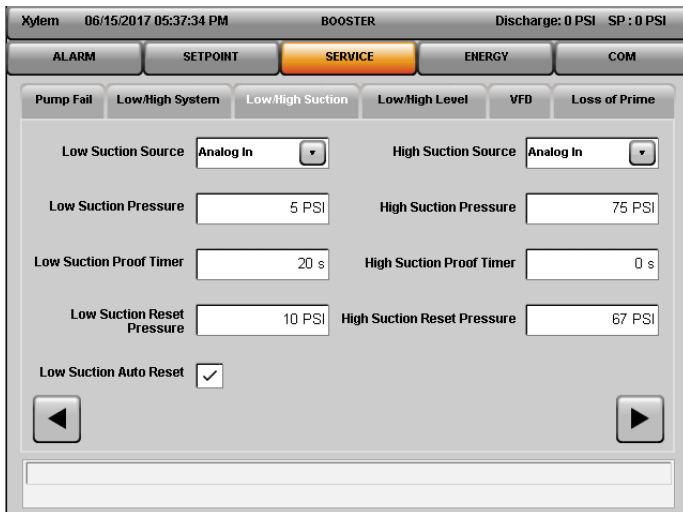
Figure 5.5.24– Alarm Setup page for Low/High Suction Pressure

Setup up the **[Low/High Suction]** alarm by configuring the following parameters:

- **Low Suction Source** – Select the Source of Low Suction pressure detection. It can be [**Digital In**] or [**Analog In**].
  If source is selected as [**Digital In**] then Optional DI has to be configured for Low suction switch. If source is selected as [**Analog In**] then one sensor has to be configured for suction sensor.
- **Low Suction Pressure -** The pressure below which an alarm will be activated for the analog input source.

- **Low Suction Proof Timer -** The proof timer prior to triggering an alarm. A value of 0 will disable this alarm. Applicable for either analog input or digital input source.
- **Low Suction Reset Pressure -** The pressure at which the controller will automatically reset when the suction pressure rises above it. Applicable for analog input source only.
- **Low Suction Auto Reset** – Check this checkbox to allow this alarm or event to be automatically reset. For analog input source, it resets using the "Reset PSI". For digital input source, it resets on a low signal of the low suction pressure switch.
  High Suction Source – Select the Source of High Suction pressure detection. It can be [**Digital In**] or [**Analog In**].
  If source is selected as [**Digital In**] then Optional DI has to be configured for High suction switch. If source is selected as [**Analog In**] then one sensor has to be configured for suction sensor.
- **High Suction Pressure -** The pressure above which an alarm will be activated for the analog input source.
- **High Suction Proof Timer -** The proof timer prior to triggering an alarm. A value of 0 will disable this alarm. Applicable for either analog input or digital input source.
- **High Suction Reset Pressure -** The pressure at which the controller will automatically reset when the suction pressure rises above it. Applicable for analog input source only.

5.5.11.4 Low/High Level

Figure 5.5.25– Alarm Setup page for Low/High Level

Setup up the **[Low/High Level]** alarm by configuring the following parameters:

- **Low Level Proof Timer -** The proof timer prior to triggering low level alarm. A value of 0 will disable this alarm. Refer to section 5.5.10.1 to configure optional DI for Low level switch.
- **Low Level Auto Reset –** Check this checkbox to allow this alarm to be automatically reset.
- **Stop Pump in Low Level –** Check this checkbox if Pump needs to be stopped when Level is Low.
- **High Level Proof Timer -** The proof timer prior to triggering an alarm. A value of 0 will disable this alarm. Refer to section 5.5.10.1 to configure optional DI for High level switch.
- **High Level Auto Reset –** Check this checkbox to allow this alarm to be automatically reset.
- **Stop Pump in High Level –** Check this checkbox if Pump needs to be stopped when Level is high.

5.5.11.5 VFD

Figure 5.5.26– Alarm Setup page for VFD

Setup up the **[VFD]** alarm by configuring the following parameters:

- **VFD Run Proof Timer –** The proof timer prior to triggering the VFD run fail alarm. A value of 0 will disable this alarm.
- **VFD Comm. Proof Timer -** The proof timer prior to triggering the VFD communication fail alarm, in seconds. A value of 0 will disable this alarm.

  VFD communication failure gets reset automatically as soon as it resumes.
- **On VFD Comm. Fail –** Select the action when the VFD communication fails. Options are available as described below:

  Stop and Trip: Failed VFD will be stopped and tripped.

  Jogging: It will set first available VFD to Jog for communication failure. Rest of the VFD's will be set to Stop and Trip. Once the VFD is placed into Jog mode after a communication failure, the VFD will continue to run on jog speed until communication is restored with the controller. Also, if the speed needs to be increased or decreased before communication is

restored, the VFD would have to be put into Hand Mode. Refer to Hand Mode Instruction in section 6.13. Also, when communication is working and it is required to turn power off for any VFD then refer instruction in section 6.14.

⚠️ CAUTION: While Pump/VFD is running on Jog speed in the event of communication failure, controller will not have any control of VFD's speed which can potentially lead to over-pressure in the system without a service tech constantly monitoring the booster package. The rick of jogging the booster package shall be borne solely by the operator.

- **Jog Speed –** This selection is available if Jogging is selected as an action during VFD communication failure. Enter the Jog Speed at which VFD should jog. It can be set between minimum and maximum speed of current VFD system settings.
- **VFD UV, OV, OC Proof Timer –** The proof timer prior to triggering the VFD UV/OV/OC fail alarm.
- **VFD UV, OV, OC Max number of Reset –** Number of automatic resets attempt for VFD UV/OV/OC failure.
- **Reset Delay Timer –** The time delay between VFD UV/OV/OC failure and automatic reset attempt, in seconds.
- **Reset Count Proof Timer –** The proof timer prior to setting the reset count to zero, in minutes. Timer starts from the last reset attempt and run until controller detects UV/OV/OC fault or timer lapse.

5.5.11.6 Loss of Prime
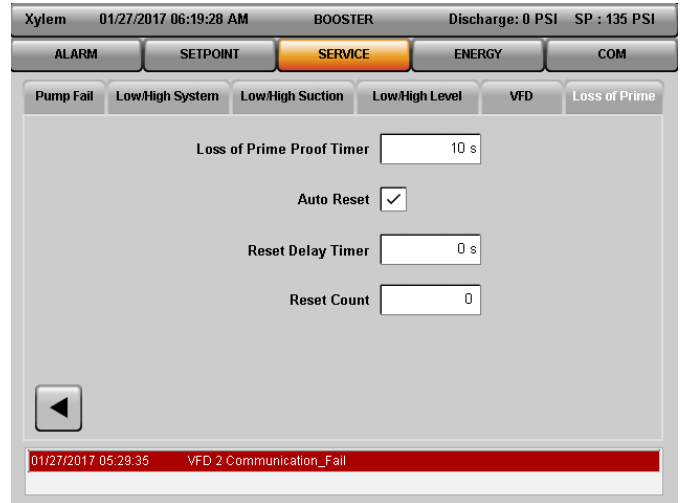
Figure 5.5.27– Alarm Setup page for Loss of Prime

Setup up the **[Loss of Prime]** alarm by configuring the following parameters:

- **Loss of Prime Proof Timer –** The proof timer prior to triggering the Loss of Prime Alarm. Refer to section 5.5.10.1 to configure optional DI for Loss of Prime switch.
- **Auto Reset –** Check this checkbox to allow this alarm to be automatically reset.
- **Reset Delay Timer –** The time delay between Loss of Prime and automatic reset attempt, in seconds.
- **Reset Count –** Counter for counting number of resets.

5.5.12 Date/Time Setting
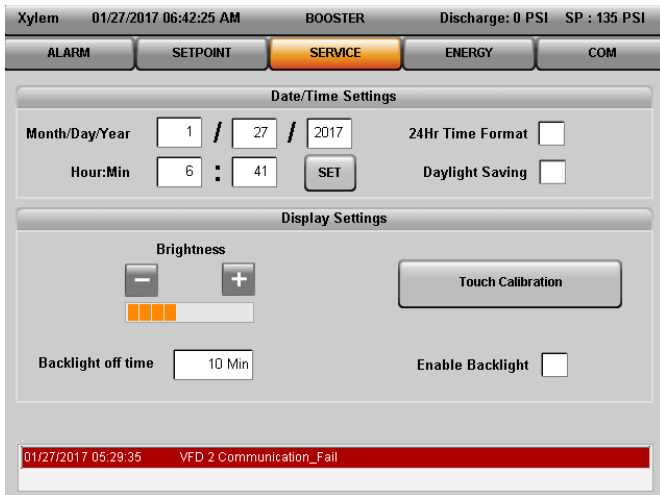
Figure 5.5.28 – Date/Time Setup page

Date and Time can be set from [Date/Time] Page. Tap on [Service] button and then tap on **[Date/Time/Display]** button to navigate to this page.

Following settings can be done from this page:

- **Month/Day/Year** – Enter the current **Month, Day and Year** in their respective input space as shown in Figure 5.5.28.
  For example: 1st January 2017 should be entered as 01in [Month], 01 in [Day] and 2017 in [Year].
  Tap on **[Set]** button after entering Month, Day and Year to set the date.
- **Hour:Min** – Enter the hours using the 24 hour format and Minutes from 0 to 60 in their respective input space as shown in Figure 5.5.28.
  For example: 9:30 p.m. should be entered as 21 Hours and 30 Minutes.
- **24 Hour Time Format** – Check this checkbox if Date/Time needs to be displayed in 24hour format.
- **Daylight Saving** - Check this checkbox if Daylight saving needs to be enabled.

Some Display settings are also available on Date/Time Page. Options available for Display Settings are:

- **Brightness -** Brightness of the Screen can be adjusted by tapping on [+] and [-] buttons.
- **Backlight off Time -** Enter the time, in minutes, for which screen can be idle prior to Backlight being turned off. Touch the screen to turn Backlight on. If any alarm is present in system then Backlight will not turn off.
- **Enable Backlight -** Check this checkbox to enable Backlight on/off functionality.
- **Touch Calibration –** Tap this button to calibrate the screen touch. On tapping, it will navigate to calibration page. Touch the pointer as it appears on calibration screen. Once all pointers are touched, calibration will be automatically done and it will revert back to Date/Time screen.

5.5.13 Recipe
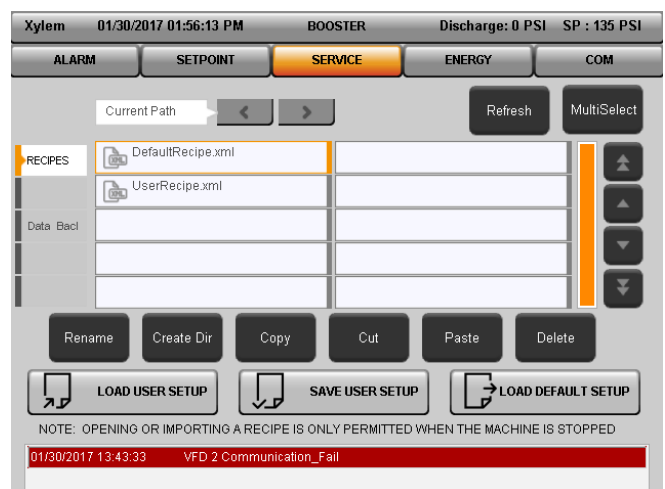
Figure 5.5.29 – Recipe Page

Recipe can be used to load and save User Defined Settings or Default Settings. Recipe page is shown in Figure 5.5.29.

All Parameters and Setpoint Settings can be stored in Recipe and loaded back when required.

Tap on **[Load User Setup]** button on **[Recipe]** Page as shown in Figure 5.5.29, to load the settings defined by user. This will overwrite Default Setup. Default Setup will be saved for future use.

Tap on **[Save User Setup]** button on **[Recipe]** Page as shown in Figure 5.5.29, to save the settings defined

by user. User can overwrite the default Setpoints and parameters and this setup can be saved for future use.

Tap on **[Load Default Setup]** button on **[Recipe]** Page as shown in Figure 5.5.29, to load the Default Settings. This will overwrite User Defined Setup. User Defined Setup will be saved for future use.
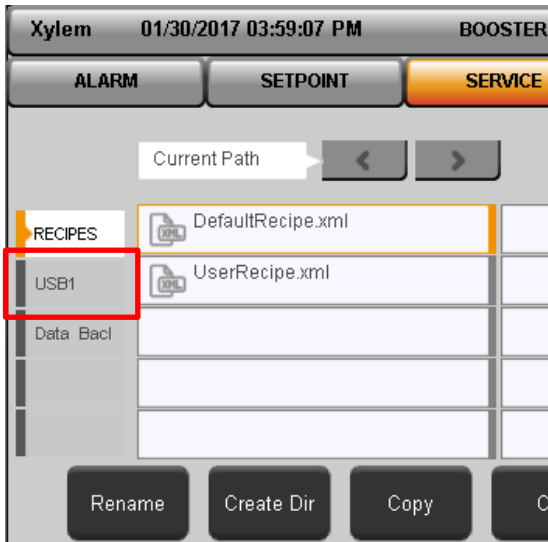
Figure 5.5.30 – USB access for Recipe

Users can load their Recipe from a USB stick or can take a backup of the existing User/Default Recipes unto a USB stick if desired. Insert a USB in the USB slot available on back panel of HMI. When a USB is inserted into the slot, the Directory for USB will appear as shown in Figure 5.5.30.

There are some utility buttons on the Recipe Screens which facilitates certain user operations:

- **Rename** – [Rename] button is used to rename any Recipe file located in the default location or on a USB stick.
- **Create Dir** – [Create Dir] button is used to create a new directory to save the recipe file.
- **Copy** – [Copy] button is used to copy a recipe file from one location to another.
- **Cut** – [Cut] button is used to move Recipe file from one location to another.
- **Paste** – [Paste] button is used to Paste the copied Recipe file to the desired location.

- **Delete** – [Delete] button is used to delete the existing recipe file from the default location or a USB stick.
- **Refresh** – [Refresh] button helps to refresh the list of recipes available in the directory. An updated list is visible on tapping the Refresh button.
- **MultiSelect** – [MultiSelect] button is used to select multiple Recipe files for Cut/Copy/Delete operation.

Note: Opening or Importing a Recipe is only permitted when the machine is stopped.
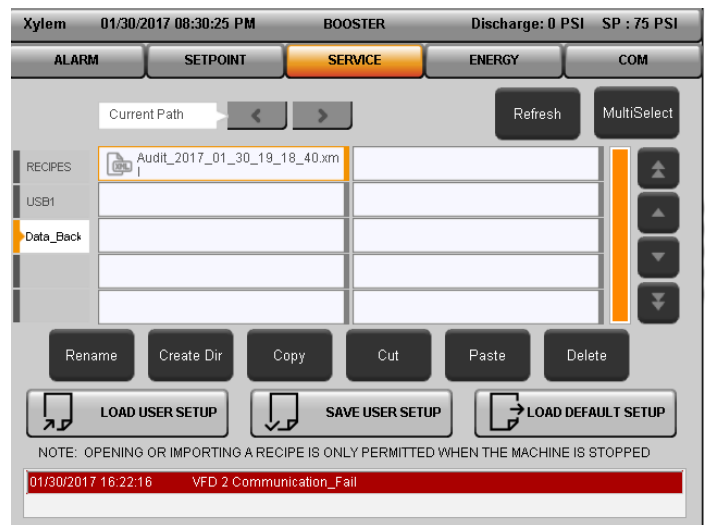
Figure 5.5.31 – Data Backup Directory for Alarm/event Log Backup

One more directory available is [Data_Backup]. This directory stores Logger Data from the Event Log in XML format.

5.5.14 Logger

Sections under [**Logger**] are:

5.5.14.1 Event Log
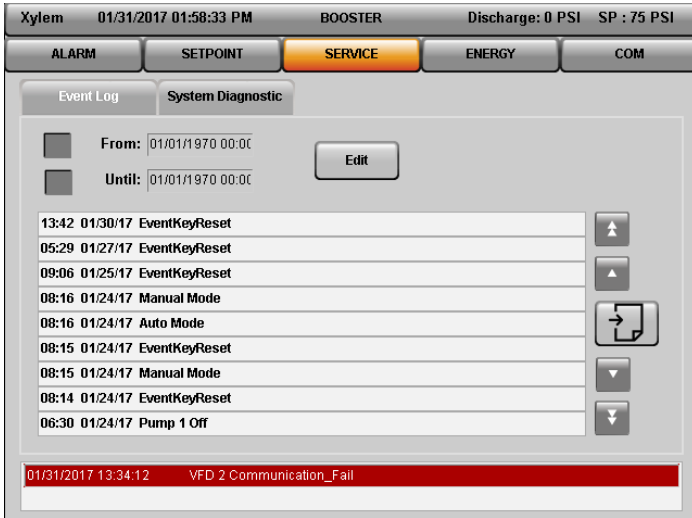
Figure 5.5.32 – USB access for Recipe

[**Event Log**] captures the event of the system with Date and Time as shown in Figure 5.5.32.

Historical events can be checked for desired time frame. Tap on [**Edit**] button to enter the desired time frame in the Filter Settings as shown in Figure 5.5.33.
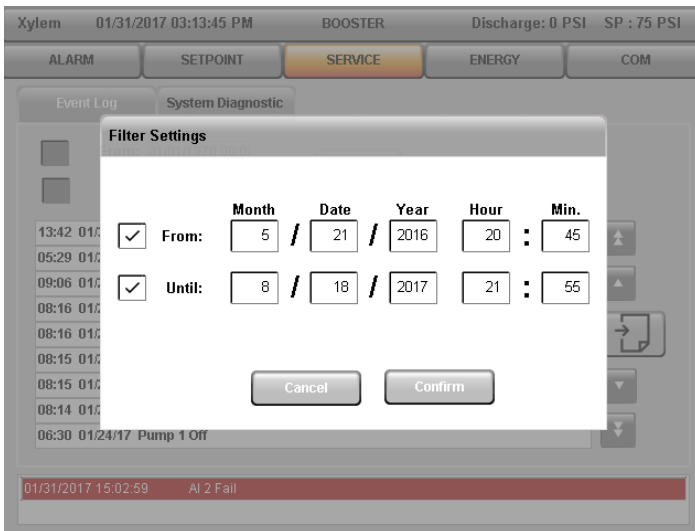
Figure 5.5.33 – Filter Settings for Event Log

Event Log can be exported and saved as an XML file. To export event log, tap on [icon] button available on [**Event Log**] Page.

This stored XML file can be found in Data_Backup Directory on **[Recipe]** Page as shown in Figure 5.5.31.

5.5.14.2 System Diagnostic

System Diagnostic manager is used to diagnose system hardware and software data statistics. The SDM also provides the following diagnostics options:

- SDM support in diagnostics mode
- Load the System Dump for system analysis
- Motion axis information, trace data and operations, upload the network command trace
- I/O viewer in hardware tree for displaying I/O status
- Hardware analysis with additional display of model number / equipment ID
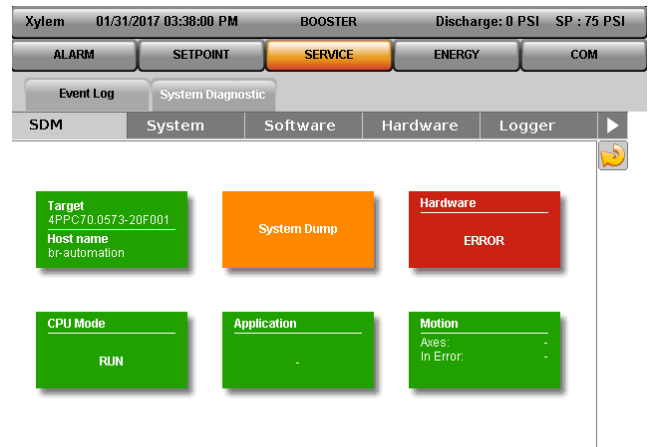
Figure 5.5.34 – System Diagnostic Mode Page

5.5.15 Test

Sections under [**Test**] are:

5.5.15.1 Test IO
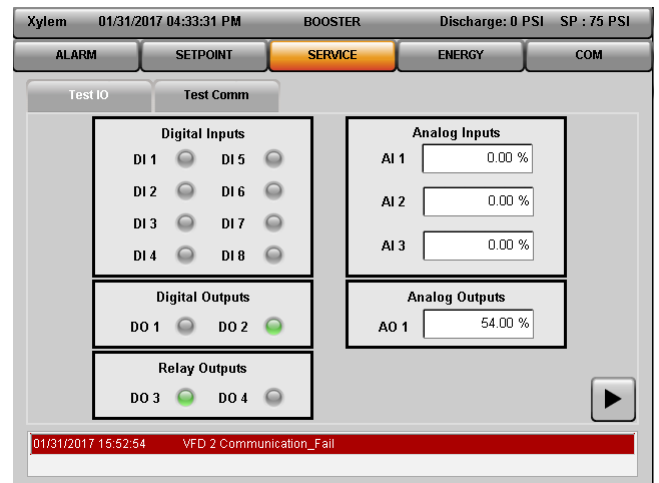
Figure 5.5.35 – Test IO

Testing of Digital inputs, Digital Outputs, Relay Outputs, Analog Inputs and Analog Outputs can be accomplished on the [Test IO] Page.

- **Digital/Relay Outputs** - Status of Digital Outputs and Relay Outputs can be changed by tapping on indication bulb. To make output TRUE when output is FALSE, Tap on indication bulb and the indication will be ⬤. To make output False when output is True, Tap on indication bulb and the indication will be ⬤.
- **Digital Input** - Status of Digital Inputs can be checked by indication bulb. If the input is 1 then indication is ⬤ and if the input is 0 then indication is ⬤. Digital Inputs can only be read.
- **Analog Input** - Value of Analog Input can be monitored on the numberic display as shown in figure 5.5.35.   Analog Inputs can only be read.
- **Analog Output** - Value of Analog Output can be monitored as well as changed. To change the value of Analog Output, tap on numeric output. On tapping the numeric input, a numeric keypad will appear from which a new value can be entered.

5.5.15.2 Test Comm

VFD (Variable Frequency Drive) and BMS (Building Management System) Communication can be checked on [**Test Comm**] Page.
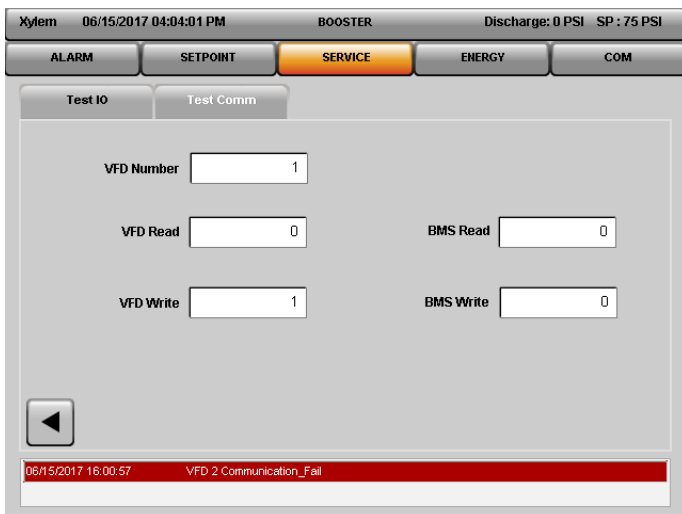
Figure 5.5.36– Test Communication (VFD and BMS)

- **Test VFD Communication -** VFD communication can be checked at a time. Enter the VFD Number in the Numeric Input box. If the Communication is healthy, VFD Read and VFD Write counter will start counting.
- **BMS Communication** – As soon as the BMS communication is established, counter for BMS Read and BMS Write will start counting.

5.5.16 Info

System Information can be checked on [**Info**] Page.
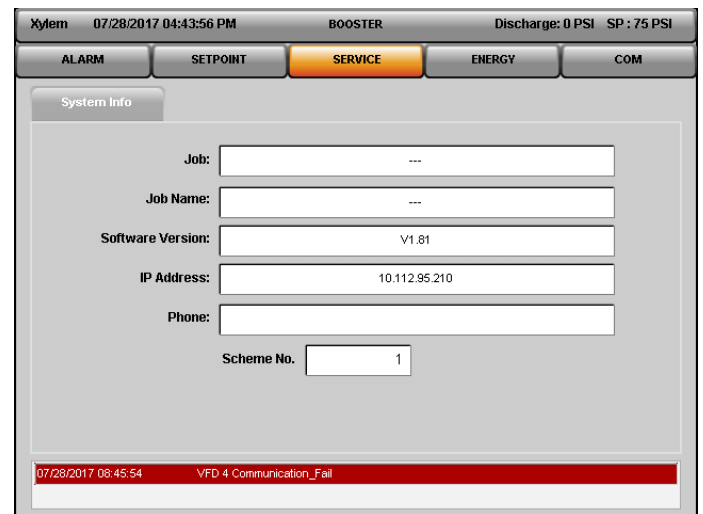
Figure 5.5.37 – System Info

Following system information can be checked on this screen:

1. Job: It shows the Job number set by the factory.
2. Job Name: It shows the Job name set by factory. However, user can also edit the Job name.
3. Software Version: It shows the installed Application Software version.
4. IP Address: It shows the IP Address of the System.
5. Phone: It shows the contact number for registering a service request.
6. Scheme No: It shows the current Scheme of the system.

5.6 Energy

Sections under [**Energy**] tab are as follows:

5.6.1 Data Table

Data Table Shows total KWh and Flow values for daily, weekly, monthly & yearly performance. Scrolling is possible using [UP] and [DOWN] arrow keys.

1. **Day** – Daily sorting of KWh and Flow is available on this page. It is shown in Figure 5.6.1. Date is in MM/DD/YYYY Format. Maximum up to last 180 days of data can be reviewed.

Figure 5.6.1 – Daily Data Table

2. **Week** – Weekly sorting of KWh and Flow is available on this page. It is shown in Figure 5.6.2. Date is in MM/DD/YYYY Format. Maximum up to last 60 weeks of data can be reviewed.

Figure 5.6.2 – Weekly Data Table

3. **Month** – Monthly sorting of KWh and Flow is available on this page. It is shown in Figure 5.6.3. Date is in MM/YYYY Format. Maximum up to last 30 months of data can be reviewed.

Figure 5.6.3 – Monthly Data Table

4. **Year** – Yearly sorting of KWh and Flow is available on this page. It is shown in Figure 5.6.4. Maximum up to last 20 years of data can be reviewed.

Figure 5.6.4 – Yearly Data Table

5.6.2 Operation

System Operation is logged on this page. This is shown in Figure 5.6.5.
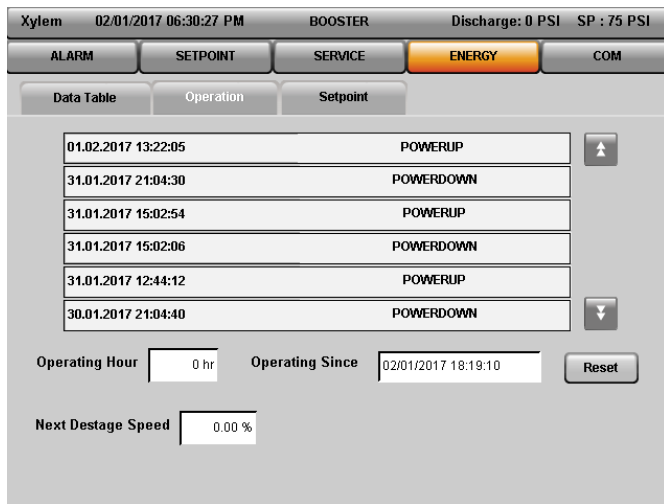
Figure 5.6.5 – Operation Page

On this page System operations like Power Up and Power Down are logged with Time Stamp. Date Format is MM/DD/YYYY.

[**Operating Hour**] shows the time of System operation since last Power Up.

[**Operating Since**] shows the time of last system Power Up.

[**Next DeStage Speed**] shows the speed of pump when next Destage will occur.

5.6.3 Setpoint

- **Auto Setpoint**: Page for Auto Setpoint logging is shown in Figure 5.6.6. Setpoint changed through Flow Compensation function will be logged on this page along with the Date/Time stamp, Number of pumps running, Speed and Suction Pressure.
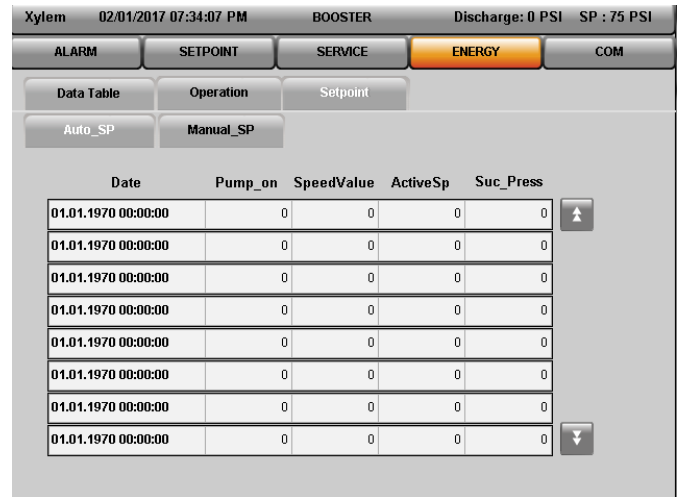
Figure 5.6.6 – Auto Setpoint

- **Manual Setpoint**: Page for Manual Setpoint logging is shown in Figure 5.6.7. Setpoint changed through Fixed Setpoint and Schedule Setpoint will be logged along with Date/Time stamp.
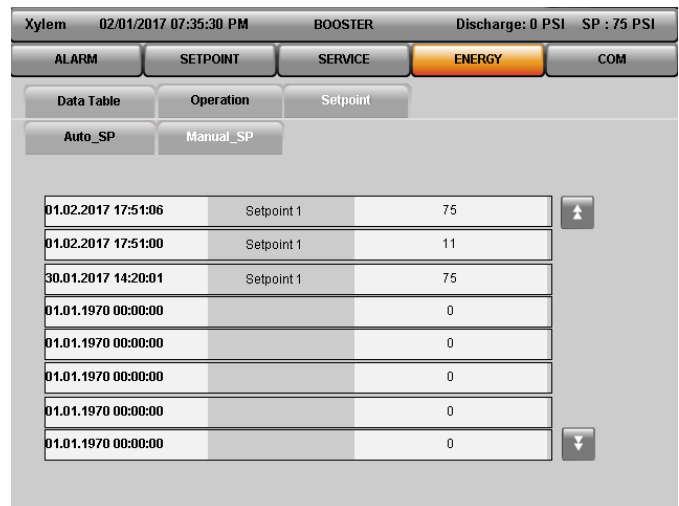
Figure 5.6.7 – Manual Setpoint

5.7 Communication

AquaForce e-MT system supports five different communications Protocol. Those Communication protocols are explained in the following sections.

Only one communication protocol can be active at a time. The remaining communication protocols will be disabled.

5.7.1 Modbus RTU
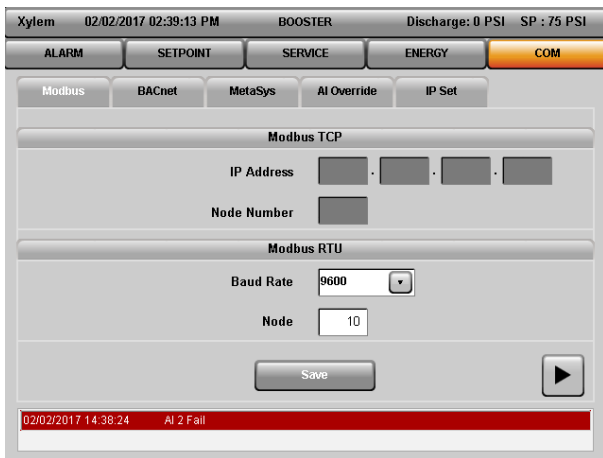
Figure 5.7.1 – Modbus Page

Enter the Node number and Baud rate on Modbus page as shown in Figure 5.7.1. Node number has to be unique for each device in the network. Baud rate has to be same for each device in the network.
To make these changes active in controller, tap on [Save] button available on [Modbus] Page. Once the [Save] button is tapped, controller will restart and changes will be incorporated into the controller.

5.7.2 Modbus TCP/IP

Enter the Node number and IP address in the given range on Modbus page as shown in Figure 5.7.2.
To make these changes active in controller, tap on [Save] button available on [Modbus] Page. Once the [Save] button is tapped, controller will restart and changes will be incorporated into the controller.
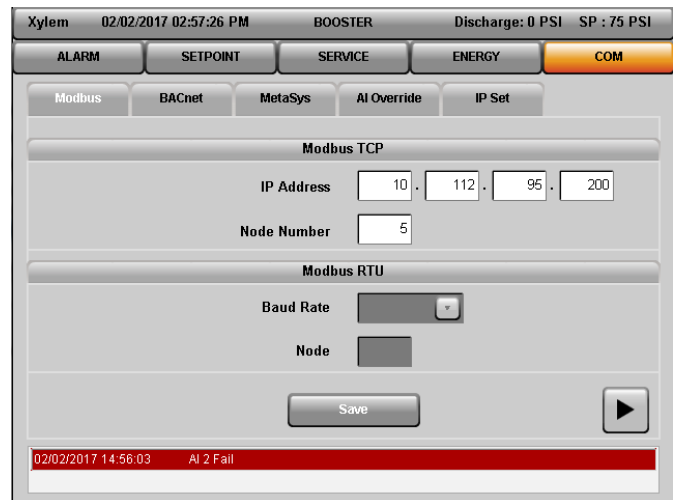
Figure 5.7.2 – Modbus Page

5.7.3 BACnet IP

From the device manufacturer, obtain the Node number, IP address Range and Subnet Mask Address Range of the device that will communicate with the controller.
For Foreign Device to communicate with AquaForce e-MT Controller, check the Foreign Device checkbox. From the Foreign Device manufacturer, obtain the Port Number, IP Address Range and Gateway Address Range of the Foreign Device that will communicate with the controller.
Enter all the above gathered data from manufacturer on BACnet IP Page as shown in Figure 5.7.3.
To make these changes active in controller, tap on [Save] button available on [BACnet] page. Once the [Save] button is tapped, controller will restart and changes will be incorporated into the controller.
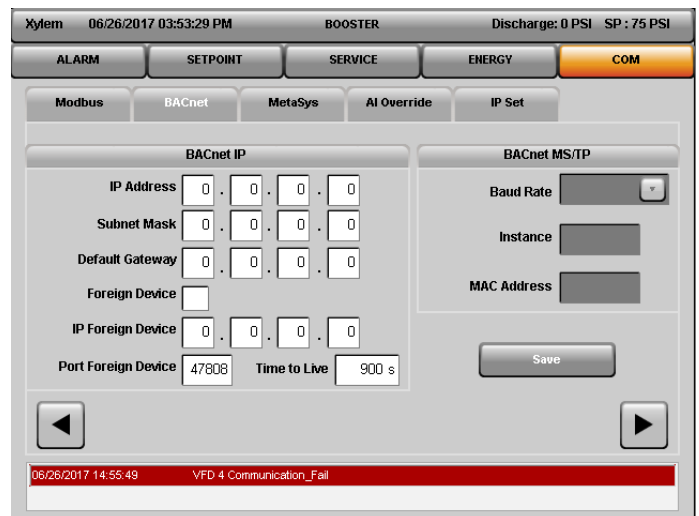
Figure 5.7.3 – BACnet Page

5.7.4 BACnet MS/TP

Enter the MAC Address, Instance Number and Baud Rate on BACnet page as shown in Figure 5.7.4.

To make these changes active in controller, tap on [Save] button available on [BACnet] page. Once the [Save] button is tapped, controller will restart and changes will be incorporated in the controller.
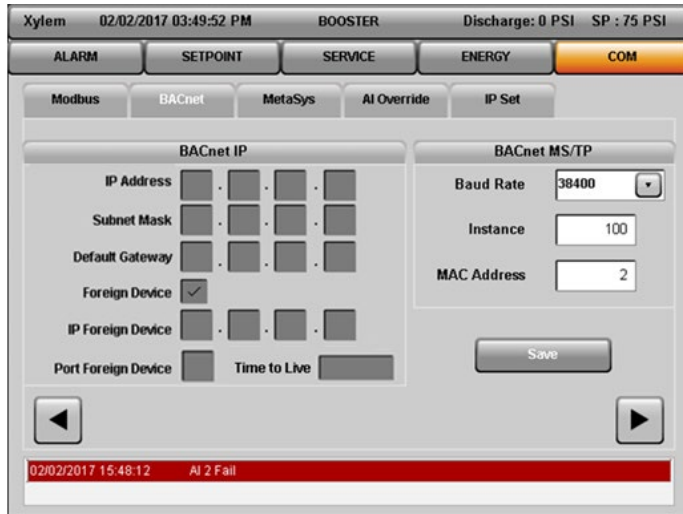
Figure 5.7.4 – BACnet Page

5.7.5 MetaSys N2
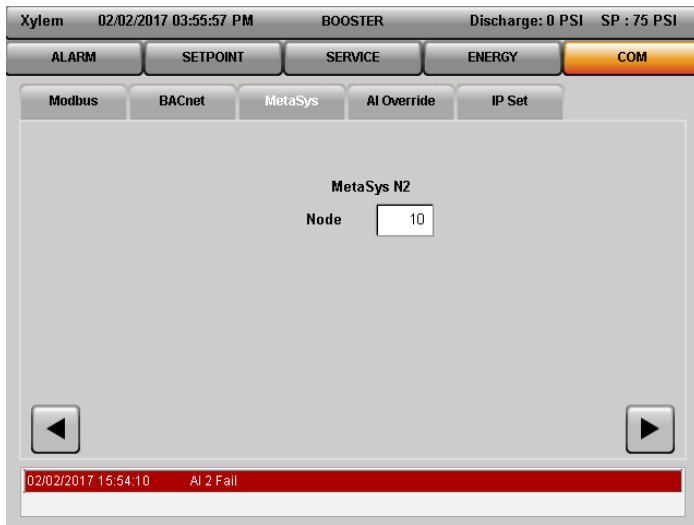
Figure 5.7.5 – MetaSys N2 Page

Enter the Node number on the MetaSys N2 page as shown in Figure 5.7.5. Node number has to be unique for each device in the network.

To make these changes active in controller, tap on [Save] button available on [MetaSys N2] Page. Once

the [Save] button is tapped, controller will restart and changes will be incorporated in the controller.

5.7.6 AI Override
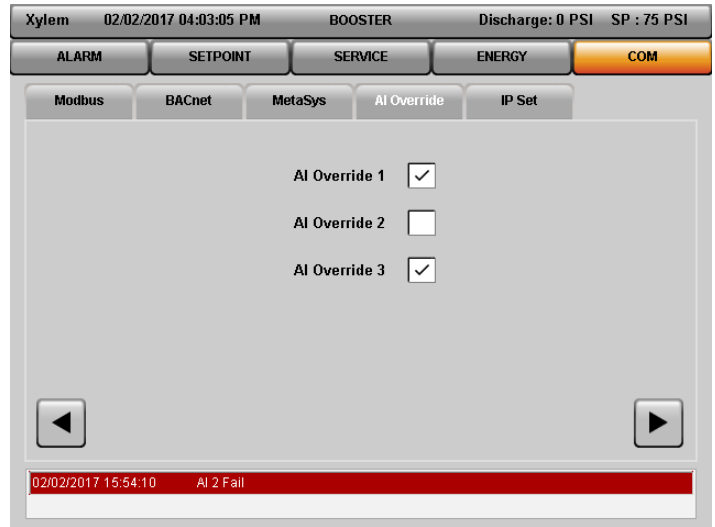
Figure 5.5.6 – AI Override

Check the applicable AI Override checkbox to override an Analog Input through the communications port.

5.7.7 IP Set
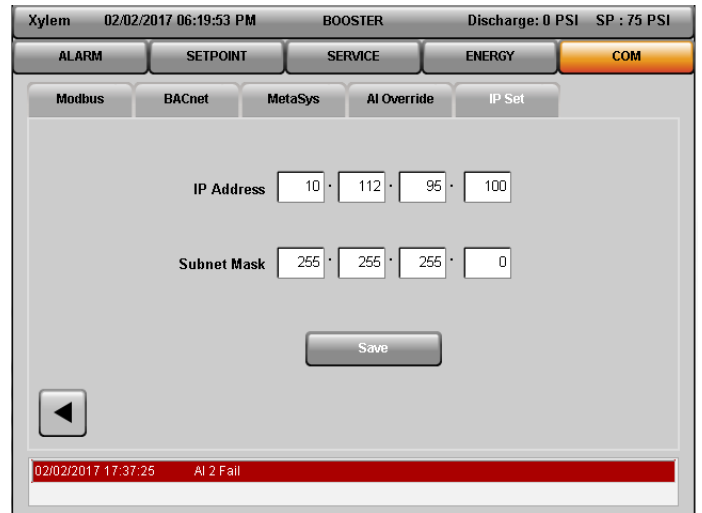
Figure 5.5.7 – IP Set

If no BMS communication is enabled, then there is an option to set the IP Address of the AquaForce controller.

On the IP Set page, as shown in Figure 5.5.7, enter the IP Address and Subnet Mask address of the controller.

To make these changes active in controller, tap on [Save] button available on [Set IP] Page. Once the [Save] button is tapped, controller will restart and changes will be incorporated into the controller.

5.8 Trend Screen

Just beside Alarm status display on the Home Screen, there is a button [icon] to open Trend Screen as shown in Figure 5.1 (12). When this trend button is pressed, Trend Screen will open as shown in Figure 5.8.1

On this Trend Screen, graphical representation of parameters like Setpoint, Flow, Suction/Discharge Pressure, Pump Speed, Power etc. can be shown. Historical graphs for these parameters can also be seen by tapping Left/Right cursor button located at bottom end of Trend Screen.

Customized Bounds and Intervals can be set by tapping on [**Set Interval**] and [**Set Bounds**] buttons located at bottom right part of the Trend Screen.

[**Sensor Min/Max Info**] button is located at bottom left part of trend screen. On tapping this button, it will display minimum and maximum values of sensors (Flow, Suction Pressure and Discharge Pressure) which it has attained to date. This value can be reset by tapping [**Reset**] Button.

[**Data Export**] button is located at bottom left part of trend screen. This button gives user option to back up the sensor's data by exporting it externally. On tapping this button, a pop up will appear which contains a checkbox in front of each sensor's name.
User can check/uncheck the checkboxes depending on which data needs to be exported.

Figure 5.8.1 – Trend Screen

5.9 Parameter Range Table

REDUNDANT SENSOR MENU ITEMS				
Menu Item	**Variable**	**Default**	**Range**	**Field Value**
Redundant Sensor Type	Active Sensor	1	1-4	
	Drift Threshold	5	0-100	
	Drift Proof Timer	0	0-999	

STAGE/DESTAGE SETUP MENU ITEMS				
Menu Item	**Variable**	**Default**	**Range**	**Field Value**
PV Stage	Stage Speed	95	0-100	
	Stage Proof Timer	30	0-999	
	Stabilization Timer	60	0-999	
PV DeStage	DeStage Speed	85	0-100	
	DeStage Proof Timer	30	0-999	
	Hard DeStage Speed	50	0-100	
	Hard DeStage Proof Timer	30	0-999	
EOC stage (Flow Meter Required)	Pump Max Flow	0	0-65535	
	Stage Proof Timer	30	0-999	
EOC DeStage (Flow Meter Required)	DeStage Flow	0	0-100	
	DeStage Proof Timer	30	0-999	
Flow DeStage	Flow DeStage	0	0-65535	
	De-Stage Proof Timer	30	0-999	
	Force DeStage Timer	0	0-999	
Power Stage	Power Stage	Yes	Yes/No	

VFD MENU ITEMS				
Menu Item	**Variable**	**Default**	**Range**	**Field Value**
VFD Setup	Ramp up Time (s)	5	0-1800	
	Ramp down Time (s)	5	0-1800	
	Minimum Frequency (Hz)	30	0-60	
	Maximum Frequency (Hz)	60	0-60	

PID MENU ITEMS				
Menu Item	**Variable**	**Default**	**Range**	**Field Value**
PID	P	300	0-999	
	I	1	0-999	
	D	15	0-999	
	SP Deviation	0	0-999	
	Index	0	0-999	
	Startup Delay	5	0-999	
	PID Inverse	Yes	Yes/No	

EXERCISE MENU ITEMS				
Menu Item	**Variable**	**Default**	**Range**	**Field Value**
Exercise	Period (Hrs)	0	0-999	
	Duration (s)	0	0-999	

TIMED ALTERNATION MENU ITEMS				
Menu Item	**Variable**	**Default**	**Range**	**Field Value**
Timed Alternation	Period (Hrs)	168	0-999	
	Duration (s)	10	0-999	

DAILY ALTERNATION MENU ITEMS				
Menu Item	**Variable**	**Default**	**Range**	**Field Value**
Daily Alternation	Hours (Hrs)	0	0-24	
	Minute (min)	0	0-60	

WEEKLY ALTERNATION MENU ITEMS				
Menu Item	**Variable**	**Default**	**Range**	**Field Value**
Weekly Alternation	Hours (Hrs)	0	0-24	
	Minute (min)	0	0-60	
	Day (1= Mon and 7= Sun)	0	1-7	

MONTHLY ALTERNATION MENU ITEMS				
Menu Item	**Variable**	**Default**	**Range**	**Field Value**
Monthly Alternation	Hours (Hrs)	0	0-24	
	Minute (min)	0	0-60	
	Day (Day of the Month)	0	1-31	

NO FLOW SHUT DOWN MENU ITEMS				
Menu Item	**Variable**	**Default**	**Range**	**Field Value**
No Flow Shut Down	NFSD Test Proof Timer (S)	10	0-999	
	Min Speed Proof Timer (S)	30	0-999	
	Restart PSI Drop (PSI)	10	0-999	
	Minimum Run (Min)	1	0-999	

LINE FILL MENU ITEMS				
Menu Item	**Variable**	**Default**	**Range**	**Field Value**
Line Fill	Enable	Yes	Yes/No	
	Trigger Pressure (PSI)		0-999	
	Speed Step		0-999	
	Steady Time		0-999	
	Speed at 0 PSI		0-999	
	Deadband (PSI)		0-999	
	Max No. of Pumps		0-999	
	Fault Time		0-999	

ALARM SETUP - MENU ITEMS				
Menu Item	**Variable**	**Default**	**Range**	**Field Value**
Pump Failure	Proof Timer (S)	10	0-999	
Low System Pressure	Stop Pump in Low System	Yes	Yes/No	
	Low system Pressure	Set 15 PSI below System Setpoint	0-999	
	Low system proof timer	30	0-999	
High System Pressure	High System Pressure	112	0-999	
	High System Proof timer	20	0-999	
Low Suction Pressure	Low Suction Source	Analog In	Analog In / Digital In	
	Low Suction Pressure	5	0-999	
	Low Suction Proof timer	20	0-999	
	Low Suction Reset Pressure	10	0-999	
	Low Suction Auto Reset	Yes	Yes/No	

ALARM SETUP - MENU ITEMS				
Menu Item	**Variable**	**Default**	**Range**	**Field Value**
High Suction Pressure	High Suction Source	Analog In	Analog In / Digital In	
	High Suction Pressure	75	0-999	
	High Suction Proof timer	0	0-999	
	High Suction Reset Pressure	67	0-999	
Low Level	Low Level Proof Timer	0	0-999	
	Low Level Auto Reset	NO	Yes/No	
	Stops Pump in Low Level	NO	Yes/No	
High Level	High Level Proof Timer	0	0-999	
	High Level Auto Reset	NO	Yes/No	
	Stops Pump in High Level	NO	Yes/No	
VFD Comm. Failure	VFD Run Proof Timer (S)	30	30-999	
	VFD Comm. Proof Timer (S)	30	30-999	
	On VFD Comm. Fail	Stop and Trip	1. Stop and Trip 2.Joggging	
	Jog Speed	30 Hz	VFD Minimum - VFD Maximum	
VFD UV/OV/OC Failure	VFD UV,OV,OC Proof Timer (S)	10	0-999	
	VFD, UV, OC Max number of Reset	3	0-5	
	Reset Delay Timer (S)	0	0-99	
	Reset Count Proof Timer (Min)	5	0-99	
Loss of Prime	Loss of Prime Proof Timer (S)	10	0-999	
	Auto Reset	Yes	Yes/No	
	Reset Delay Timer (S)	0	0-999	
	Reset Count	0	0-10	

FRICTION LOSS COMPENSATION MENU ITEMS				
Menu Item	Variable	Default	Range	Field Value
Friction loss Compensation	Loss 2 (PSI)	0	0-999	
	Loss 3 (PSI)	0	0-999	
	Loss 4 (PSI)	0	0-999	
	Loss 5 (PSI)	0	0-999	
	Loss 6 (PSI)	0	0-999	

FRICTION LOSS COMPENSATION MENU ITEMS				
Menu Item	Variable	Default	Range	Field Value
Friction loss Compensation	Enable friction loss	No	Yes/No	
	Total Friction Loss (PSI)	0	0-999	
	Auto Calculation	No	Yes/No	
	Log Stabilization Timer (S)	30	0-255	
	Loss 1 (PSI)	0	0-999	

6. Maintenance

6.1 Preface

The following is a description of the hardware, diagnostics, and corrective action to maintain a process being controlled by the Pump Controller.

NOTE: THE FOLLOWING SHOULD NOT BE INTERPRETED AS THE MAXIMUM CONFIGURATION OF THIS CONTROLLER, RATHER THIS DESCRIBES ITS APPLICATION AS A AQUAFORCE e-MT PUMP CONTROLLER ONLY.

6.2 Technical Overview

The Pump Controller is a microprocessor based dedicated pump controller unique to and exclusively manufactured by Xylem Goulds Water Technology. All aspects of this unit are strictly proprietary to Xylem Goulds Water Technology.

6.3 Digital Inputs

The controller has provision for digital inputs with an operating voltage of 24 VDC. This signal voltage must be obtained from the 24 VDC power supply mounted to the subpanel.

It is not recommended that other power sources be used without factory approval.

Customer connections are made directly to the terminals blocks wired to the digital input module.

6.4 Digital Outputs

The controller has provision for relay outputs to control 240V 50/60 HZ devices.

The relays are not removable. If defective, the digital output module must be returned to the factory for repair.

All relays operate as single pole single throw. Components are provided to reduce contact arc and extend electrical life.

Customer connections are made directly to the terminals blocks wired to the digital output module.

6.5 Analog Inputs

Analog inputs are provided for process variables and optional transmitters. All analog inputs operate at 4-20mA. They must be powered from 24 VDC power supply included with the controller

6.6 Memory

The logic is stored in a non-removable flash PROM chip which can only be updated from the USB & Ethernet program port on the CPU. The user setup data is stored in xml file format. The logged data for pressure & flow is stored in csv file format.

6.7 CPU

The CPU does not require any maintenance, and cannot be replaced as a field repair.

6.8 Power Supply

The power supply provides 24 VDC for all digital and analog signals as well as the CPU. It is specifically rated only for the controller and other loads should not be applied without factory approval.

The power supply is protected with both primary and secondary fusing as indicated on the wiring diagram. The size of these fuses is indicated on a sticker inside each enclosure.

DANGER:

- Troubleshooting live control panels exposes personnel to hazardous voltages. Electrical troubleshooting must only be done by a qualified electrician. FAILURE TO FOLLOW THESE INSTRUCTIONS COULD RESULT IN SERIOUS PERSONAL INJURY, DEATH, AND/OR PROPERTY DAMAGE.

6.9 Protection

Analog inputs – the analog inputs provided on the AquaForce e-MT Pump Controller must be wired according to the wiring diagram that shipped with the unit.

Protection – all analog inputs are protected from high voltage, crossed wiring, etc. A sustained fault will be limited to 20mA by the current limiting circuit.

Digital Inputs – as long as input power is derived from the integral 24VDC power supply they are protected.

Digital Outputs – each output shall not exceed the ratings on the digital output module.

6.10 Instruments and Their Use

With the diagnostics described herein extensive instruments are not required. However, the instruments used should be quality units to meet the following at a minimum.

Under no circumstances shall any instrument be used to test any on board components. Especially risky is an ohmmeter with battery voltage higher than TTL logic or applied with incorrect polarity.

6.10.0 AC/DC voltmeter

- Input impedance shall not be less than 10 MEGOHM.
- Accuracy - AC ± 2% of Full Scale
- DC ± 3% of Full Scale
- Rated circuit to ground voltage = 1000V.

6.10.1 Ohmmeter

- Accuracy ± 2%
- Overload protection voltage = 1000V.

6.10.2 Millimeter

- Accuracy ± 2% of Full Scale

6.10.3 Signal generator (analyzer) – recommended

A. Beta calibrator Model 434 20mA signal analyzer.
B. Altek calibrator Model 334 4-20mA loop analyzer.

Either instrument may be purchased from a Local Process Control Distributor.

NOTE: If some other instrument is used it must float above ground, preferably battery powered.

6.11 Field Repair

6.11.0 General
Typical field repair should include: replacing fuses, replacing input/output modules and assuring connections are correct and secure.

DANGER:

Troubleshooting live control panels exposes personnel to hazardous voltages. Electrical troubleshooting must only be done by a qualified electrician. FAILURE TO FOLLOW THESE INSTRUCTIONS COULD RESULT IN SERIOUS PERSONAL INJURY, DEATH, AND/OR PROPERTY DAMAGE.

6.12 Program updating
To update to a new version of the program the program must be downloaded through the USB port on the controller. This can be accomplished by one of the following means:

1) A factory authorized technician uploads on job site.
2) Replace the controller with one that has been pre-programmed at the factory.

Contact your Xylem representative for the preferred method of upgrading your software.

6.13 Procedure to Switch Danfoss Drive into Hand Mode
Case: Loss of communication between Controller and Drive. (Controller loses power)
- Drive/s will show Alarm code A17.
- Press "Main Menu" key and navigate to parameter 8-04
- Change setting to "Off"

- Go back to main page by pressing "STATUS" key
- Press "OFF" key to make sure that the drive does not start up after pressing reset.
- Press "RESET" in drive to reset the A17 Fault message
- Press "HAND ON" key to start the Drive in manual mode
- Use the UP, DOWN, LEFT & RIGHT arrow keys to change the speed.

- Press "AUTO ON" key in drive to go back to auto mode after resolving the communication problem.

6.14 Procedure for turning VFD's Power OFF when it is set to Jog Speed:

- Disable respective Pump from Controller's Home screen
- Turn power off for the respective VFD

6.15 Troubleshooting

VFD FAILURE

    a. Remedy:
- I. Cycle Power to VFD and Station.
- II. Check power wiring and fuses for affected VFD.
- III. Check all wiring between VFD and PLC.
- IV. Check to be sure VFD is not in LOC mode.

HIGH LEVEL:

    a. Remedy:
- I. Check application for legitimate 'high level' fault.
- II. Check that PLC is properly programmed for the correct number of switches/sensors.
- III. Check for open or closed switch contacts. Refer to wire diagrams for proper connection.

HIGH SUCTION:

    a. Remedy:
- I. Check application for legitimate 'high suction' pressure fault. Is a PRV necessary?
- II. Check that PLC is properly programmed for the correct number of switches/sensors.
- III. Check for open or closed switch contacts. Refer to wire diagrams for proper connection.

HIGH SYSTEM (Discharge):

    a. Remedy:
   I. Check application for high discharge pressure conditions. Does the mechanical gauge on the discharge header match the actual pressure displayed on the PLC?
   II. Check suction pressure conditions. Is suction pressure significantly higher than original system design point?
   III. Check Ramp Speed settings. Fast ramp speeds can increase the chance of over-pressurizing the system, especially with larger pumps.

LOW SYSTEM (Discharge):

    a. Remedy:
   I. Check application for low discharge pressure conditions. Does the mechanical gauge on the discharge header match the actual pressure displayed on the PLC?
   II. Are the pumps running in the correct direction?
   III. Check suction pressure conditions. Is suction pressure significantly lower than original system design point?
   IV. Is the system drawing a vacuum? Can the water supply keep up with demand?
   V. Could there be a broken pipe/leak in the system? In other words, does the system seem to be running in a 'open discharge' condition?
   VI. Check Ramp Speed settings. Slow ramp speeds can increase the chance of a rapid drop in system pressure.

LOW SUCTION:

    a. Remedy:
   I. Check application for legitimate 'low suction' pressure fault. Is a PRV set incorrectly?
   II. Could the system be drawing a vacuum?
   III. Check that PLC is properly programmed for the correct number of switches/sensors.
   IV. Check for open or closed switch contacts. Refer to wire diagrams for proper connection.

6.16 Maintenance (Physical)

6.16.0 Electrical

No maintenance is required for the electrical panel except to keep the modules free of dirt and dust that might hold moisture. Cabinet door should be kept closed, and the components kept dry.

6.16.1 Mechanical

- If a Goulds Water Technology pump was supplied it was lubricated at the factory. Future lubrication should be according to the instructions that came with the pump.
- If there is a danger of freezing, drain the pump. Inspect pump and system piping regularly.

  For leaky seals or gaskets and loose or damaged components, replace or repair as required.

7. Appendix

7.1 Modbus RTU Point Table

Function Code	Points#	Point Description	Range/Value	Modbus Address for RTU	Unit
02	0	Pump#1 Failure	1=Failure 0=O.K.	10001	
02	1	Pump#1 VFD Failure	1=Failure 0=O.K.	10002	
02	2	Pump#1 off Alarm	1=Alarm 0=O.K.	10003	
02	3	Pump#2 Failure	1=Failure 0=O.K.	10004	
02	4	Pump#2 VFD Failure	1=Failure 0=O.K.	10005	
02	5	Pump#2 off Alarm	1=Alarm 0=O.K.	10006	
02	6	Pump#3 Failure	1=Failure 0=O.K.	10007	
02	7	Pump#3 VFD Failure	1=Failure 0=O.K.	10008	
02	8	Pump#3 off Alarm	1=Alarm 0=O.K.	10009	
02	9	Pump#4 Failure	1=Failure 0=O.K.	10010	
02	10	Pump#4 VFD Failure	1=Failure 0=O.K.	10011	
02	11	Pump#4 off Alarm	1=Alarm 0=O.K.	10012	
02	12	Pump#5 Failure	1=Failure 0=O.K.	10013	
02	13	Pump#5 VFD Failure	1=Failure 0=O.K.	10014	
02	14	Pump#5 off Alarm	1=Alarm 0=O.K.	10015	
02	15	Pump#6 Failure	1=Failure 0=O.K.	10016	
02	16	Pump#6 VFD Failure	1=Failure 0=O.K.	10017	
02	17	Pump#6 off Alarm	1=Alarm 0=O.K.	10018	
02	18	System Reset Required	1=Yes 0=No	10019	
02	19	Pump#1 Enable	1=Enable 0=Disabled	10020	
02	20	Pump#2 Enable	1=Enable 0=Disabled	10021	
02	21	Pump#3 Enable	1=Enable 0=Disabled	10022	
02	22	Pump#4 Enable	1=Enable 0=Disabled	10023	
02	23	Pump#5 Enable	1=Enable 0=Disabled	10024	
02	24	Pump#6 Enable	1=Enable 0=Disabled	10025	
02	25	Pump#1 On/Off	1=On 0=Off	10026	
02	26	Pump#2 On/Off	1=On 0=Off	10027	
02	27	Pump#3 On/Off	1=On 0=Off	10028	
02	28	Pump#4 On/Off	1=On 0=Off	10029	
02	29	Pump#5 On/Off	1=On 0=Off	10030	
02	30	Pump#6 On/Off	1=On 0=Off	10031	
02	31	System Start/Stop	1=Start 0=Stop	10032	
02	32	Analog Input #1 Failure	1=Failure 0=O.K.	10033	
02	33	Analog Input #2 Failure	1=Failure 0=O.K.	10034	

02	34	Analog Input #3 Failure	1=Failure 0=O.K.	10035	
02	36	General Alarm	1=Alarm 0=O.K.	10036	
02	37	System Operation Mode	1=Auto 0=Manual	10037	
05	0	Pump Sequence Alternation	1=Yes 0=No	00001	
05	1	System Reset Request	1=Yes 0=No	00002	
05	2	System Start/Stop	1=Start 0=Stop	00003	
04	0	System Pressure	0 to Span (in AquaForce user setup menu)	30001	PSI
04	1	Suction Pressure	0 to Span (in AquaForce user setup menu)	30002	PSI
04,06	2	AI#1	0 to Span (in AquaForce user setup menu)	30003, 40003	
04,06	3	AI#2	0 to Span (in AquaForce user setup menu)	30004, 40004	
04,06	4	AI#3	0 to Span (in AquaForce user setup menu)	30005, 40005	
04,06	6	Setpoint #1	0 to Span (in AquaForce user setup menu)	30006, 40006	
04,06	7	Setpoint #2	0 to Span (in AquaForce user setup menu)	30007, 40007	
04,06	8	Setpoint #3	0 to Span (in AquaForce user setup menu)	30008, 40008	
04	10	System Flow	0 to Span (in AquaForce user setup menu)	30009	GPM
04	11	System Power (KW)	0 to Span (in AquaForce user setup menu)	30010	KW
04	12	Drive#1 Current	0 to Span (in AquaForce user setup menu)	30011	A
04	13	Drive#2 Current	0 to Span (in AquaForce user setup menu)	30012	A
04	14	Drive#3 Current	0 to Span (in AquaForce user setup menu)	30013	A
04	15	Drive#4 Current	0 to Span (in AquaForce user setup menu)	30014	A
04	16	Drive#5 Current	0 to Span (in AquaForce user setup menu)	30015	A
04	17	Drive#6 Current	0 to Span (in AquaForce user setup menu)	30016	A
04	18	Drive#1 Power (KW)	0 to Span (in AquaForce user setup menu)	30017	KW
04	19	Drive#2 Power (KW)	0 to Span (in AquaForce user setup menu)	30018	KW

04	20	Drive#3 Power (KW)	0 to Span (in AquaForce user setup menu)	30019	KW
04	21	Drive#4 Power (KW)	0 to Span (in AquaForce user setup menu)	30020	KW
04	22	Drive#5 Power (KW)	0 to Span (in AquaForce user setup menu)	30021	KW
04	23	Drive#6 Power (KW)	0 to Span (in AquaForce user setup menu)	30022	KW
04	24	Speed %	0 to 100	30023	%
04	25	Lead Pump Number	1 to Pump# (in AquaForce user setup menu)	30024	
04	26	Active Zone Number	1 to Zone # (in AquaForce user setup menu)	30025	

7.2 Modbus IP Point Table

Function Code	Points#	Point Description	Range/Value	Modbus Address for RTU	Unit
02	0	Pump#1 Failure	1=Failure 0=O.K.	16401	
02	1	Pump#1 VFD Failure	1=Failure 0=O.K.	16402	
02	2	Pump#1 off Alarm	1=Alarm 0=O.K.	16403	
02	3	Pump#2 Failure	1=Failure 0=O.K.	16404	
02	4	Pump#2 VFD Failure	1=Failure 0=O.K.	16405	
02	5	Pump#2 off Alarm	1=Alarm 0=O.K.	16406	
02	6	Pump#3 Failure	1=Failure 0=O.K.	16407	
02	7	Pump#3 VFD Failure	1=Failure 0=O.K.	16408	
02	8	Pump#3 off Alarm	1=Alarm 0=O.K.	16409	
02	9	Pump#4 Failure	1=Failure 0=O.K.	16410	
02	10	Pump#4 VFD Failure	1=Failure 0=O.K.	16411	
02	11	Pump#4 off Alarm	1=Alarm 0=O.K.	16412	
02	12	Pump#5 Failure	1=Failure 0=O.K.	16413	
02	13	Pump#5 VFD Failure	1=Failure 0=O.K.	16414	
02	14	Pump#5 off Alarm	1=Alarm 0=O.K.	16415	
02	15	Pump#6 Failure	1=Failure 0=O.K.	16416	
02	16	Pump#6 VFD Failure	1=Failure 0=O.K.	16417	
02	17	Pump#6 off Alarm	1=Alarm 0=O.K.	16418	
02	18	System Reset Required	1=Yes 0=No	16419	
02	19	Pump#1 Enable	1=Enable 0=Disabled	16420	
02	20	Pump#2 Enable	1=Enable 0=Disabled	16421	
02	21	Pump#3 Enable	1=Enable 0=Disabled	16422	
02	22	Pump#4 Enable	1=Enable 0=Disabled	16423	
02	23	Pump#5 Enable	1=Enable 0=Disabled	16424	
02	24	Pump#6 Enable	1=Enable 0=Disabled	16425	
02	25	Pump#1 On/Off	1=On 0=Off	16426	
02	26	Pump#2 On/Off	1=On 0=Off	16427	
02	27	Pump#3 On/Off	1=On 0=Off	16428	
02	28	Pump#4 On/Off	1=On 0=Off	16429	
02	29	Pump#5 On/Off	1=On 0=Off	16430	
02	30	Pump#6 On/Off	1=On 0=Off	16431	
02	31	System Start/Stop	1=Start 0=Stop	16432	
02	32	Analog Input #1 Failure	1=Failure 0=O.K.	16433	
02	33	Analog Input #2 Failure	1=Failure 0=O.K.	16434	
02	34	Analog Input #3 Failure	1=Failure 0=O.K.	16435	
02	36	General Alarm	1=Alarm 0=O.K.	16437	
02	37	System Operation Mode	1=Auto 0=Manual	16438	

05	0	Pump Sequence Alternation	1=Yes 0=No	16501	
05	1	System Reset Request	1=Yes 0=No	16502	
05	2	System Start/Stop	1=Start 0=Stop	16503	
04	0	System Pressure	0 to Span (in AquaForce user setup menu)	8201	PSI
04	1	Suction Pressure	0 to Span (in AquaForce user setup menu)	8202	PSI
04,06	2	AI#1	0 to Span (in AquaForce user setup menu)	8203, 24580	
04,06	3	AI#2	0 to Span (in AquaForce user setup menu)	8204, 24581	
04,06	4	AI#3	0 to Span (in AquaForce user setup menu)	8205, 24582	
04,06	6	Setpoint #1	0 to Span (in AquaForce user setup menu)	8207, 24584	
04,06	7	Setpoint #2	0 to Span (in AquaForce user setup menu)	8208, 24585	
04,06	8	Setpoint #3	0 to Span (in AquaForce user setup menu)	8209, 24586	
04	10	System Flow	0 to Span (in AquaForce user setup menu)	8211	GPM
04	11	System Power (KW)	0 to Span (in AquaForce user setup menu)	8212	KW
04	12	Drive#1 Current	0 to Span (in AquaForce user setup menu)	8213	A
04	13	Drive#2 Current	0 to Span (in AquaForce user setup menu)	8214	A
04	14	Drive#3 Current	0 to Span (in AquaForce user setup menu)	8215	A
04	15	Drive#4 Current	0 to Span (in AquaForce user setup menu)	8216	A
04	16	Drive#5 Current	0 to Span (in AquaForce user setup menu)	8217	A
04	17	Drive#6 Current	0 to Span (in AquaForce user setup menu)	8218	A
04	18	Drive#1 Power (KW)	0 to Span (in AquaForce user setup menu)	8219	KW
04	19	Drive#2 Power (KW)	0 to Span (in AquaForce user setup menu)	8220	KW
04	20	Drive#3 Power (KW)	0 to Span (in AquaForce user setup menu)	8221	KW

04	21	Drive#4 Power (KW)	0 to Span (in AquaForce user setup menu)	8222	KW
04	22	Drive#5 Power (KW)	0 to Span (in AquaForce user setup menu)	8223	KW
04	23	Drive#6 Power (KW)	0 to Span (in AquaForce user setup menu)	8224	KW
04	24	Speed %	0 to 100	8225	%
04	25	Lead Pump Number	1 to Pump# (in AquaForce user setup menu)	8226	
04	26	Active Zone Number	1 to Zone # (in AquaForce user setup menu)	8227	

7.3 Conformance Statement –

BACnet Protocol Implementation Conformance Statement

Date:	3/17/2017
Vendor Name:	Xylem Inc. (Goulds)
Product Name:	AquaForce Pump Controller,
Product Model Number:	e-MT
Applications Software Version:	1.6 or above
Firmware Revision:	FW 4.5
BACnet Protocol Revision:	12.0

Product Description

The AquaForce Pump Controller is a variable speed pumping system for water booster systems. It operates either as a stand-alone controller or as part of a building-wide integrated system. The BACnet communication interface will provide communication between the AquaForce pump controller and the BACnet system residing on RS-485 or IP media.

BACnet STandardized Device Profile (Annex L)

☐ BACnet Operator Workstation (B-OWS)

☐ BACnet Building Controller (B-BC)

☐ BACnet Advanced Application Controller (B-AAC)

☒ BACnet Application Specific Controller (B-ASC)

☐ BACnet Smart Sensor (B-SS)

☐ BACnet Smart Actuator (B-SA)

List all BACnet Interoperability Building Blocks Supported (Annex K)

DS-RP-B	DM-TS-B	DM-DCC-B
DS-WP-B	DM-DDB-B	DM-DOB-B

Segmentation Capability

☐ Able to transmit segmented messages	Window Size	N/A
☐ Able to receive segmented messages	Window Size	N/A

Standard Object Types Supported

Analog input

Dynamically creatable:	No
Dynamically deletable:	No
Optional properties supported:	None
Writable properties:	Present Value Conditionally writable
	Out of Service
Proprietary properties:	None
Property range restrictions:	None

Analog output

Dynamically creatable:	No
Dynamically deletable:	No
Optional properties supported:	None
Writable properties:	Present Value
Proprietary properties:	None
Property range restrictions:	None

Binary input

Dynamically creatable:	No
Dynamically deletable:	No
Optional properties supported:	None
Writable properties:	Present Value Conditionally writable
	Out of Service
Proprietary properties:	None
Property range restrictions:	None

Binary output

Dynamically creatable:	No
Dynamically deletable:	No
Optional properties supported:	None
Writable properties:	Present Value
Proprietary properties:	None
Property range restrictions:	None

Device

Dynamically creatable:	No
Dynamically deletable:	No
Optional properties supported:	Local_Date
	Local_Time
	Max_Master
	Max_Info_Frames

Writable properties:	None
Proprietary properties:	None
Property range restrictions:	None

Data Link Layer Options

☒ BACnet IP, (Annex J)

☐ BACnet IP, (Annex J), Foreign Device

☐ ISO 8802-3, Ethernet (Clause 7)

☐ ANSI/ATA 878.1, 2.5 Mb. ARCNET (Clause 8)

☐ ANSI/ATA 878.1, RS-485 ARCNET (Clause 8), baud rate(s) _____

☒ MS/TP master (Clause 9), baud rate(s): 9600, 19200, 38400, 57600, 115200

☐ MS/TP slave (Clause 9), baud rate(s): 9600, 19200, 38400

☐ Point-To-Point, EIA 232 (Clause 10), baud rate(s):

☐ Point-To-Point, modem, (Clause 10), baud rate(s):

☐ LonTalk, (Clause 11), medium: _____

☐ Other:

Device Address Binding

Is static device binding supported? (This is currently necessary for two-way communication with MS/TP slaves and certain other devices.) ☐ Yes ☒ No

Networking Options

☐ Router, Clause 6 - List all routing configurations, e.g., ARCNET-Ethernet, Ethernet-MS/TP, etc.

☐ Annex H, BACnet Tunneling Router over IP

☐ BACnet/IP Broadcast Management Device (BBMD)

Does the BBMD support registrations by Foreign Devices? ☐ Yes ☐ No

Character Sets Supported

Indicating support for multiple character sets does not imply that they can all be supported simultaneously.

☐ ANSI X3.4	☐ IBM'/Microsoft'DBCS	☐ ISO 8859-1
☐ ISO 10646 (UCS-2)	☐ ISO 10646 (UCS-4)	☐ JIS C 6226
☒ ISO 10646 (UTF-8)		

If this product is a communication gateway, describe the types of non-BACnet equipment/network(s) that the gateway supports: N/A

7.4 Bacnet (IP / MS-TP) Point Table

Object Identifier	Point Description	Range/Value
Binary Input , 1	Pump#1 Failure	1=Failure 0=O.K.
Binary Input , 2	Pump#1 VFD Failure	1=Failure 0=O.K.
Binary Input , 3	Pump#1 off Alarm	1=Alarm 0=O.K.
Binary Input , 4	Pump#2 Failure	1=Failure 0=O.K.
Binary Input , 5	Pump#2 VFD Failure	1=Failure 0=O.K.
Binary Input , 6	Pump#2 off Alarm	1=Alarm 0=O.K.
Binary Input , 7	Pump#3 Failure	1=Failure 0=O.K.
Binary Input , 8	Pump#3 VFD Failure	1=Failure 0=O.K.
Binary Input , 9	Pump#3 off Alarm	1=Alarm 0=O.K.
Binary Input , 10	Pump#4 Failure	1=Failure 0=O.K.
Binary Input , 11	Pump#4 VFD Failure	1=Failure 0=O.K.
Binary Input , 12	Pump#4 off Alarm	1=Alarm 0=O.K.
Binary Input , 13	Pump#5 Failure	1=Failure 0=O.K.
Binary Input , 14	Pump#5 VFD Failure	1=Failure 0=O.K.
Binary Input , 15	Pump#5 off Alarm	1=Alarm 0=O.K.
Binary Input , 16	Pump#6 Failure	1=Failure 0=O.K.
Binary Input , 17	Pump#6 VFD Failure	1=Failure 0=O.K.
Binary Input , 18	Pump#6 off Alarm	1=Alarm 0=O.K.
Binary Input , 19	System Reset Required	1=Yes 0=No
Binary Input , 20	Pump#1 Enable	1=Enable 0=Disabled
Binary Input , 21	Pump#2 Enable	1=Enable 0=Disabled
Binary Input , 22	Pump#3 Enable	1=Enable 0=Disabled
Binary Input , 23	Pump#4 Enable	1=Enable 0=Disabled
Binary Input , 24	Pump#5 Enable	1=Enable 0=Disabled
Binary Input , 25	Pump#6 Enable	1=Enable 0=Disabled
Binary Input , 26	Pump#1 On/Off	1=On 0=Off
Binary Input , 27	Pump#2 On/Off	1=On 0=Off
Binary Input , 28	Pump#3 On/Off	1=On 0=Off
Binary Input , 29	Pump#4 On/Off	1=On 0=Off
Binary Input , 30	Pump#5 On/Off	1=On 0=Off
Binary Input , 31	Pump#6 On/Off	1=On 0=Off
Binary Input , 32	System Start/Stop	1=Start 0=Stop
Binary Input , 33	Analog Input #1 Failure	1=Failure 0=O.K.
Binary Input , 34	Analog Input #2 Failure	1=Failure 0=O.K.
Binary Input , 35	Analog Input #3 Failure	1=Failure 0=O.K.
Binary Input , 36	General Alarm	1=Alarm 0=O.K.
Binary Input , 37	System Operation Mode	1=Auto 0=Manual
Binary Output , 1	Pump Sequence Alternation	1=Yes 0=No
Binary Output , 2	System Reset Request	1=Yes 0=No

Binary Output , 3	System Start/Stop	1=Start 0=Stop
Analog Input , 1	System Pressure	0 to Span (in AquaForce user setup menu)
Analog Input , 2	Suction Pressure	0 to Span (in AquaForce user setup menu)
Analog Input , 3	AI#1	0 to Span (in AquaForce user setup menu)
Analog Input , 4	AI#2	0 to Span (in AquaForce user setup menu)
Analog Input , 5	AI#3	0 to Span (in AquaForce user setup menu)
Analog Input , 6	Setpoint #1	0 to Span (in AquaForce user setup menu)
Analog Input , 7	Setpoint #2	0 to Span (in AquaForce user setup menu)
Analog Input , 8	Setpoint #3	0 to Span (in AquaForce user setup menu)
Analog Input , 9	System Flow	0 to Span (in AquaForce user setup menu)
Analog Input , 10	System Power (KW)	0 to Span (in AquaForce user setup menu)
Analog Input , 11	Drive#1 Current	0 to Span (in AquaForce user setup menu)
Analog Input , 12	Drive#2 Current	0 to Span (in AquaForce user setup menu)
Analog Input , 13	Drive#3 Current	0 to Span (in AquaForce user setup menu)
Analog Input , 14	Drive#4 Current	0 to Span (in AquaForce user setup menu)
Analog Input , 15	Drive#5 Current	0 to Span (in AquaForce user setup menu)
Analog Input , 16	Drive#6 Current	0 to Span (in AquaForce user setup menu)
Analog Input , 17	Drive#1 Power (KW)	0 to Span (in AquaForce user setup menu)
Analog Input , 18	Drive#2 Power (KW)	0 to Span (in AquaForce user setup menu)
Analog Input , 19	Drive#3 Power (KW)	0 to Span (in AquaForce user setup menu)
Analog Input , 20	Drive#4 Power (KW)	0 to Span (in AquaForce user setup menu)
Analog Input , 21	Drive#5 Power (KW)	0 to Span (in AquaForce user setup menu)
Analog Input , 22	Drive#6 Power (KW)	0 to Span (in AquaForce user setup menu)
Analog Input , 23	Speed %	0 to 100
Analog Input , 24	Lead Pump Number	1 to Pump# (in AquaForce user setup menu)
Analog Input , 25	Active Zone Number	1 to Zone # (in AquaForce user setup menu)
Analog Output , 1	AI#1 Command	0 to 65535
Analog Output , 2	AI#2 Command	0 to 65535
Analog Output , 3	AI#3 Command	0 to 65535
Analog Output , 4	SP#1 Command	0 to 65535
Analog Output , 5	SP#2 Command	0 to 65535
Analog Output , 6	SP#3 Command	0 to 65535

7.5 Metasys N2 Point Table

NPT	NPA	Point Description	Range/Value
BI	1	Pump#1 Failure	1=Failure 0=O.K.
BI	2	Pump#1 VFD Failure	1=Failure 0=O.K.
BI	3	Pump#1 off Alarm	1=Alarm 0=O.K.
BI	4	Pump#2 Failure	1=Failure 0=O.K.
BI	5	Pump#2 VFD Failure	1=Failure 0=O.K.
BI	6	Pump#2 off Alarm	1=Alarm 0=O.K.
BI	7	Pump#3 Failure	1=Failure 0=O.K.
BI	8	Pump#3 VFD Failure	1=Failure 0=O.K.
BI	9	Pump#3 off Alarm	1=Alarm 0=O.K.
BI	10	Pump#4 Failure	1=Failure 0=O.K.
BI	11	Pump#4 VFD Failure	1=Failure 0=O.K.
BI	12	Pump#4 off Alarm	1=Alarm 0=O.K.
BI	13	Pump#5 Failure	1=Failure 0=O.K.
BI	14	Pump#5 VFD Failure	1=Failure 0=O.K.
BI	15	Pump#5 off Alarm	1=Alarm 0=O.K.
BI	16	Pump#6 Failure	1=Failure 0=O.K.
BI	17	Pump#6 VFD Failure	1=Failure 0=O.K.
BI	18	Pump#6 off Alarm	1=Alarm 0=O.K.
BI	19	System Reset Required	1=Yes 0=No
BI	20	Pump#1 Enable	1=Enable 0=Disabled
BI	21	Pump#2 Enable	1=Enable 0=Disabled
BI	22	Pump#3 Enable	1=Enable 0=Disabled
BI	23	Pump#4 Enable	1=Enable 0=Disabled
BI	24	Pump#5 Enable	1=Enable 0=Disabled
BI	25	Pump#6 Enable	1=Enable 0=Disabled
BI	26	Pump#1 On/Off	1=On 0=Off
BI	27	Pump#2 On/Off	1=On 0=Off
BI	28	Pump#3 On/Off	1=On 0=Off
BI	29	Pump#4 On/Off	1=On 0=Off
BI	30	Pump#5 On/Off	1=On 0=Off
BI	31	Pump#6 On/Off	1=On 0=Off
BI	32	System Start/Stop	1=Start 0=Stop
BI	33	Analog Input #1 Failure	1=Failure 0=O.K.
BI	34	Analog Input #2 Failure	1=Failure 0=O.K.
BI	35	Analog Input #3 Failure	1=Failure 0=O.K.
BI	36	General Alarm	1=Alarm 0=O.K.
BI	37	System Operation Mode	1=Auto 0=Manual
BO	1	Pump Sequence Alternation	1=Yes 0=No
BO	2	System Reset Request	1=Yes 0=No

BO	3	System Start/Stop	1=Start 0=Stop
ADI	1	System Pressure	0 to Span (in AquaForce user setup menu)
ADI	2	Suction Pressure	0 to Span (in AquaForce user setup menu)
ADI	3	AI#1	0 to Span (in AquaForce user setup menu)
ADI	4	AI#2	0 to Span (in AquaForce user setup menu)
ADI	5	AI#3	0 to Span (in AquaForce user setup menu)
ADI	6	Setpoint #1	0 to Span (in AquaForce user setup menu)
ADI	7	Setpoint #2	0 to Span (in AquaForce user setup menu)
ADI	8	Setpoint #3	0 to Span (in AquaForce user setup menu)
ADI	9	System Flow	0 to Span (in AquaForce user setup menu)
ADI	10	System Power (KW)	0 to Span (in AquaForce user setup menu)
ADI	11	Drive#1 Current	0 to Span (in AquaForce user setup menu)
ADI	12	Drive#2 Current	0 to Span (in AquaForce user setup menu)
ADI	13	Drive#3 Current	0 to Span (in AquaForce user setup menu)
ADI	14	Drive#4 Current	0 to Span (in AquaForce user setup menu)
ADI	15	Drive#5 Current	0 to Span (in AquaForce user setup menu)
ADI	16	Drive#6 Current	0 to Span (in AquaForce user setup menu)
ADI	17	Drive#1 Power (KW)	0 to Span (in AquaForce user setup menu)
ADI	18	Drive#2 Power (KW)	0 to Span (in AquaForce user setup menu)
ADI	19	Drive#3 Power (KW)	0 to Span (in AquaForce user setup menu)
ADI	20	Drive#4 Power (KW)	0 to Span (in AquaForce user setup menu)
ADI	21	Drive#5 Power (KW)	0 to Span (in AquaForce user setup menu)
ADI	22	Drive#6 Power (KW)	0 to Span (in AquaForce user setup menu)
ADI	23	Speed %	0 to 100
ADI	24	Lead Pump Number	1 to Pump# (in AquaForce user setup menu)
ADI	25	Active Zone Number	1 to Zone # (in AquaForce user setup menu)

7.6 Typical Wiring Diagram

7.6 Typical Wiring Diagram (Continued)
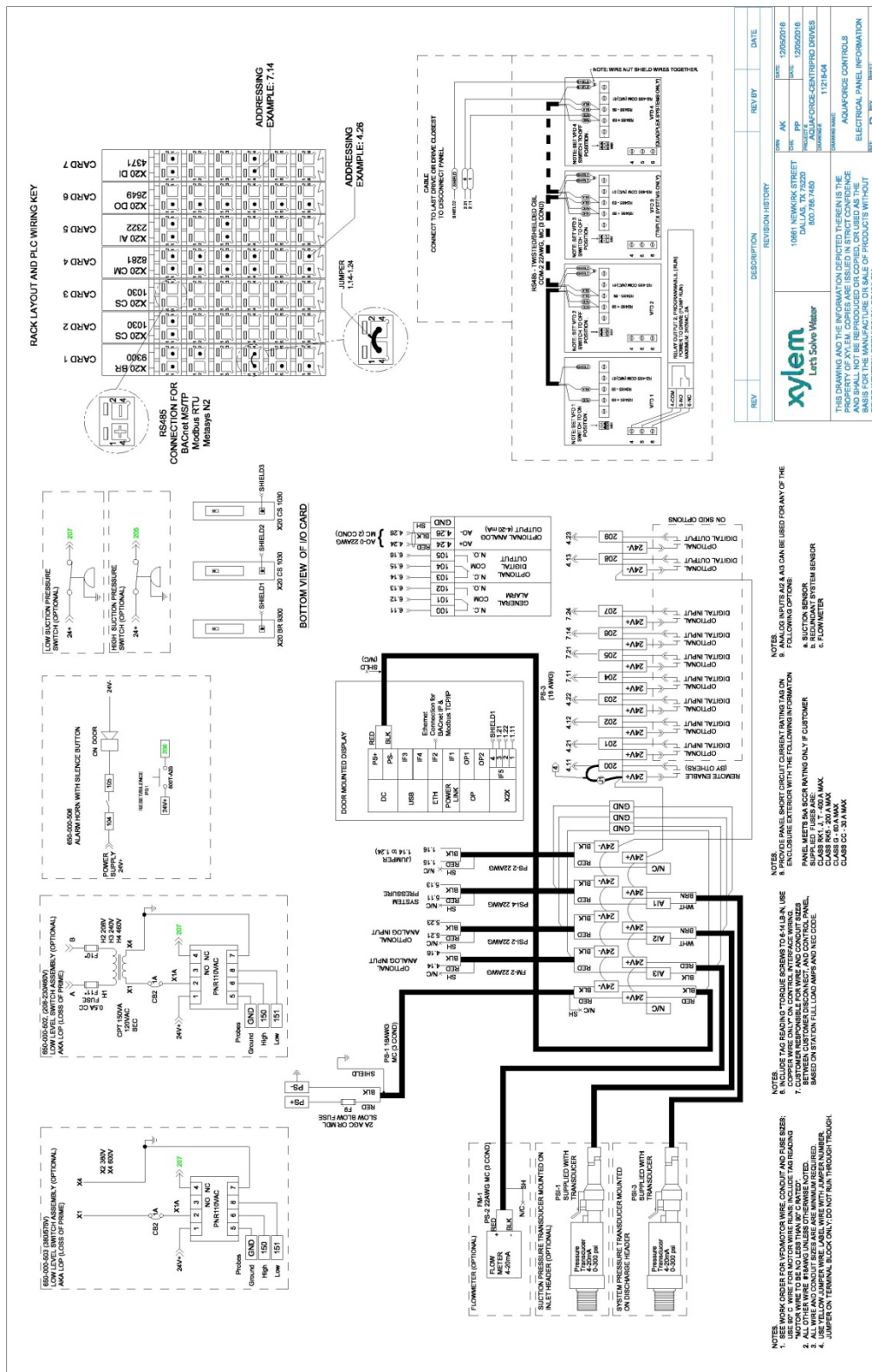
Notice – Inclusion of third-party PLCs and associated software

This product includes Programmable Logic Controllers (PLCs) manufactured by B&R Automation to enable feedback control of the system. B&R uses certain software versions in its PLC that B&R knows to be potentially vulnerable. Xylem strongly advises that you, as the system operator, engage with B&R to understand any support and security requirements of the PLC, including reviewing the support site located at https://www.br-automation.com/en/service/support-portal/. Any updates to this PLC require coordination between B&R and Xylem. Please contact your Xylem sales representative with any such questions.

Xylem Product Cybersecurity

Xylem values your system security and the availability of your critical services. For more information on Xylem cybersecurity practices or to contact the cybersecurity team please visit xylem.com/security.

8. Product Warranty

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 nonconformance 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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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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To make a warranty claim, check first with the dealer from whom you purchased the product or visit www.xyleminc.com for the name and location of the nearest dealer providing warranty service.

Xylem |'zīləm|

1) The tissue in plants that brings water upward from the roots;

2) a leading global water technology company.

We're a global team unified in a common purpose: creating advanced technology solutions to the world's water challenges. Developing new technologies that will improve the way water is used, conserved, and re-used in the future is central to our work. Our products and services move, treat, analyze, monitor and return water to the environment, in public utility, industrial, residential and commercial building services settings. Xylem also provides a leading portfolio of smart metering, network technologies and advanced analytics solutions for water, electric and gas utilities. 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 with a strong focus on developing comprehensive, sustainable solutions.

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