1. WARRANTY PAGES, DATA SHEETS, PUMP CURVES, SYSTEM DIAGRAMS, SYSTEM DESCRIPTION,

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   - Flow sensor
   - Operator Interface Terminal or OIT
   - Isolation valves
   - Check valves
   - Wye strainer
   - Manifold and air relief valve
   - Station heater (optional)

   Functions of Door-Mounted Controls And Indicators
   - Main disconnect switch or circuit breaker
   - Inverter mode selector switch
   - Pump selector switches (“hand-off-auto” switches)
   - Elapsed Run Time meters
   - Strainer Blowdown selector switch
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What’s happening during normal set point mode/variable speed station operation mode?

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- OIT screen saver
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  - Speed control screen
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  Leaking pumps
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  Pumping station running continuously
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- DF -- display failure
- F1, F2, etc. Pump failure
- FS -- flow sensor failure
- HF -- high flow rate
- HS -- high system pressure
- HT -- high temperature inside the control panel
- IC -- inverter contactor fault
- IF -- inverter (variable frequency drive) failure
- IP -- irregular power
- IT -- inverter (variable speed drive) trip
- JS -- jobsite system settings are lost
- LB -- low battery level in programmable controller
- LI -- low level (for stations with vertical turbine pumps only)
- LS -- low system pressure
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- PF -- power failure
- PI -- input failure in programmable controller
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SYSTEM DESCRIPTION

The SyncroFlo Golf Irrigation Pumping Station is an automatically controlled water pumping station, specially designed for the turf irrigation needs of golf courses.

The basic system consists of two or more **Main Pumps (1)**, controlled by an electronic **Programmable Controller (not shown)** housed in a **Control Panel (10)**. The system includes a small **Pressure Maintenance Pump (2)**, which maintains system pressure when the main pumps are not needed. If sprinklers are turned off, the pressure maintenance pump may still cycle on and off to keep the system pressure within the preset limits.

Figure One: Typical system as viewed from above
Any time that the pumping station is activated, the Programmable Controller runs as many motors as necessary. A Variable Speed Drive (located inside the control panel) varies the speed of one pump in order to maintain the correct pressure in the system. In rare cases, larger systems may have multiple drives controlling multiple motors. A Flow Sensor (8) and one or more Pressure Transducers (not shown) provide feedback about the state of the system to the Programmable Controller. If system pressure exceeds the preset limit, and the VFD can not slow the pumps quickly enough, a Station Relief Valve (including its pilot valve) (6) will open to reduce the pressure rapidly. This typically occurs during shutdown, when the system drops rapidly from full pressure. The Station Relief Valve is itself controlled by a small Pilot Valve (not shown), which is installed on the Relief Valve.

Alternately, the entire pumping station can be run manually in “hand” mode. During manual operation, all starting and stopping of pumps is done manually.

The system can compensate for partial failures of the system, such as a case when one Main Pump fails, by automatically switching off the failed unit and relying on the remaining unit(s).

**DESCRIPTION OF ADDITIONAL SYSTEM COMPONENTS**

The Heat Exchanger or Air Conditioner keeps the Variable Speed Drive inside the control panel cabinet from overheating. The heat exchanger works by transferring heat from the air inside the cabinet to cool water, supplied from the same source that your pumping stations uses. Water is circulated through a small radiator and is drained back into the water supply. The air conditioner operates like an ordinary household air conditioner window unit, and is equipped with an adjustable thermostat.

The Flow Sensor, installed in the outlet pipe of your pumping station, sends flow data to the Process Controller inside the control panel cabinet. The flow monitor, in conjunction with the pressure transducer(s), controls the operation of the pumping station by measuring its output. The flow meter measures the volume of water flow from the pumping station by using the flowing water to turn a small impeller wheel. The rotation of the impeller generates a low voltage signal, which consists of voltage pulses that occur at a rate proportional to the flow of water.

The Operator Interface Terminal or OIT provides information about the performance of the pumping station, and most aspects of the pumping station's operation are controlled from the OIT. It also provides information about failures in the system. It is located on the front of the control panel and consists of a keypad and information screen.

Various Isolation Valves are installed in the station piping. These are used mainly during maintenance operations to make it easier to remove and replace components. During normal operation these remain open, except for the manifold drain valve.
**Check valves** are installed in several places in the system to prevent the reverse flow of water. For example, the output of each pump usually flows through a check valve, which prevents the system from draining when the pumps are cut off.

An optional **Wye Strainer** prevents foreign matter that may have entered the system from being passed into the irrigation network. It is cleaned at regular intervals by being automatically back flushed with water from the system. An **motorized ball valve**, operated at regular intervals by the process controller, automatically cleans the strainer. Other systems without a Wye strainer require manual strainer cleaning.

A **Manifold** serves as the collection point for the output of the main pump(s) and a separation point for unwanted air in the system. Air is purged from the manifold by the operating the automatic **Air Relief Valve**, which is installed on the manifold.

The **Station Heater** is optional equipment that is used to maintain a comfortable temperature inside the site-built pumping station enclosure, and helps prevent frozen pipes.

**DOOR MOUNTED CONTROLS AND INDICATORS**

Note: keep panel doors tightly shut when station is in service.

**Main Disconnect Switch or Circuit Breaker**

A main disconnect switch or circuit breaker is provided with each station. The switch handle goes through the right door of the control panel to the switch or circuit breaker inside. The doors of the control panel will not open until the switch handle is in the “Off” or OPEN position, or unless the service latch release is used.

The main disconnect or breaker is used to turn off the whole pumping station (except for an optional auxiliary power supply) and isolate any main fuses from incoming power.

The handle on a main circuit breaker can also be used to reset the breaker by turning it to the RESET position then back to “On”. The magnetic trip adjustment on the body of a main circuit breaker should be set to maximum to avoid false tripping.

**Inverter Mode Selector Switch**

This switch has a green handle, and is labeled “INVERTER MODE”. Do not turn this switch to the TEST or “Off” position while the inverter is running a main pump. You cannot hurt the inverter if you do so, but the main pump motor may "thump" when it switches across-the-line, caused by a surge in pressure in the irrigation piping.

**TEST**: This position is used to test the inverter without running a pump, therefore the station runs in constant speed mode while the inverter is being tested. If not desired, we recommend placing all pump selector switches in the “Off” position before proceeding. Test the inverter after it has been locked out by any of its alarms. You can then be sure
that the inverter works properly, at least without a motor connected to it, before it runs a pump again.

More information on using the test function is provided in tab 5 under the “Variable Frequency Drive” section.

**OFF:** This position should be used only when the inverter is down for service or to test the inverter as described above. The station operates in constant speed mode while the switch is in this position.

**AUTO:** This position must be used for normal automatic operation of the inverter and the station as a whole. Variable speed operation takes place in this position and is available unless the inverter has been locked out by one of its alarms.

**Run Light:** The light inside the INVERTER MODE selector switch turns on any time the inverter is running, whether in “Test” or “Auto.”

**Pump Selector Switches** (“Hand-Off-Auto” Switches)

These switches have green lenses, and are labeled “NO. X PUMP”, where X is the number of the pump. These switches are also referred to as “H-O-A” switches.

**HAND:** Use this position for temporary manual operation, or to test a pump. The station should be supervised when pumps are running “in hand”, since all pump sequencing functions are bypassed. The pumps and the irrigation system are still protected by all alarms when pumps are run “in hand”. If the PLC fails, the pumps can still be run “in hand”, but the inverter, all pump sequencing controls, and the alarms will not function.

**OFF:** Use this position when restarting the station, or when a pump is down for service. 5 seconds after a pump is turned off, sequence shifting is engaged. Sequence shifting may cause another pump to start, depending on what the station is doing at the time.

**AUTO:** Use this position for normal automatic operation of each pump and the station as a whole. The PLC has full control over all pump operations in this position including: all pump sequencing functions, automatic alternation, sequence shifting, and all alarms.

**RUN Light:** Each pump is indicated as running by a light which is inside its selector switch handle.

**Elapsed Run Time Meters**

Each pump has a non-resettable run time meter located above its selector switch. You can monitor station usage and schedule maintenance for the pumps and motors based on total run hours.

**Strainer Blowdown Selector Switch**

This switch, along with a relay and a discharge manifold wye strainer with a motorized ball valve, is provided with the optional automatic strainer blowdown. It has a green handle, and is labeled “STRAINER BLOWDOWN”. The station uses the motorized ball
valve to blowdown (flush) the wye strainer each time the last running main pump is about to stop. Since the strainer screen cannot be back washed (cleaned by reverse flow), frequent flushing is preferred to prevent the strainer screen from clogging to the point that it requires removal and cleaning.

**OFF:** This position does not allow the motorized ball valve to open or close. Use this position to cut power to the ball valve if it has to be serviced while the station is running, when you do not want to use the blowdown feature, if you want to keep the ball valve open to help drain the station, or during a long manually operated blowdown cycle. If the power fails during the opening portion of the blowdown cycle, the PLC remembers to close the valve once power is restored, as long as the switch is not in this position.

**AUTO:** This position allows the PLC to operate the blow down cycle automatically. The PLC starts the blowdown cycle 29 seconds after the last running main pump begins to stop. The delay ensures that the pump is really going to stop to prevent unnecessary blowdown cycles from occurring. The PLC keeps the main pump running, opens the motorized ball valve for 20 seconds, and then closes the ball valve. If additional pumps are needed during a blowdown cycle, they will start as needed. Once the cycle is completed, the last main pump stops. Automatic blowdown always works unless the PM pump is the only pump available.

**MAN:** This position is used at any time to manually start a blowdown cycle. The switch springs back to the AUTO position after it is released, so that the cycle can run. If you do not want the blowdown cycle to start automatically later, wait at least 21 seconds after manually starting the cycle, then turn the switch to the “Off” position. If you turn the switch to “Off” before 20 seconds have elapsed, the ball valve stays open. To close the valve again, turn the switch to MAN, then release it to AUTO. The valve will close after 40 seconds, or less. If the PLC fails, you can still start a blowdown cycle manually. Turn the switch to MAN and hold it for about 3 seconds, then release it to AUTO. The ball valve opens and closes by itself. If you want to blowdown the strainer for a longer time, hold the switch in the MAN position as long as you want, then release it to AUTO.

**Run Light:** The light inside the strainer blowdown selector switch turns on while the ball valve is opening or closing. It turns off while the valve is fully open, or no blowdown cycle is occurring.

**Transfer Pump Selector Switch**

This switch is provided to control an optional local transfer pump, or as part of an optional remote transfer pump control package. It has a green handle, and is labeled “TRANSFER PUMP” or “LAKE LEVEL CONTROL.” A local transfer pump is located on the pump station and draws water from the wet well to send to some other reservoir. A remote transfer pump draws water from a remote source and places it in the lake from which the pump station draws its water. A local or remote level control is used to signal a transfer pump to start or stop. The on-off settings of the level control must be far enough apart to prevent short cycling of the transfer pump because of wave action. A local transfer pump is protected by the power failure and irregular power detection features of the system, as well as either low level or pump failure detection, depending on
which one applies. A remote transfer pump is not protected by any of these as part of the SyncroFlo package.

**OFF:** Use this position when the transfer pump or its level controls are down for service.

**HAND:** Use this position for temporary manual operation only, or to test the transfer pump. This position should not be used without supervision, since the transfer pump level controls are bypassed in this mode. Note that a remote transfer pump can still be prevented from running by its local controls.

**AUTO:** Use this position for normal automatic operation of the transfer pump. The level controls turn the transfer pump on or off, as required. Note that a remote transfer pump can still be prevented from running by its local controls.

**Run Light:** The transfer pump is indicated as running by a light inside its selector switch handle. Note that the run light for a remote transfer pump turns on even if it is shutdown at its remote controls.

### Station Lighting Selector Switch

This switch, along with the incandescent lights that it operates, is provided with the optional station lighting package to provide light for operation or maintenance at night. The switch handle is black and is labeled “STATION LIGHTING”.

### High Flow and Low System Alarms Selector Switch

This switch has a black handle and is labeled “HIGH FLOW AND LOW SYSTEM ALARMS”. It allows the high flow rate and low system pressure alarms to be turned on or off. Normally this switch should be placed in the ENABLED position which allows either alarm to shutdown the station. With the switch in the DISABLED position, neither alarm can shutdown the station.

The DISABLED position is typically used to keep the station running with high flow rates and/or low discharge pressures, when the irrigation piping is being filled at start-up or when one or more pumps are down for servicing. Be sure to check the station often to make sure that system pressure is not low enough to suggest a large break in the irrigation piping or ineffective watering while the DISABLED position is being used.

### Alarm Condition Light

This light is red, and is labeled “ALARM CONDITION”. It can be tested by pressing the ALARM LT. TEST key on the EagleEye OIT keypad.

**Continuous:** If this light is on continuously, then an alarm condition is present.

**Flashing:** If this light is flashing (3 seconds on, 1 second off), then an alarm occurred previously and was automatically reset.

### Reset Button

This button is red, and is labeled “RESET”. This button is used to perform several functions: see the following paragraphs.
Push this button to reset an alarm and return to normal automatic operation. If the ALARM CONDITION light does not turn off, the fault condition still exists. Check the ALARM LIST on the OIT to find which alarm’s signal is still on.

This button is also used to reset the ALARM CONDITION light which flashes after an alarm has automatically reset.

Pressing this button times out all minimum run timers and allows the pumps to stop if they are no longer required to be running. The pumps do not stop immediately since each of them has a stop delay that must expire first. The RESET button only releases a pump from its minimum run timer while it is running. This is a useful feature for testing or monitoring station operation. Hold this button in for 1 minute to test the PLC input failure alarm. The station will shutdown, but it will resume normal operation again once the button is released. The only time you need to hold the RESET button in that long, is when you want to test this feature.
2. Installation Guide

Site Preparation

1. Install wet well and pour foundation slab. Slab must be given time to cure and be prepared to receive station.

2. Electrical conduits, outlet piping and any other pumping station related penetrations through the foundation slab must be in place and conform to the site preparation drawings.

3. Any pump station enclosure or housing should be erected after the pump station and pumps have been installed.

   If housing or roof over the pump station is provided, it must have an opening for pump removal.

   Enclosure must allow for adequate ventilation and, where required, freeze protection. Proper clearance around the station must be maintained. (Refer to site preparation drawing.)

4. Sweep the foundation slab clean and remove any debris.

Receiving Pump Station

1. Inspect station, pump boxes, etc. for damage. If any damage has occurred, note on Bill of Lading.

2. Count pieces as listed on Bill of Lading to be sure all pieces have been delivered. If any pieces are missing, make a note of the shortages on the Bill of Lading.

3. If any damage or any shortages have occurred, call SyncroFlo, Inc. at once.

4. Remove any grease or oil that may be on the surface of the equipment. This will aid in installation.
Installation Procedure

1. Preliminary site inspection.

Check wet well depth (for stations designed to work with a wet well). The correct wet well depth can be determined from [what?]. Remove any debris from wet well.

Check to be sure foundation slab is level.

Remove any debris around working area. Sweep foundation slab clean.

Compare location of piping outlets and conduits to assure they conform with the site preparation drawings.

2. Installing the Skid

A lifting crane must be used to install the pumping station. Verify that the lifting crane has adequate lift capacity, reach, and hook height to handle station and pump installation. *SyncroFlo will not be responsible for mishandling of equipment during off-loading and installation.*

Lift the station from the truck and install it over the wet well in accordance with site prep drawings.

Check to be sure there is adequate clearance for pumps, diffuser tube and probes to be installed without coming in contact with the sides or bottom of the wet well.

Check to see if the station is level within 1/4" per 10" in all directions. If not level/ shim under the low corners and mid points of the skid with steel plates not less than 3" square to level the skid.

3. Remove motors from skid.

If motor electrical conduit and power leads have to be disconnected at the motor starter cabinets, be sure the power leads are marked so that they will be re-installed on the same terminals. This will prevent reverse rotation of the pumps.

Temporarily cover pump openings in skid to avoid dropping anything into the wet well.

4. Prepare the station for pump installation.

Install pump drain line nipples through skid into wet well.
Install pressure relief line diffuser tube, (if provided).

Install the wet well level probe holder and probes.

5. Install the first pump

Remove pump suction strainer.

Lift pump #1 with lifting lugs provided on pump discharge head.

*Note: If the pump headshaft is installed, extreme care must be exercised to assure the slings picking up the pump do not come in contact with or bend the headshaft.*

Position the pump vertically over the hole in which it is to be installed.

Install the pump suction strainer. (If removed)

Remove the temporary cover over the hole in which the pump is to be installed.

Set the pump head foundation gasket in place on skid.

Carefully lower and set the pump in place on skid.

Install, but do not fully tighten, the pump head tie-down bolts.

Connect the discharge piping train from the pump discharge heads into the piping manifold connection. *Note: Be sure no strain is placed on discharge head or manifold piping when connecting pump to manifold. Pump discharge head may be shifted on skid in order to obtain proper alignment.*

6. Install the first motor

Remove the motor drip cover. Remove the pump drive clutch and non-reverse ratchet. Lift the motor vertically using the lugs provided.

Thoroughly clean pump discharge head and motor mounting flange surfaces.

Position the motor above the headshaft so that it can be lowered vertically and set in place on the discharge head.

Lower the motor and set in place on the discharge head. Be sure the motor flange is aligned with the pump discharge head.
Turn motor to align motor to pump discharge head tiedown holes and to place conduit box in proper position.

7. Install pump headshaft.

Be sure threads of shafts and couplings, as well as shaft faces, are clean.
Install the slinger below the headshaft-motorshaft coupling.
Lubricate shaft threads with an SAE-10 oil.
Insure that shafts ends butt at the center of the coupling.
Screw shafts together always turning headshaft counter-clockwise. *Never turn the shafts clockwise.*
After the shafts have butted, tighten them securely using a pipe wrench. Use caution not to bend the headshaft in this tightening process.

8. Finish the motor and pump installation

Remove slings from motor and, by looking down at the motor, be sure the pump headshaft penetrates at the approximate center of the motor hollow shaft. *If shaft is off center or touching the side of the motor hollow shaft call SyncroFlo, Inc.’s local service representative or the Norcross, Georgia home office service department before proceeding.*
File smooth any wrench marks on shaft.
Install and tighten motor-discharge head tiedown bolts.
Re-install motor drip covers on top of motors.
Place motor clutches, non-reverse ratchets, ratchet pins or balls, top shaft adjusting nuts, top shaft Gib keys and top shaft adjusting nut lock screws in dry safe location for future installation.
Tighten all pump discharge head to skid tiedown bolts.

9. Repeat steps 4 through 8 for each remaining pump and motor.

10. Install all pump discharge head, bypass lines and air valve assemblies.

   Re-connect motor leads in pump control panels.
Connect and tighten conduit.

Connect and tighten motor leads to motor starter terminals. *Note: Be sure leads are connected to exactly the same terminal as that from which removed to avoid reverse rotation.*

11. Complete the Installation of the Station.

Install and connect wiring to water level probes.

Inspect and tighten all electrical connections.

Inspect and tighten all hydraulic connections including gauges, control valve piping, drain piping, air release valve piping, etc.

Check manifold strainer cap, (if provided), to assure victaulic coupling is properly seated in strainer body grooves, cap grooves and that victaulic coupling bolts are tight.

Lubricate all pump motors in accordance with manufacturer's instructions.

Open all station and control valve drain valves.

Sweep and wash down pumping station.

Touch up paint if necessary.

12. Complete Site Owner Training and Installation Report

Instruct owner in procedures for grouting beneath skid and leveling, (if not already performed), as well as in station anchoring and connection of piping and electrical into station.

Fill out installation Field Service Report, including any discrepancy items that may be required.

13. Station Startup

Starting procedures are provided in Chapter 3.

14. Post-Installation Check

One week after startup, inspect and tighten (if necessary) all electrical lugs and connections, and all hydraulic tube connections.
3. Starting, Stopping, and Monitoring the System

Starting the System for Automatic Operation: Modes of Operation

Confirm that all pump H-O-A switches are set to “Off.” Ensure that electric power is on and that three-phase power is supplied to the station. If necessary, turn the main disconnect switch on the front of the control panel to "on"

Ensure that the "Inverter Mode" switch on the front of the control panel is set to "auto."

Turn the pump H-O-A switch on the front of the control panel to "Auto"

Depending on the time of day and other irrigation system conditions, the pumping station will now start in one of several modes. To determine which mode the station is in, use the Operator Interface Terminal (OIT). Press the button next to the “Mode” label on the OIT will indicate which mode is engaged. See Chapter 3 for more information about using the OIT.

Possible Modes:

1. **Refill Mode** - Refill mode is used whenever the system has been allowed to drain. In refill mode, a single pump slowly fills the system to avoid damaging the system. This mode will start automatically if an alarm has occurred, the system pressure has fallen 50 psi or more below the normal mode setpoint, and the “ALARM ACK” and Reset buttons have been pressed. This mode is fully automatic and requires that at least one main pump switch is set to “Auto,” and the Inverter Mode Selector switch is set to “Auto.”

2. **Lockout Mode** – The OIT is programmed so that at certain times during the day, the main pumps will not run because the system is in Lockout Mode. Only the Pressure Maintenance pumps will run in order to maintain the system in a ready state. You can set up or disable Lockout Mode using the OIT.

3. **Energy Mode** - The pumping station process controller will automatically shift the system into energy mode under certain conditions, such as when the demand for water is very low. For example, the setpoint is normally 10 PSI below the normal mode setpoint, and demand remains at less than 1/3 the capacity of a main pump for 60 seconds or more. By lowering the pressure, Energy Mode saves energy.

4. **Normal Mode** - This is the normal operating mode of the station, allowing the pumping station to run at full capacity. To check the Normal Mode setpoint, press the “SETTINGS” key, then the 3, 2, and 1 keys. The operator can raise or lower the system pressure slightly in Normal Mode by using the Operator Interface Terminal. Follow the procedure outlined in the “Set Point Modes” section of the SyncroFlo Operator’s Guide.
Additional details about Set Point Modes and the various station operation modes can be found in section 4.
What is Normal Set Point Mode/Variable Speed Station Operation Mode?

Usually, while in operation the station will be in **Normal Set Point Mode**. At the same time, it will usually be operating in **Variable Speed Mode**. The Inverter Mode Selector switch on the control panel must be in the “Auto” position for the system to run in Variable Speed Mode.

During Normal/Variable Speed operation, if the pressure drops slowly, the pressure maintenance pump will usually start first, followed by a main pump, then the second main pump (if equipped). The Variable Frequency Drive (also called the Inverter) varies the speed of one of the main pumps in order to keep the system at a constant pressure. These pumps will begin supplying water to the irrigation system at a predetermined pressure until the conditions are met to turn them off. If the pressure drops suddenly (defined as a drop of 10 psi in less than 2 seconds), a main pump will start immediately without waiting for the pressure maintenance pump to start. In such situations, the pressure maintenance pump may not operate at all.

If for any reason the flow of pressurized water in the system slows or stops (such as a sudden reduction in demand caused by shutting off all or part of the irrigation network), water will be diverted automatically by the Station Relief Valve.

During periods when there is no flow, the system will switch to “Energy” mode while it is idle. When flow increases, the system automatically switches back into Normal mode.

An optional Wye Strainer blowdown device may be installed, which automatically cleans the wye strainer shortly before the station shuts down. In Normal/Variable Speed Mode, the process controller will automatically actuate the motorized valve that operates the strainer. Additional information about the automatic blowdown device is in the “Door Mounted Controls and Indicators” section of the Operator’s Guide, located in the SyncroFlo Operation, Installation, and Maintenance Guide.

What Other Modes Of Station Operation are Possible?

**Constant Speed Mode** - If for any reason the Variable Speed Drive (or “inverter) is out of service, the station may be operated in Constant Speed Mode. The Variable Speed Driver may be intentionally taken out of service by setting the “Inverter Mode” switch on the control panel to “Test” or “Off.” **NOTE**: Do not change the Inverter Mode switch while a Main Pump is running. The constant speed mode is still fully automatic, but motors are not driven at variable speeds and pressure regulation is handled differently.

**Sequence Shifting Mode during Pump Failure** - If any of the pumps is disabled, your pumping station will automatically begin using Sequence Shifting operation. This allows the system to continue to operate as normally as possible using the remaining pumps. Sequence shifting can be manually activated by switching the Hand-Off-Auto switch on
the control panel to the “Off” position. If you suspect that a motor or pump is having problems, simply switch it off and allow Sequence Shifting to do the rest. Remember to compensate for the loss of a pump by modifying your irrigation pattern, to reduce the demand for water.

**Starting the System for Manual or “Hand” Operation**

In an emergency, the pumping station can be operated manually. With no pump motors running, set all the Pump Selector Switches on the control panel to the “Off” position.

Then set one of the Main Pump control switches to “Hand” to begin pumping water through the system. Monitor the pressure and flow rate using the OIT. If necessary, set a second Main Pump control switch to “Hand” to maintain the preset system pressure. Excess pressure will open the Station Relief valve, sending water back into the wet well or water supply. During Hand operation, the pumping station must be monitored at all times, since there is no automatic control of the station.

**What Happens When Something Goes Wrong?**

Your pumping station is capable of self-diagnosing many failures and setting off an alarm. When this happens, an alarm code will appear on the screen of the Operator Interface Terminal, which is located on the front of the control panel.

If you are qualified to service the pumping station, proceed to the Troubleshooting chapter.

**Stopping the System**

Turning off the system for winterizing at the end of the season is covered in Chapter 5.

Shutting down the system can be accomplished at any time, in any mode of operation, by turning each of the H-O-A switches on the control panel to the “Off” position. Start by turning off motors which are not currently running, then turn off any running motors. Next, turn the Main Disconnect switch on the front of the control panel to the “Off” position.
4. Advanced Operating Procedures

Monitoring The System: EagleEye OIT Basics

The EagleEye Operator Interface Terminal (OIT) is used to display information, operate special features like manual speed control, and make changes to the various settings that are displayed.

The OIT’s LCD, backlit screen glows a pale yellow color for easy viewing of the black characters in bright light or darkness. The front of the OIT is water tight (NEMA-4 rated) but the rear housing, inside the control panel, is not water proof at all. Therefore the control panel doors must be kept shut and all latches must be secured tight, to prevent water from entering the rear of the OIT. **Water damage caused this way is not covered under warranty.** Always keep the control panel doors shut.

OIT Keyboard Layout

Screen Keys

Special function and numeric keys

**OIT Screen Keys**

Screen keys have color-coded labels to the left of the actual keys. The color codes and their meanings are as follows: **Green** - Station Operation, **Yellow** - Settings, **Blue** - Totals, **Red** - Alarm Information. To view any category of information simply press the
appropriate screen key. Note that pressing any of the color coded screen keys alone can not change station operation, so feel free to explore. See the section on OIT information screens for details on each screen.

### OIT Special Function and Numeric Keys

<table>
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<tr>
<th>Last Message</th>
<th>1</th>
<th>←</th>
<th>Δ+</th>
<th>Clear</th>
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<tr>
<td>Next Message</td>
<td>4</td>
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<tr>
<td>Setup</td>
<td>HELP</td>
<td>Toggle</td>
<td>ENTER</td>
<td></td>
</tr>
</tbody>
</table>

**Special Function** keys are used to change settings. The paragraphs below describe the functions of the various types of special function keys.

**Numeric Keys**: The group of twelve keys indicated above will only work as numeric keys when a settings menu screen is displayed or immediately after the CLEAR key has been pressed while viewing a screen that has a cursor (underline marker) beneath a numerical setting. Otherwise these keys perform the primary functions indicated by the word(s) or symbol(s) on them (except for 1 & 0 which do nothing). When we refer to a number key in this document, we mean the key that has that number on it. Note that the change sign (±) key is not applicable to any settings and the decimal (•) key is only applicable to some of the PID settings.

**Page Up and Page Down Keys** - Use these keys to move up (backwards) and down (forwards) respectively, through lists of screens. The first screen of any list will tell you when to use these keys and each screen in the list has this symbol ↔ in the lower right hand corner as a reminder.
**Alarm Acknowledge** Key - Press this key to acknowledge (clear) any alarm message screen. Up to 10 alarm messages may be stored, so you may need to press this key more than once to clear all alarm messages.

If you press any of the screen keys while an alarm message is being displayed, a message appears to remind you that the alarm must be acknowledged first:

**Help Key** - Press this key and hold to display a help screen for most screens that have a cursor on them. The cursor indicates that some adjustment can be made. Usually, a help screen provides instructions on how to make the adjustment.

If no help is available, the OIT beeps 3 times and a “help not available” screen appears.

**Toggle Key** - This key acts like a push-on, push-off switch. Press this key to change on/off settings like manual speed.

**Δ+ Δ− (Increase and Decrease) Keys** - Use these keys to add 1 or subtract 1, respectively, from any numerical setting. Typically these keys are used with manual speed control.

**Cursor (or Arrow) Keys** - use these keys to move the cursor (underline marker) from one setting to another. Note that pressing any one of these keys repeatedly, will move the cursor through each setting on a given screen.

**Clear Key** - Press this key to clear any numerical setting and begin to enter a new number. This key can also be used to reset the display after communications have been interrupted.

**Delete Key** - Press this key to delete the number at the cursor while changing numerical values.

**Enter Key** - Press this key to enter numerical values that have been keyed in.

**Last Message** and **Next Message Keys** - Use these keys to move backwards or forwards respectively, through the last 10 screens that were displayed. The EagleEye OIT program does not require the use of these keys. However, the LAST MESSAGE key is convenient to use if you need to back up through the SETTINGS menu screens.

**Setup Key** - Used for factory programming access only. If you press this key by mistake, the words “Enter Setup Password:” are displayed on the screen. Press the CLEAR key to continue normal operations.

**OIT Screen Saver**

After 30 minutes of inactivity, the OIT scrolls a default message from right to left across the top line of the display. Press any key to resume normal operations once this screen saver message appears.
OIT INFORMATION SCREENS

Press the gray box **next to the label** to access any status screen.

**Status Screen**

The Status key looks like this. Press the box next to the word “Status”

*Example of what will appear on the screen:*

```
DATE   TIME   GPM PSI  SP %HZ  ALL OK
06/06/96 15:25 1135 125 125 095
```

*Data shown is an example only.*

This screen appears automatically after the power is turned on.

SP denotes the current “set point” and %HZ denotes percent speed.

ALL OK appears at the end of the first line when no alarms are present.

ALARM! appears and flashes, at the end of the second line and ALL OK disappears from the first line, if an alarm is active.

ALL OK and ALARM! alternate on and off after an alarm has automatically reset but the ALARM CONDITION light has not been reset.

**Mode Screen**

Press the box next to the word “MODE”

VFD mode is on when variable speed operation is possible. REFILL mode can not turn on if VFD mode is off or if manual speed control is on.

**Speed Control Screen**
The number of the pump that is running variable speed appears at the beginning of the first line. “NO” appears if no pumps are running variable speed.

Press the TOGGLE key to turn on manual speed control. Then press any arrow key to move the cursor to the %HZ field. Next use the Δ+ and Δ- keys to increase or decrease speed by 1% respectively. You can also change speeds in larger amounts by pressing the CLEAR key, keying in a new number from 0 to 100, and pressing the ENTER key.

Be sure to arrow over and toggle off manual speed control when you are finished.

Note that Refill Mode is disabled when manual speed control is on.

A help screen is available for manual speed control. Press and hold the help key to view the help instructions.

**Settings Screen**

Press the box next to the word “SETTINGS”

Press this key to see the current system settings. To change the settings see Changing Settings at the end of this section.

**Total Gallons Screen**

Press the box next to the words “TOTAL GALLONS”

Press this key to display the total volume of water that has been pumped through the system.
Gallons Per Day Screen

Press the box next to the word “GALLONS PER DAY” to view a screen that shows the number of gallons used in a 24 hour period. The hour setting can be adjusted to coordinate with the end of the “irrigation day” at your course.

The day number ranges from 00 (today) to 29 days previous. Use the $\Delta+$ and $\Delta-$ keys to increase or decrease the day number by 1 respectively. You can also change the day in larger amounts by pressing CLEAR, keying in a new number from 0 to 29, and pressing the ENTER key.

Day 00 is today, therefore no ending time or date will appear.

A help screen is available for gallons per day history. Press and hold the Help key to display the help information.

Run Hours Screen

Press the box next to the words “RUN HOURS” to show the proper number of pumps for your station. These totals are non-resettable.

Pump Starts Screen

Press the box next to the words “PUMP STARTS” to show the proper number of pumps for your station. These totals are non-resettable.

Alarm Lt. Test Screen
The key is also a test button for the alarm light. Pressing the key will turn on the alarm light on the control panel.

If you press this key at any time when the alarm light is supposed to be on, “‘On’” will appear at the end of the second line of the screen, instead of “Off”.

**Alarm List Screen**

Press this key to display a list of all possible alarms.

Use the **page down** and **page up** keys to move through the list.

If an alarm occurs, you can scroll through the list to see which alarm(s) have occurred. You can also use the **Last Alarm** and **Alarm History** keys to access this information.

**Last Alarm Screen**

Press this key to see a record of the system conditions that existed when the last alarm occurred.

The alarm is indicated by the two letter code near the beginning of the bottom line. The alarm codes and their meanings are as follows:

- **PF** - Power failure
- **IP** - Irregular power
- **LS** - Low system pressure
- **HS** - High system pressure
- **HF** - High flow rate
- **LL** - Low level (vertical turbine pumps only). Low suction on positive suction, centrifugal pump systems only.
- **HT** - High panel temperature
- **IT** - Inverter trip
- **IF** - Inverter failure
- **IC** - Inverter contactor fault
- **Ox** - Motor overload (where x denotes the motor number)
- **Cx** - Contactor fault (where x denotes the motor number)
- **Fx** - Pump failure (where x denotes the pump number)
* PT - Pressure transducer failure
* FS - Flow sensor failure
* JS - Jobsite settings lost. Can only be reset from OIT Alarm list
* PC - PLC failure
* LB - PLC low battery
* PI - PLC input failure
* DF - Display failure (does not appear in the alarm list)

The station mode is also indicated on this screen by the two letter code at the end of the bottom line. The first letter denotes speed mode: V = variable, C = constant. The second letter denotes set point mode: N = normal, E = energy, R = refill, L = lockout.

The pump code at the end of the top line, shows which pumps were running. For example: “02300” means that pumps 2 & 3 were running.

**Alarm History Screen**

Press the box next to the words “ALARM HISTORY” to see a list of all alarms that have occurred, up to a maximum of 200 records.

The codes for this screen are the same as those for the Last Alarm screen except there are two additional codes. SR - Station reset, denotes an alarm that had shut down the entire pump station was reset. AR - Alarm reset, denotes the reset of any alarm that does not shut down the entire station.

Record 000 is the most recent event while record 199 is the oldest event.

Use the Δ+ and Δ- keys to increase or decrease the record number by 1 respectively. You can also change the record in larger amounts by pressing the clear key, keying in a new number from 0 - 199 with the numbered keys, and then pressing the enter key.

A help screen is available for alarm history. Press and hold the Help key to view the help information.

**Checking the Current Settings Using the OIT**

The Operator Interface Terminal is used to set to many of your system settings.. The flow chart below shows how to access the menu screens.

Press the key that has the number of the menu item you want and the appropriate screen will appear. Use the page up and page down keys to view the settings.
Press the box next to the word “SETTINGS”

Press the Settings key (see above)

** ** SETTINGS ** **
1-CLOCK   2-BEGIN 24 HR PERIOD   3-OTHER

The screen above will appear. You may:

Press 1 to check or change the time and date.
Press 2 to check the start time for your irrigation “day.”
Press 3 to access other settings (see below).

Detailed instructions on changing settings are provided later in this section.

The screen below is what you will see if you press 3 from the choices above:

** ** OTHER SETTINGS ** **
1-VFD   2-CONTROL   3-RELOAD SETTINGS

Press 1 to check or change the VFD settings.
Press 2 to check or change pressure, mode, flow, speed, and PID settings.
Press 3 to reload the default factory settings.

Detailed instructions on changing these settings are provided in the following section.

** How to Change OIT Settings **

Many adjustments to your pumping station can be made directly from the Operator Interface Terminal.

General Procedure:

Press the Settings key. Note that the key is next to the word “settings.”

Use the number keys to select the setting you want to change. (See “Checking Settings” above for instructions).
Press the **Help** key for instructions on changing that setting.

**Index of Settings Instructions**

1. Set the time or date on the **Clock**
2. Set the time when the **Gallons Per Day** monitor begins recording
3. Change **VFD Settings** including **heat exchanger** options
4. Restore the system to **Factory Settings**
5. Change **Operating Settings** in various modes (**Normal**, **Energy**, **Refill**, and **Lockout**)
6. Change **Pressure** settings
7. Change **Flow** settings
9. Change **PID** settings
10. Calibrate the **Pressure Transducer**

**1. Setting the Clock**

1) Press the **Settings** key, then the 1 key, then press **Help** for instructions.

2) Don’t forget to move the cursor over and toggle off **Set Clock** when you are finished making changes. Otherwise the clock will not run. Special functions such as lockout mode, gallons per day, and alarm history will not work unless the clock is running.

3) The hour does **not** automatically change for daylight savings time.

4) Date is in U.S. format (mm/dd/yy)

5. Clock is in 24-hour, “military” format

**2. Setting the 24 Hour Period for Gallons Per Day Totals**

1) To access this screen, press **Settings**, then 2.

   Use the **Help** key for setting instructions.

2) Set for the hour that marks the beginning the next “irrigation day” at your course.

3) The hour scale is military style (00-23 = 12 a.m-11 p.m.).

**3. Setting VFD Operating Options**

1) To access this screen, press **Settings**, then 3, then 1.
2) You will be presented with a series of setting screens. Make a note of the current settings for each setting so that you can return to them if necessary.
3) Press the Help key for setting instructions at each of the following setting screens in the list.

4) Set the “Start each main pump with the variable speed drive” option to “Off” or “On.” Set to “On” to maximize soft starting benefits. Set to “Off” for smoothest hydraulic and mechanical operation. This setting may not appear on stations that have multiple main pump horsepower sizes.

5) Set the “Inverter Setup Mode is” setting to “Off” or “On.”

The Inverter Mode selector switch on the front of the control panel must in the “Off” position before this setting can be turned on. Set to “On” to power up the inverter without running it. This allows a service technician to set operating parameters and perform diagnostics on the inverter. Returning the Inverter Mode selector switch to the “Auto” or “Test” positions, turns this setting off automatically.

6) Set the “Run Heat Exchanger with Inverter” setting to “On” or Off.” The factory setting is “On.” Set to “On” when the station is located outdoors or in a very hot pump house. Set to “Off” only when cold water is causing condensation in the heat exchanger coil. This setting will not appear when an air conditioner is used.

4. Reloading the Factory Settings

Be sure to have recorded any “Jobsite” (changed from factory) settings prior to reloading the factory settings as you may wish to restore jobsite settings later.

1) To access this screen, press Settings, then 3, then 3 again. Use the Help key for setting instructions.

2) Set to “On” to reload the factory settings (and remove all jobsite settings). This setting automatically turns off once reloading is completed. The words “All Done” appear for 2 seconds after reloading.

5. Changing Mode Settings

1) To access this screen, press Settings, then 3, then 2, then 1.

2) You will be presented with a series of setting screens. Make a note of the current settings for each setting so that you can return to them if necessary.
3) Use the **Help** key for setting instructions at each of the following setting screens in the list.

4) Set the **Normal Mode Set Point Pressure** after making a note of the current setting. Setting range allowed is 0-200.

5. Set the **Energy Mode Set Point Differential Pressure** after making a note of the current setting. Setting range allowed is 0-30.

6) Set the **Energy Mode Flow Rates On/Off** setting after making a note of the current setting. You can set the rate (in gallons per minute) at which Energy Mode is activated, and the rate (in gallons per minute) at which Energy Mode is deactivated. The setting range allowed is 0-1000 GPM.

7) Set the **Energy Mode Start Delay** after making a note of the current setting. The factory setting is 60 seconds. Setting range allowed is 0-300.

8) Set the **Refill Mode Disable** setting of “On” or “Off.” Factory setting is “Off.” Refill mode is not operational when set to “On.” Consult SyncroFlo before disabling a system that is set to “On.”

9) Set **Refill Mode Start Pressure and Refill Mode Off Differential** after making a note of the current settings. The setting ranges allowed are: 0-200 & 1-99, respectively. Note that for Refill Mode to start, manual speed control must be off.

10) Set **Refill Mode Step Settings** after making a note of the current settings. The factory settings are to add 5 PSI every 30 seconds. The setting ranges allowed are: 1-10 & 1-60, respectively.

11) Set **Lockout Mode Enable** to “On” or “Off” after making a note of the current setting. The factory setting is “Off.”

12) Set the **Lockout Mode Begins at** and **Ends at** settings after making a note of the current settings. The factory settings are 00:00 (begins) and 00:00 (ends). Setting range allowed is 0-23 (note that it is the “military” timekeeping system)

Note: The ending hour must be greater than the beginning hour (can not cross over midnight).

**6. Pressure Settings**
1) To access this screen, press Settings, then 3, then 2, then 2 again.

2) You will be presented with a series of setting screens. Make a note of the current settings for each setting so that you can return to them if necessary.

3) Use the Help key for setting instructions at each of the following setting screens in the list.

4) Set the Pump 1 On Differential Pressure and Pump 1 Off Differential Pressure settings after making a note of the current settings. The factory settings are 05 PSI (on) and 05 PSI (off). Setting range allowed is 0-10.

5. ) Set the Pump 2 On Differential Pressure and Pump 2 Off Differential Pressure settings after making a note of the current settings. Setting range allowed is 10-20 and 100-200 PSI, respectively.

6) Set the Differential Pressure for Variable Speed Starting setting after making a note of the current settings. The factory setting is 2 PSI. Setting range allowed is 0-5.

7) Set the Low System Differential Pressure and High System Pressure settings after making a note of the current settings. The setting ranges allowed are: 10-30 & 100-200, respectively.

8) Set the Pressure Acceleration Time setting after making a note of the current setting. The factory setting is 05 seconds. Setting range allowed is 1-30.

**7. Flow Settings**

1) To access this screen, press Settings, then 3, then 2, then 3.

2) You will be presented with a series of setting screens. Make a note of the current settings for each setting so that you can return to them if necessary.

3) Use the Help key for setting instructions at each of the following setting screens in the list.

4) Set the Pump 3 On Flow Rate and Pump 3 Off Flow Rate after making a note of the current settings. Setting range allowed is 0-5000.

5) Set the Pump 3 On Flow Rate and Pump 3 Off Flow Rate after making a note of the current settings. Setting range allowed is 0-5000.
Note: This screen does not appear on 3 pump systems.

Setting range allowed is 0-5000.

6) Set the High Flow Rate With 1 Main Pump and High Flow Rate With 2 Main Pumps settings after making a note of the current settings. Setting range allowed is 0-5000.

7) Set the High Flow Rate With 3 Main Pumps setting after making a note of the current setting. Setting range allowed is 0-5000.

8. Speed Settings

1) To access this screen, press Settings, then 3, then 2, then 4.

2) You will be presented with a series of setting screens. Make a note of the current settings for each setting so that you can return to them if necessary.

3) Use the Help key for setting instructions at each of the following setting screens in the list.

4) Set the Minimum Speed With Manual Control setting after making a note of the current setting. The factory setting is 25%. Setting range allowed is 25-50 %.

5) Set the Minimum Speed in Refill Mode setting after making a note of current settings. The factory setting is 50%. Setting range allowed is 25-75.
6) Set the **Minimum Speed in Normal and Energy Modes** after making a note of the current setting. The factory setting is 75%. Setting range allowed is 50-90.

7) Set the **Maximum Speed in Refill Mode** after making a note of the current setting. The factory setting is 95%. Setting range allowed is 90-100.

8) Set the **Main Pump Off Speed** after making a note of the current setting. The factory setting is 90%. Setting range allowed is 50-90.

**9. PID Settings**

1) To access this screen, press **Settings**, then 3, then 2, then 5.

2) You will be presented with a series of setting screens. Make a note of the current settings for each setting so that you can return to them if necessary.

3) Use the **Help** key to bring up the **STATUS** screen to monitor the affect of your changes.

4) Set the **Dead Band** setting after making a note of the current setting. The factory setting is 1.0 PSI. Setting range allowed is 0.0-5.0.

5. Set the **Sample Rate** and **Input Filter** after making a note of the current setting. The factory setting is 001 millisecond and 99%, respectively. The setting ranges allowed are: 0-999 & 0-99, respectively.

6) Set the **P Gain**, **I, D Gain** and **DT** after making a note of the current settings. **Note:** **Consult the factory before adjusting any of these settings!** The factory settings are 01000% (P Gain) 1.0 Sec (I), 20% (D Gain), and 0.01 Sec (DT).

**10. Calibrating the Pressure Transducer**

1) This screen is hidden to prevent accidental changes. It is accessed by pressing **Settings**, then **Other** (3), then **Control** (2), and then by pressing 9.

2) If a new pressure transducer must be installed, or if the pressure transducer will be removed and re-installed, be sure to follow carefully the instruction in section 5. The transducer is very fragile and may be damaged by improper installation.

3) Pressure transducer calibration is usually only required to “zero” the unit. With the unit installed but subject to 0 PSI water pressure, set the **Zero Frequency** to match the **Current Frequency**. Setting range allowed is 50-250.
5. Troubleshooting the System

Many failures can be detected by the system. The system will trigger an alarm and an error code will appear on the Operator Interface Terminal (OIT). If this is the case, proceed to the section below entitled “OIT Alarms.”

Hints for Discovering the Causes of Problems

Read through the following list and try to determine whether any of these events may have taken place.

A. Has there been a change in water supply or system demand? For example, has your water utility company expanded its network, resulting in a drop in water pressure? This is a very rare problem that may occur when positive suction, close-coupled pumps are connected to a municipal water supply.

B. Has there been a change in pressure settings? Pressure settings were set when your pumping stations was installed, but they may be manually raised or lowered using the Operator Interface Terminal [OIT]. A malfunctioning Station Relief Valve may also cause pressure-related malfunctions. Changing its settings may cause a malfunction. See Chapter 4 for instructions on resetting station settings to the factory defaults or to troubleshoot the station relief valve.

C. Has there been a deterioration of water supply? Your water supply may have changed due to an influx of organic matter (such as an algae bloom), silt, or other material. If so, your pumping station may need to be modified by adding filters or taking other measures. Call your SyncroFlo representative.

D. Has there been a change in power supply or power network construction? A new substation or transformer, or new construction in your area may result in deterioration of the power supply. If so, your pumping station may have to be modified.

E. Has there been a lightning strike nearby? Has there been any other kind of power surge recently? See Chapter 5 for instructions on inspecting the station for lightning damage.

F. Is there excessive or high water around the station? Station flooding can damage the pump motors or control components.

G. Is the air temperature in or around the station higher than normal? High air temperatures may result in a shutdown of some of the electronic components in the
Control Panel. See the troubleshooting section information in Section 5 for identifying certain temperature-related problems that can affect the VFD and heat exchanger/air conditioner.

H. Is the air temperature in or around the station lower than normal? Freezing as a result of an improperly winterized system can damage the pressure transducer(s), station relief valve, and other system components.

J. Has there been a severe dust or sand storm near the station recently? Sand or dirt may accumulate in the motors, damaging them. In stations with wet wells, sand storms may also cause silting that may block the pump inlet.

K. Has the station been vandalized? Using the drawings in the SyncroFlo Installation and Operation manual, visually inspect the system for damage.

**Troubleshooting Procedures**

Qualified technicians will find the SyncroFlo Installation, Operation and Maintenance manual useful for detailed descriptions of station operation, as well as manufacturer's specifications for each major component. Many failures will result in an alarm and an error message on the Operator Interface Terminal (OIT). Refer to the alarms section to begin troubleshooting these problems.

**DO NOT ATTEMPT TO SERVICE OR TROUBLESHOOT ANY ELECTRICAL COMPONENT WITH UNQUALIFIED PERSONNEL. AVOID ANY CONTACT WITH LIVE ELECTRICAL COMPONENTS. DO NOT ATTEMPT TO REPLACE ANY COMPONENT WHILE THE POWER IS ON.**

**Begin With a System Inspection and a Look at the OIT**

Begin with an inspection of the station. Look for components that may have been damaged by freezing, lightning, vandalism, or flooding. Look and smell inside the control panel and around the electric motors to identify failed electrical components. If the system is running, look and listen for unusual sounds or vibration that may indicate problems with the pumps or motors.

Most failures can be diagnosed internally by the system. Information about failures will be displayed on the Operator Interface Terminal, or OIT, which is located on the front of the control panel. Therefore, first check the OIT display. If an error message is displayed, proceed to section entitled “OIT Alarms.”

**Failures not indicated by OIT Alarms**
Refer to Chapter 5, “Component-Level Troubleshooting,” if you are having problems in the following areas.

**Power Failure**
Refer to the General Electrical Check in the next section of Chapter 5.

**Leaking pumps**
Pumps require regular servicing to avoid leaks. Refer to the manufacturer’s pump manual, reprinted in Chapter 8 of your SyncroFlo Installation, Operation, and Maintenance manual.

**Excessive Vibration**
Most systems run smoothly when they are working properly. Vibration may be an indication of motor or pump failure or misuse of the system. Refer to the pump manufacturer’s manuals, reprinted in your SyncroFlo Installation, Operation, and Maintenance manual.

**Pumping Station Running Continuously**
Refer to the procedures for servicing and adjusting the Station Relief Valve and Pilot Valve later in this chapter.

**Alarm light Flashing, but no display on the OIT**
See Display Failure in the section below entitled “OIT Alarms.”

**Failure to operate in “Auto” mode**
If the system will not operate with the motor selector switches in “Auto,” but no alarm code appears on the OIT, you may have a Programmable Controller failure. Diagnostic procedures are the same as those listed below in the Programmable Controller Failure alarm in the OIT Alarms section.

**Pressure Transducer Failure**
This may cause the station to shut down. Some types of pressure transducer failures are described in the OIT Alarms section below under the heading “PT -- Pressure Transducer Failure.” Also refer to the procedures for servicing the Pressure Transducer later in this chapter.

**OIT Alarms**
The Operator Information Terminal should be the first place you check to begin diagnosing a problem with the system.

If you are unfamiliar with the operation of the OIT, see chapter 3 or refer to the Quick Guide below. Otherwise, read the alarm code on the OIT screen (you may need to access the Alarms History screen if multiple failures have occurred) and refer to the list below.

**List of alarm codes, in alphabetical order.**
C1, C2, C3, etc. -- Contactor Fault (contactor number indicated)
DF -- Display Failure
F1, F2, F3, etc., -- Pump Failure (pump number indicated)
FS -- Flow Sensor failure
HF -- High Flow Rate
HS -- High System Pressure
HT -- High Temperature inside the Control Panel
IC -- Inverter Contactor Fault
IF -- Inverter (Variable Speed Drive) Failure
IP -- Irregular Power
IT -- Inverter (Variable Speed Drive) trip
JS -- Jobsite system settings are lost
LB -- Low battery level in Programmable Controller
LL -- Low Level (for stations with vertical turbine pumps only). Indicates low suction on positive suction, close-coupled systems
LS -- Low System Pressure
O1, O2, O3, etc. -- Motor overload (motor number indicated)
PC -- Programmable Controller failure
PF -- Power Failure
PI -- Input failure in Programmable Controller
PT -- Pressure Transducer failure

Quick Guide to Using the OIT.

See Chapter 4 for complete instructions on using the OIT.

If the alarm light is on, press the Alarm Ack button on the OIT to turn it off. If multiple alarms were activated, you may need to press the button several times.

Press Last Alarm to display the most recent alarm, and to get details on how the pumping station was performing when the most recent alarm was activated.

Press Alarm History to scroll through a list of the last 200 alarms. Use the Δ+ and Δ- keys to scroll up or down through the list.

Press Alarm List to scroll through the complete list of all possible OIT alarms. Use the “page up” and “page down” keys to scroll.
Alarms, What they Mean, and How to Begin Fixing the Problem

C1, C2, etc. -- Contactor Fault

The number following the “C” indicates which contactor has failed. Your pumping station uses motor contactors to switch on or off each motor. Each main pump motor has two contactors, but the alarms do not indicate which of the two contactors failed. These alarms detect faults with the motor contactors through their auxiliary contacts. The alarms can activate any time that a motor contactor is in the wrong position (open when it should be closed or vice versa). If the fault signal remains on for 2 seconds continuously, the alarm latches on, the affected motor is shut down (or the motor may stay on if the contactor has failed in the closed position), sequence shifting is activated, and the rest of the station continues to operate normally.

Before proceeding, acknowledge the alarm by pressing the “Alarm Ack” button on the OIT.

Diagnosing contactor failures: **Shut off power to the pumping station** using the main disconnect switch. Visually inspect all contactors. Contactors are located inside the control panel cabinet. Tighten the connectors for all cables at the Programmable Controller and the contactors. Ensure that contactors are not jammed in the open or closed position. Ensure that any mechanical links between adjacent contactors are functional. Also, press the reset buttons on the motor overload relays. Close the cabinet, turn the main power switch to the “On” position, and restart the system. If the problem reoccurs, follow the procedures below.

<p>| Problem: Motor contactor will not reset. Contactor jammed in open or closed position. | Possible Cause: Faulty contactor. Motor contactors can usually be checked for jams by pressing the center of the unit with the station power turned off. The mechanism should move freely. | Remedy: Replace contactor if it is jammed. If contactor repeatedly trips, check for power supply problem or motor fault. |
| Problem: Motor contactor fails to pull in when the Hand-Off-Auto (H-O-A) switch on the front of the control panel is in &quot;auto,&quot; but starts when it is in &quot;hand.&quot; | Possible Cause: Loose wire at H-O-A switch or Programmable Controller terminal strip, faulty H-O-A switch, or faulty contactor coil. | Remedy: Check and tighten connections on PC terminal strip(s) or at H-O-A switch. Check the H-O-A switch to determine if it is working properly. Check contactor coil and replace coil or contactor as |</p>
<table>
<thead>
<tr>
<th>Problem</th>
<th>Possible Cause</th>
<th>Remedy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Motor contactor fails to pull in when the H-O-A switch on the front of the control panel is in &quot;hand.&quot;</td>
<td>Loose cable at H-O-A switch, bad motor contactor coil, or bad H-O-A switch.</td>
<td>Check and tighten all terminals on H-O-A switch and contactor coil, or replace H-O-A switch or motor contactor.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Problem</th>
<th>Possible Cause</th>
<th>Remedy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Motor starts in both &quot;Auto&quot; and &quot;Hand&quot; position, but trips the contactor overload relay after a short period.</td>
<td>Loose connection or loose overload heater strip; overloaded or failing motor/pump.</td>
<td>After shutting off power to the pumping station, tighten all power terminals and overload strips. Check motor current draw and temperature. Check pump.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Problem</th>
<th>Possible Cause</th>
<th>Remedy</th>
</tr>
</thead>
<tbody>
<tr>
<td>OIT registers a Cx (where x indicates the contactor number) alarm, but contactors appear to be functioning properly.</td>
<td>Defective auxiliary contact on contactor.</td>
<td>Check and replace auxiliary contact. See chapter 5.5</td>
</tr>
</tbody>
</table>

**DF -- Display Failure**

**Note:** If your pumping station has suffered a display failure, you will see the alarm light flashing on the control panel, but nothing will be displayed on the Operator Interface Terminal.

This alarm detects the loss of communication with the EagleEye OIT. If communication between the Programmable Controller and the OIT is lost for 30 seconds continuously, the alarm latches on but the station continues to operate normally. To make sure the station can run in its normal automatic mode, the Programmable Controller turns off the following OIT controlled features if they were on: manual speed control, the set clock function, and inverter mode setup.

<table>
<thead>
<tr>
<th>Problem</th>
<th>Possible Cause</th>
<th>Remedy</th>
</tr>
</thead>
<tbody>
<tr>
<td>OIT Display failure; OIT lights are working (several short lines may be displayed on the screen).</td>
<td>Electrical noise, poor connections at communication cable plugs, or failure of 24V DC power supply. Possible water damage.</td>
<td>Check for sources of extraneous electromagnetic “noise” such as sparking or arcing contacts, or proximity to radio transmitters or other radio frequency devices. Check communication cable terminal plugs for clean connections. Check 24V DC power supply. Replace OIT as necessary.</td>
</tr>
</tbody>
</table>

**F1, F2, etc. Pump Failure**
**Note:** These alarms are typically used only on stations with centrifugal pumps (check the date sheets in your Installation, Operation, and Maintenance manual if you are not sure what kind you have) for “loss of water” protection. However, pump failure alarms may be enabled on any type of station. One alarm is provided for each pump.

These alarms detect pump failures using pressure switches that are mounted on the control panel. The alarms can only activate when a pump is supposed to be running but its discharge pressure is extremely low. If the pump failure pressure switch signal remains on for 10 seconds continuously, the alarm latches on, the affected pump is shut down, sequence shifting is activated, and the rest of the station continues to operate normally.

<table>
<thead>
<tr>
<th>Problem: Pump failure alarm.</th>
<th>Possible cause: Pressure switch setting too high; pressure switch sensing line valved off or clogged. Pressure switch failure or incorrect wiring.</th>
<th>Remedy: Refer to the procedures for adjusting pressure switches in chapter 5.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Possible cause:</strong> Loss of water supply or flow rate greater than supply capacity.</td>
<td><strong>Remedy:</strong> If the station pumps are working, then the problem is that the demand for water from your system is too high. Ensure that your water supply has not been lost. If water supply is normal, you must reduce the demand for water. For example, run fewer sprinklers.</td>
<td></td>
</tr>
<tr>
<td><strong>Possible cause:</strong> Reverse rotation, pump failure, or motor failure.</td>
<td><strong>Remedy:</strong> Ensure that water is not back-flowing through the system. If this is a new pumping station, or if you are attempting to start a replacement motor for the first time, ensure that the motor is wired correctly. Your motor may have failed. Your pump may have failed. Check and repair or replace. Check all motor fuses. Ensure that check valves are working properly. Refer to chapter 5.5 for additional servicing information.</td>
<td></td>
</tr>
<tr>
<td><strong>Possible Cause:</strong> Closed suction valve or obstruction in pump or suction piping.</td>
<td><strong>Remedy:</strong> Check all butterfly valves and ensure that they are in the open position. Usually, the only</td>
<td></td>
</tr>
</tbody>
</table>
hand-operated valves in the system that are normally closed are the hose Bibb valve (the small valve that looks like a garden hose spigot) and the manifold drain ball valve. Your pump may have an obstruction. Check for a clogged screen at the supply tube.

FS - Flow Sensor failure

This alarm detects a failure of the flow sensor. If the flow rate never exceeds 0 GPM (gallons per minute) during 10 consecutive attempts to automatically start the first main pump, the alarm latches on. The station will continue to operate, because the pressure transducer acts as a backup control mechanism. However, the flow sensor must be working for the station to work at peak performance.

<table>
<thead>
<tr>
<th>Problem: Flow sensor failure</th>
<th>Possible Cause: Loose wire, broken connection, or short circuit.</th>
<th>Remedy: Check wire from sensor to PC and replace as necessary.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Possible Cause: Power surge or lightning has damaged sensor.</td>
<td>Remedy: Replace sensor.</td>
</tr>
<tr>
<td></td>
<td>Possible Cause: Loose or burned out pull-up resistor.</td>
<td>Test and replace resistor. Refer to the schematic diagram in your SyncroFlo Operation, Installation, and Maintenance manual.</td>
</tr>
<tr>
<td></td>
<td>Possible Cause: Loose input terminal at PC.</td>
<td>Remedy: Switch off all power to the pumping station. Tighten all screws on the terminal strips of the PC.</td>
</tr>
<tr>
<td></td>
<td>Possible Cause: clogged flow sensor or internal flow sensor failure.</td>
<td>Remedy: See chapter 5 for flow sensor testing and servicing. See also the manufacturer’s literature, reprinted in section 13.</td>
</tr>
</tbody>
</table>

HF -- High Flow Rate
This alarm detects abnormally high flow rates using the flow sensor located on the discharge manifold. The alarm can only activate when the flow rate is high, refill mode is off, the High Flow and Low System alarm switch on the control panel is set to “enable,” and no other alarms have shut down the station. If the flow rate remains high for five minutes continuously, the alarm latches on and the station shuts down. This alarm can always be reset, because after station shutdown there is nothing to reactivate the alarm.

<table>
<thead>
<tr>
<th>Problem: Flow rate too high.</th>
<th>Possible Cause: High flow rate setting too low. Flow rate settings are set by the factory, but may have been changed on the job site.</th>
<th>Remedy: Follow the procedures for resetting the flow rate in chapter 3.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Possible Cause: Flow rate greater than station capacity.</td>
<td>Remedy: Reduce the demand for water. For example, turn off some of the sprinklers running on the system.</td>
<td></td>
</tr>
<tr>
<td>Possible Cause: Main pump selector switch turned off.</td>
<td>Remedy: Turn main pump switch on the front of the control panel to “Auto” to run in normal mode.</td>
<td></td>
</tr>
<tr>
<td>Possible Cause: Main pump motor overload or contactor fault.</td>
<td>Remedy: Troubleshoot using the procedures outlined under the Motor Contactor (C) alarm section.</td>
<td></td>
</tr>
<tr>
<td>Possible Cause: Flow sensor failure or flow sensor falsely reading high flow.</td>
<td>Remedy: See flow sensor testing and replacement procedure in chapter 5.</td>
<td></td>
</tr>
<tr>
<td>Possible Cause: Large break in irrigation piping.</td>
<td>Remedy: Inspect and repair piping as needed.</td>
<td></td>
</tr>
<tr>
<td>Possible Cause: Air trapped in piping.</td>
<td>Remedy: Check for proper operation of the air relief valve and for proper piping installation.</td>
<td></td>
</tr>
</tbody>
</table>

**HS High System Pressure**

This alarm detects abnormally high system pressure with the pressure transducer located inside the control panel. It can only activate when the system pressure is above the high setting and no other alarms have shut down the pump station. If the high system pressure signal remains on for 1 minute continuously, the alarm latches on and the station is shut down.
down. This alarm can not be reset until the high system pressure is removed, or the signal from the pressure transducer goes to normal.

<table>
<thead>
<tr>
<th>Problem: High system pressure</th>
<th>Possible Cause: High system pressure setting too low.</th>
<th>Remedy: Pressure settings are set by the factory, but may have been changed on the job site. Follow the procedures for resetting the high pressure in chapter 3. Note that pressure settings can be changed for each mode of station operation (normal, energy, and refill).</th>
</tr>
</thead>
<tbody>
<tr>
<td>Possible Cause: station relief valve set too high.</td>
<td>Remedy: Check and adjust station relief valve. See chapter 5.</td>
<td></td>
</tr>
<tr>
<td>Possible Cause: Relief valve inlet butterfly valve closed.</td>
<td>Remedy: Ensure that the butterfly valve on the outlet side of the relief valve is set to the open position.</td>
<td></td>
</tr>
<tr>
<td>Possible Cause: One or more ball valves closed on pilot valve, which controls the station relief valve.</td>
<td>Remedy: Ensure that the valve(s) are set to the open position.</td>
<td></td>
</tr>
<tr>
<td>Possible Cause: Relief valve failure.</td>
<td>Remedy: See chapter 5.</td>
<td></td>
</tr>
</tbody>
</table>

**HT -- High Temperature inside the control panel**

This alarm detects high temperature inside the control panel with a thermostat. The alarm can only activate if the temperature inside the control panel is high and no other alarms have shut down the station. If the thermostat signals high temperature for 30 minutes continuously, the alarm latches on, but no other action is taken. If the temperature drops at least 10 degrees below the thermostat setting for 3 seconds continuously, the alarm resets automatically. If necessary, this alarm can be manually reset without waiting for an automatic reset.

| Problem: High temperature inside the control panel. | Possible Cause: Thermostat setting too high or located improperly. | Remedy: If a new thermostat has been installed, ensure that it was installed in the same location as the original. In general a thermostat should |
be located on a metal surface in the upper half of the control panel, away from the air inlet and from heat producing components such as transformers, but near the Variable Frequency Drive unit. The thermostat is set by the factory but may need to be adjusted slightly for local conditions. See the pumping station data sheets for thermostat factory setting.

| Possible Cause: Heat exchanger (or air conditioner, if equipped) failure. | Remedy: Check air conditioner filters (if equipped) or check heat exchanger water flow. Refer to Chapter 5. |
| Possible Cause: Wye strainer on feed line to heat exchanger is blocked. | Remedy: Check that the isolation valve on the feed line is open and that the Wye strainer is clean. |
| Possible Cause: Flow rate to the heat exchanger is too high or too low. | Remedy: Adjust the flow rate to 1-2 gallons (U.S.) per minute. |

**IC -- Inverter Contactor Fault**

This alarm detects a fault with the inverter (Variable Speed Drive) line contactor through the contactor’s auxiliary contact. This alarm will activate any time that the inverter line contactor is in the wrong position (open when it should be closed or vice versa). If the fault signal remains on for five seconds continuously, the alarm latches on, the Variable Speed Drive shuts down, the motor controlled by the Variable Speed Drive is connected directly to full line voltage (causing that motor to run at full speed), and the pumping station runs in constant speed mode.

| Problem: Inverter Contactor fault | Possible Cause: Line contactor is faulty. | Remedy: Replace line contactor immediately. |
| Possible Cause: Loose cable on contactor or Programmable Controller. | Remedy: After shutting down all power to the pumping station, tighten all terminal screws on the Programmable Controller. |
and the line contactor.

<table>
<thead>
<tr>
<th>Possible Cause:</th>
<th>Remedy:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contactor coil or auxiliary contact failure.</td>
<td>Test and replace as necessary.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Possible Cause:</th>
<th>Remedy:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Programmable controller input or output failure.</td>
<td>See chapter 5.</td>
</tr>
</tbody>
</table>

**IF -- Inverter (Variable Frequency Drive) failure**

The Variable Speed Drive or “inverter” has its own fault sensing capabilities, but it cannot detect all possible fault conditions. Therefore a backup system is used to detect them. Inverter failure is indicated when three Inverter Trip (IT) alarms occur within a 15-minute period. On the occurrence of the third alarm, an IF failure is registered and the system locks out variable speed operation. This alarm can always be reset because there is no alarm signal after an IF shutdown.

<table>
<thead>
<tr>
<th>Problem:</th>
<th>Possible Cause:</th>
<th>Remedy:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inverter failure:</td>
<td>Blown inverter fuses; internal VFD fault.</td>
<td>After shutting off power to the pumping station, check the power cables to the inverter circuit for blown fuses and replace as needed. Blown fuses may indicate a damaged Variable Speed Drive or a motor failure. See VFD troubleshooting.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Possible Cause:</th>
<th>Remedy:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inverter upper limit (maximum speed) setting too high.</td>
<td>The procedure for changing the job site settings for the inverter is described in chapter 3.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Possible Cause:</th>
<th>Remedy:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Loose wire on the Programmable Controller or Variable Speed Drive.</td>
<td>After shutting off power to the pumping station, carefully tighten the set screws on all Programmable Controller and Variable Speed Drive terminals.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Possible Cause:</th>
<th>Remedy:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total failure of inverter control board.</td>
<td>Replace Variable Speed Drive.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Possible Cause:</th>
<th>Remedy:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Programmable Controller failure or incorrect</td>
<td>See chapter 5.</td>
</tr>
</tbody>
</table>
IP -- Irregular Power

This alarm detects abnormal conditions in the electric power supplied to the pumping station, using a power monitor unit, which is located in the control panel. The alarm can only activate when the power monitor signals and no other alarms have shut down the pumping station. Immediately after the power monitor senses something wrong on the power lines, the alarm latches on and the station is shut down. If power conditions return to normal for 30 seconds continuously, the alarm resets automatically and the station is allowed to run.

<table>
<thead>
<tr>
<th>Problem</th>
<th>Possible Cause</th>
<th>Remedy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Irregular Power</td>
<td>Incoming supply voltage less than 90 percent of normal between any incoming cable and ground or between any two incoming cables.</td>
<td>Check main circuit breakers. If problem persists, check supply voltage. The supply voltage to your station is controlled by your power provider. Low voltage may occur during periods of peak demand. Contact the power producer to correct the problem.</td>
</tr>
<tr>
<td></td>
<td>Power monitor voltage adjustment too high or monitor faulty.</td>
<td>Adjust power monitor. Replace as needed. See Chapter 5.</td>
</tr>
<tr>
<td></td>
<td>A reversal, shift, imbalance, or loss of supply phase.</td>
<td>Have your electric power provider ensure that the phase relationships of all incoming supply cables are correct.</td>
</tr>
<tr>
<td></td>
<td>Power cables are not connected to the pumping station correctly.</td>
<td>If power cables that are disconnected are later reconnected to different terminals, the result may be a phase imbalance or reversal. Refer to chapter 5.</td>
</tr>
<tr>
<td></td>
<td>Reverse motor rotation.</td>
<td>If tests indicate that power is normal, and the system or motors are new, the motors may have been wired incorrectly. Disconnect power, switch</td>
</tr>
</tbody>
</table>
the two incoming power leads, and reconnect power.

**IT Inverter (Variable Speed Drive) Trip**

This alarm detects the trip of the fault contact in the inverter. Immediately after a trip signal is received, the alarm latches on, the inverter shuts down, the variable speed pump is switched immediately to run across the line (therefore at full speed), and the station runs in constant speed mode.

At that point, the Programmable Controller automatically tries to reset the inverter once every 30 seconds until the fault is cleared. The inverter reset/fault counter inside the Programmable Controller, and is set to zero after each 15 minute period, unless 2 reset attempts or 3 faults have already occurred within that time. This allows the Programmable Controller to try to keep the inverter operating unless a persistent or serious condition exists.

If the fault remains after 2 reset attempts, or if 3 separate faults occur within 15 minutes, the Programmable Controller keeps the inverter locked out of the circuit and an Inverter Failure (IF) alarm is indicated. If the fault clears when the Programmable Controller issues a reset command to the inverter, the Programmable Controller stops the appropriate main pump and allows the inverter to run that pump again. This alarm can be manually reset. You do not have to wait for an automatic reset.

<table>
<thead>
<tr>
<th><strong>Problem:</strong> Inverter fault</th>
<th><strong>Possible Cause:</strong> Overcurrent condition</th>
<th><strong>Remedy:</strong> Check for overheating or overloaded motor. See chapter 5.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Possible Cause:</strong></td>
<td><strong>Remedy:</strong> Check system voltage or contact your electric service provider</td>
<td></td>
</tr>
<tr>
<td>Undervoltage</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Possible Cause:</strong></td>
<td><strong>Remedy:</strong> After shutting down power to the pumping station, check all fuses. Check to see that no power cables are damaged and that all terminal connections are tight. Ensure that system voltage and phases are correct.</td>
<td></td>
</tr>
<tr>
<td>Irregular power conditions.</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Possible Cause:</strong></td>
<td><strong>Remedy:</strong> For information on changing variable speed drive settings, see chapter 3.</td>
<td></td>
</tr>
<tr>
<td>Inverter deceleration or acceleration setting too low.</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Possible Cause:</strong></td>
<td><strong>Remedy:</strong> The drive is capable of diagnosing and reporting other failure conditions. A copy of the manufacturer's operating manual.</td>
<td></td>
</tr>
<tr>
<td>Fault conditions listed in the variable speed drive operation manual.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
JS -- Jobsite system settings are lost

This alarm detects the loss of settings from the active memory of the Programmable Controller. If the Programmable Controller finds that its most critical setting is equal to zero at any time, the alarm latches on, the original factory settings are automatically reloaded, and the system continues to operate normally. This alarm can only be reset while viewing its status screen in the “Alarm List” and pressing the TOGGLE key on the OIT.

<table>
<thead>
<tr>
<th>Problem: Jobsite settings lost alarm</th>
<th>Possible Cause: New CPU or EEPROM module just installed.</th>
<th>Remedy: Jobsite settings must be reentered.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Possible Cause: Programmable Controller battery failure.</td>
<td>Remedy: Replace battery. See chapter 5.</td>
</tr>
<tr>
<td></td>
<td>Possible Cause: Extreme power surge or electrical fault.</td>
<td>Remedy: Jobsite settings must be reentered. PC may be damaged; replace as necessary.</td>
</tr>
<tr>
<td></td>
<td>Possible Cause: CPU memory malfunction.</td>
<td>Remedy: Replace PC.</td>
</tr>
</tbody>
</table>

LB -- Low battery level in Programmable Controller

This alarm detects low battery voltage in the Programmable Controller. The battery is used to run the realtime clock and keep data (not the program) in memory when the power is off. If the battery voltage remains low for 10 seconds continuously, the alarm latches but no other action is taken. There is a 30-day reserve of battery power after this alarm turns on. However, the battery should be replaced as soon as possible. This alarm resets automatically, but only after the battery voltage returns to normal.

<table>
<thead>
<tr>
<th>Problem: Low battery alarm</th>
<th>Possible Cause: Battery weak</th>
<th>Remedy: Replace. See chapter 5.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Possible Cause: Battery is not plugged in.</td>
<td>Remedy: Remove the battery cover and ensure that the small battery connector is plugged into the PC. See chapter 5.</td>
</tr>
<tr>
<td></td>
<td>Possible Cause:</td>
<td>Remedy: Refer to chapter</td>
</tr>
<tr>
<td>Problem: Low level alarm; low level in well or lake</td>
<td>Possible Cause: clogged or shut off supply pipe, induction flume, or inlet screen.</td>
<td>Remedy: Ensure that valves (if used) that supply your well or lake are open. If water level is maintained by a supply pipe, ensure that it is not blocked. Ensure that the screen that is fitted at the end of the pump suction flume is not clogged.</td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>Problem: Low level alarm; normal level in well or lake</td>
<td>Possible Cause: Incorrect probe lengths.</td>
<td>Remedy: Compare probe lengths to the system specification sheets included with your Installation, Operation, and Maintenance manual.</td>
</tr>
<tr>
<td></td>
<td>Possible Cause: Broken, dirty, or corroded probes.</td>
<td>Remedy: Inspect probes and clean or replace as necessary.</td>
</tr>
<tr>
<td></td>
<td>Possible Cause: Loose or improperly connected probe wires.</td>
<td>Remedy: Inspect and repair or replace as necessary.</td>
</tr>
<tr>
<td></td>
<td>Possible Cause: Level relay failure.</td>
<td>Remedy: Check for proper functioning of the relay, which is located inside the control panel.</td>
</tr>
<tr>
<td></td>
<td>Possible Cause: Loss of ground continuity from station to wet well.</td>
<td>Remedy: Connect ground as required to provide the proper reference. See the Level Relay/Probe instructions.</td>
</tr>
</tbody>
</table>

**LL Low Level (for stations with vertical turbine pumps only)**

This alarm is only provided on stations with wet well mounted, vertical turbine pumps and indicates low suction on positive pressure end suction systems. This alarm detects dangerously low water level in the wet well with a level probe assembly and a solid state relay. It can only activate when the water level is low and no other alarms have shut down the station. If the low level signal remains on for 10 seconds continuously, the alarm latches on and the station shuts down.

**LS Low System Pressure**
This alarm detects abnormally low system pressure with the pressure transducer located inside the control panel. It can only activate when the system pressure is below the low setting, the HIGH FLOW AND LOW SYSTEM ALARMS switch on the control panel is in the enabled position, lockout mode is off, and no other alarms have shut down the pump station. If the low system pressure signal remains on for five minutes (5 minutes per step or 15 minutes total during refill mode) continuously, the alarm latches on and the station is shut down. This alarm can be reset even if the low system pressure signal is still on.

<table>
<thead>
<tr>
<th>Problem: Low system pressure</th>
<th>Possible Cause: Manual speed control left on.</th>
<th>Remedy: Turn manual speed control off using the OIT. Press the speed control button on the OIT and use the toggle key to turn off manual speed control. Ensure that all pump selector switches (on the control panel) are in the “auto” position.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Possible Cause: Relief valve failed in the open position; relief valve needs adjustment pilot valve ball valve closed.</td>
<td>Remedy: For relief valve troubleshooting and adjustment, see chapter 5. Ensure that the ball valve(s) that control the water supply to the pilot valve are all in the open position.</td>
<td></td>
</tr>
<tr>
<td>Possible Cause: Relief valve pilot strainer is dirty, the needle valve is plugged, or the needle valve is screwed in too far.</td>
<td>Remedy: Clean and adjust pilot valve assembly. See chapter 5.</td>
<td></td>
</tr>
<tr>
<td>Possible Cause: Low system differential pressure setting is too low.</td>
<td>Remedy: Press the Settings button on the OIT; access the pressure settings screen; use the page up/page down buttons to access the Low System Differential screen; use the arrow keys to move the cursor under the number; raise the number. Alternately, use the OIT to return all settings to factory specifications.</td>
<td></td>
</tr>
</tbody>
</table>

**Low System Pressure, continued**

<p>| Possible Cause: Flow rate greater than station capacity or unable to pressurize the | Remedy: Turn off as many sprinklers as needed to maintain pressure. Check to |</p>
<table>
<thead>
<tr>
<th>Possible Cause</th>
<th>Remedy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pressure transducer failure or sensing line valved off.</td>
<td>Open the ball valve(s) to the pressure transducer(s). If this does not</td>
</tr>
<tr>
<td></td>
<td>correct the problem, check for a failed transducer. See chapter 5.</td>
</tr>
<tr>
<td>Pump selector switch turned off.</td>
<td>Turn all pump selector switches on the front panel to “auto.”</td>
</tr>
<tr>
<td>Motor failure, reverse motor rotation.</td>
<td>Reverse rotation of the motors is a result of improper installation of</td>
</tr>
<tr>
<td></td>
<td>new motors. See chapter 5, “Power check.” Check for tripped circuit</td>
</tr>
<tr>
<td></td>
<td>breakers, blown fuses, or malfunctioning motors. See the procedures</td>
</tr>
<tr>
<td></td>
<td>outlined under Irregular Power, Pump Failure, and Power Failure alarms.</td>
</tr>
<tr>
<td>Pump overload, contactor fault, or failure alarm.</td>
<td>See the procedures outlined under Irregular Power, Pump Failure, and</td>
</tr>
<tr>
<td></td>
<td>Power Failure alarms.</td>
</tr>
<tr>
<td>Pump isolation valve closed or check valve installed backward.</td>
<td>Check that all station valves supplying water to the pumps are in the</td>
</tr>
<tr>
<td></td>
<td>open position. If a new check valve has been installed, check that it</td>
</tr>
<tr>
<td></td>
<td>is not installed backward, preventing the proper flow of water.</td>
</tr>
<tr>
<td>Large break in irrigation piping.</td>
<td>Inspect irrigation system for major leaks.</td>
</tr>
<tr>
<td>In positive suction, close-coupled pump systems only, suction pressure may</td>
<td>Increase suction pressure or decrease demand.</td>
</tr>
<tr>
<td>be too low.</td>
<td></td>
</tr>
<tr>
<td>In negative lift, close-coupled pump systems only, suction pressure may be</td>
<td>Raise lake level.</td>
</tr>
<tr>
<td>too high.</td>
<td></td>
</tr>
</tbody>
</table>

O1, 02, 03, etc. Motor overload (motor number indicated)
These alarms detect when the overload relay of a motor’s contactor has tripped. As soon as a motor overload relay trips, the alarm latches on, the affected pump is shut down, sequence shifting mode is activated, and the rest of the station continues to operate normally. On some models, the overload relays must be reset manually before the alarms can be reset.

<table>
<thead>
<tr>
<th>Problem: Motor overload alarm</th>
<th>Possible Cause: Motor overload.</th>
<th>Remedy: Reduce flow demand; check motor for winding or bearing failure; check electric power for proper voltage and phase.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Possible Cause: Loose wire on motor starter contactor or the Programmable Controller.</td>
<td>Remedy: Using the OIT, identify which motor is at fault. After shutting down all power to the pumping station, carefully tighten all terminal connections on the Programmable Controller and motor contactors. On some pumping stations, the overload relays for the contactors must also be manually reset.</td>
</tr>
<tr>
<td></td>
<td>Possible Cause: Overload relays set incorrectly.</td>
<td>Remedy: Adjust motor overload relay to the value indicated on the motor data plate.</td>
</tr>
<tr>
<td></td>
<td>Possible Cause: Overload relay malfunction.</td>
<td>Remedy: Remove and test overload relay.</td>
</tr>
<tr>
<td></td>
<td>Possible Cause: Programmable Controller input or output failure. See chapter 5.</td>
<td></td>
</tr>
</tbody>
</table>

**PC - Programmable Controller failure**

It is unlikely that this screen will appear on the OIT following a Programmable Controller failure. Checking the status screen in the OIT alarm list is usually the only way to tell if this alarm is on. The alarm list screen will provide a CPU diagnostic code; 0000 indicates that the system is OK, 6103 indicates an I/O bus error.

This alarm indicates a Programmable Controller hardware failure. If the PC stops running for any reason, the station is shut down, the status screen shows that the alarm is on (see above), and the PC bypass circuit activates to allow the pumps to be run manually in the
“hand” position. Because the PC has stopped running, the alarm light on the front panel and the alarm messages on the OIT will probably not work.

This alarm resets automatically but only after the PC starts running again.

<table>
<thead>
<tr>
<th>Problem: PC failure Alarm</th>
<th>Possible Cause: PC operating error caused by power irregularity or other factor.</th>
<th>Remedy: Shut off power to the pumping station for at least 15 seconds, then turn power on. Alarm may reset automatically allowing normal station operation. No repair is needed unless problem recurs.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Possible Cause: Power surge, lightning strike, or other major power irregularity.</td>
<td>Remedy: If 24V DC power supply to the Programmable Controller is functioning normally, PC may be irreparably damaged, requiring replacement of unit. Refer to chapter 5 for more information on PC operation. Pumping station may be run manually until a replacement arrives.</td>
<td></td>
</tr>
<tr>
<td>Possible Cause: Poor connections</td>
<td>Remedy: Ensure that ground, power, input, and output connections are clean and tight.</td>
<td></td>
</tr>
</tbody>
</table>

**PF- Power Failure**

This alarm prevents the station from starting too soon after power is turned on. Immediately after electrical power is restored, the alarm latches on and the station remains shut down. If the power remains on for 30 seconds continuously, the alarm resets automatically and the station is allowed to run. This alarm can be manually reset; you do not have to wait for an automatic reset.

<table>
<thead>
<tr>
<th>Problem: Power Failure alarm</th>
<th>Possible Cause: Power failure</th>
<th>Remedy: Occurs normally following any power failure or when pumping station power switched on. Reset alarm manually or wait 30 seconds for automatic reset.</th>
</tr>
</thead>
</table>
PI -- Input failure in Programmable Controller
This alarm detects the loss of power to the PC inputs. Without input power, the PC cannot control the station. If input power is lost for 60 seconds continuously, the alarm latches on and the station shuts down. This alarm automatically resets but only after input power to the PC is restored.

<table>
<thead>
<tr>
<th>Problem: Input failure</th>
<th>Possible Cause: Loose wire or short circuit.</th>
<th>Remedy: After shutting off power to the pumping station, carefully tighten all terminal connections on the Programmable Controller. Check all PC wiring for possible short circuits.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Possible Cause: Failure of the 24V DC power supply.</td>
<td>Remedy: Check power supply for proper operation.</td>
<td></td>
</tr>
<tr>
<td>Possible Cause: Station reset button held in or broken</td>
<td>Remedy: check station reset button; button contact is normally closed.</td>
<td></td>
</tr>
</tbody>
</table>

PT - Pressure Transducer failure
This alarm detects a failure of the pressure transducer. It can only activate when the system pressure is out of the normal range (at 0 PSI or above 200 PSI) and no other alarms have shut down the pump station. If the pressure signal remains out of range for 30 seconds continuously, the alarm latches on and the station is shut down. This alarm can not detect all types of transducer failures. For example, a continuous pressure reading caused by freeze damage will not activate the alarm.

<table>
<thead>
<tr>
<th>Problem: Pressure Transducer Alarm</th>
<th>Possible Cause: Loose or burned out pull-up resistor.</th>
<th>Remedy: Check and replace resistor as necessary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Possible Cause: Loose terminal on the Programmable Controller.</td>
<td>Remedy: After shutting off power to the pumping station, carefully tighten all terminals on the Programmable Controller.</td>
<td></td>
</tr>
<tr>
<td>Possible Cause: Loose wire, broken connection, or short circuit.</td>
<td>Remedy: Inspect wiring to transducer (s) and repair or replace as necessary</td>
<td></td>
</tr>
<tr>
<td>Possible Cause: 24V DC power supply failure.</td>
<td>Remedy: Check 24V DC power supply for correct operation.</td>
<td></td>
</tr>
</tbody>
</table>
Possible Cause: Pressure transducer failed or frozen.
Remedy: Refer to chapter 5 for details on troubleshooting and replacing pressure transducers.

Possible Cause: Installation damage.
Remedy: Replace transducer using procedure in Chapter 5.

Possible Cause: Blocked pressure port.
Remedy: Remove and clean tubing and port. Use procedure in Chapter 5.

Possible Cause: Pressure surges or “water hammer.”
Remedy: Correct condition causing pressure “spikes.” Inspect relief valve.

COMPONENT TROUBLESHOOTING

GENERAL ELECTRICAL CHECK

DO NOT ATTEMPT TO SERVICE OR TROUBLESHOOT ANY ELECTRICAL COMPONENT WITH UNQUALIFIED PERSONNEL. AVOID ANY CONTACT WITH LIVE ELECTRICAL COMPONENTS. DO NOT ATTEMPT TO REPLACE ANY COMPONENT WHILE THE POWER IS ON.

A. Check the voltage of each incoming electrical line. To avoid motor overheating and damage to the VFD unit, the maximum difference in voltage between any two of the three power lines must not exceed 4.5 volts for 460 volt systems or 2.5 volts for 230 volt systems.

B. Check all fuses, which are located inside the control panel. Blown fuses may indicate pump or motor failures, or other power supply problems.

C. Switch each power circuit breaker (if provided) located inside the control panel to the "reset" position, and then back to the "on" position. If any circuit breaker can not be reset to the "on" position, if it immediately trips after resetting, contact SyncroFlo immediately.

D. Check that each motor overload relay can be reset by pressing the reset button on the relay. Check that all secondary control distribution circuit breakers are in the "on"
position or check each secondary fuse to ensure that it is not blown. If the motor overload relay has tripped, be sure to note which relay tripped.

E. Set all Hand-Off-Auto switches located on the front of the control panel to the "auto" position. On systems that run in constant speed mode only, set the "start/run" switch located on the front of the front panel to the "run" position.

Additional troubleshooting information is provided in Chapter 5 under the names of individual components, such as relays, contactors, and fuses.

**Valve and Pressure General Check**

**Using the OIT**

The Operator Interface Terminal can be used to monitor or check system pressure. Many low or high pressure failures can be diagnosed using the OIT, while other failures may not register and must be checked using other procedures.

Refer to “Using the OIT” in section 3 for detailed instructions on how to check system conditions or change settings. A quick pressure check guide is outlined below.

To check system pressure and flow conditions using the OIT, press the gray key next to the “STATUS” label. If you suspect that a pressure setting may have been changed, check the current pressure settings by pressing the gray key next to the “SETTINGS” label. Then key in the numbers 3, 2, and 1, and “page down” to access information about Normal Mode Set Point. For more information on checking settings, refer to “Using the OIT” in section 3. If you are not sure what the correct pressure settings are for your pumping station, refer to the document entitled “System Data Sheet,” which is included in your SyncroFlo Installation, Operation, and Maintenance manual.

**Checking the Station Relief Valve**

The Station Relief Valve typically does not usually divert large volumes of water during normal operation, except for brief periods such as when all or part of an irrigation system is suddenly turned off. A malfunctioning relief valve may stay open or partially open all the time, resulting in the pumping station running all the time or never reaching full operating pressure. See section 5 for more information about troubleshooting the valve.

**Checking Pressure Transducers**

Pressure transducers may fail completely, or in cold weather they may freeze and give a false reading. In this case, the OIT will typically register a constant pressure reading. See also the section on Pressure Transducers later in this chapter for more information about troubleshooting the transducer.
Air Release Valve

Cutaway view of the air release valve (typical)

The air release valve purges unwanted air from the system. It is fully automatic, but is not under the control of the Programmable Controller. It requires no maintenance, but rebuilding information can be found under tab 12 of the SyncroFlo Installation, Operation, and Maintenance manual.

<table>
<thead>
<tr>
<th>Problem: Air release valve continuously passes water.</th>
<th>Possible Cause: Foreign material in Air Release Valve.</th>
<th>Remedy: Isolate and remove valve. Disassemble and remove sediment, scale or other material. Refer to manufacturer’s literature in Chapter 12 of your SyncroFlo Installation, Operation, and Maintenance manual.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Possible Cause: Linkage worn or out of adjustment.</td>
<td>Remedy: Isolate and remove valve. Disassemble and replace or adjust linkage. Refer to manufacturer’s literature in Chapter 12 of your SyncroFlo Installation, Operation, and Maintenance manual.</td>
<td></td>
</tr>
<tr>
<td>Possible Cause: Corrosion buildup.</td>
<td>Remedy: Replace air release valve.</td>
<td></td>
</tr>
</tbody>
</table>

Flow Sensor
Your pumping station is equipped with a paddlewheel-type flow sensor mounted on the station’s main discharge pipe. If it is necessary to inspect or replace it, refer to the instructions provided in the manufacturer’s literature, which is reprinted in Chapter 12 of your SyncroFlo Installation, Operation, and Maintenance manual.

The most critical aspect of flow sensor installation is alignment. Install flow spool in proper direction as indicated by arrow. (↓) If it is necessary to relocate a flow sensor, ensure that the isolation valve is downstream of flow sensor. If flow sensor is installed in non-conductive pipe material (i.e. PVC, HDPE, etc.), the shield wire must be connected to an “earth” ground inside the control panel. If flow sensor is installed in metal pipe, the shield wire must NOT be connected to ground.

<table>
<thead>
<tr>
<th><strong>Problem:</strong> Flow sensor failure</th>
<th><strong>Possible Cause:</strong> Paddlewheel impeller not rotating because of blockage or wear. If sensor has been replaced recently, ensure that the correct model number sensor was installed.</th>
<th><strong>Remedy:</strong> Remove and inspect flow sensor. See instructions in the manufacturer’s literature, which is reprinted in Chapter 12 of your SyncroFlo Installation, Operation, and Maintenance manual for procedure for replacing worn or seized impeller.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Problem:</strong> Main pumps appear to be turning off at inappropriate times and large pressure fluctuations occur during operation.</td>
<td><strong>Possible Causes:</strong> The system has detected a potential flow sensor failure and has switched into Backup Pressure mode (see Chapter 4). Flow sensor may have failed or station shutoff valve may be closed.</td>
<td><strong>Remedy:</strong> Check the flow meter by pressing the button next to the “STATUS” label on the OIT. Check for a “FS” (flow sensor failure) alarm on the OIT. Ensure that the station discharge valve is open any time the station is in operation. If necessary, remove and inspect the flow sensor. See instructions in the manufacturer’s literature, which is reprinted in Chapter 12 of your SyncroFlo Installation, Operation, and Maintenance manual.</td>
</tr>
</tbody>
</table>
Heat Exchanger and Air Conditioner

A cooling unit, either a heat exchanger or an air-conditioner, is used to limit the temperature inside the control panel to less than 104 degrees Fahrenheit (40 degrees Celsius). This is done to protect the inverter, because higher temperatures can cause the inverter to work improperly, or they can even damage it. Most stations are equipped with a heat exchanger, but air conditioners are used in hotter climates, or where pumping stations are subject to solar heating. The heat exchanger requires an annual flushing. Its failure due to clogging or freezing of the inlet or outlet tubes may cause overheating of the electronics inside the control panel cabinet.

The inverter uses its own fan(s) to draw cool air across its heat sinks while it is running.

Heat Exchanger

The heat exchanger draws warm air into its top vent from inside the control panel, and it discharges cool air from its bottom vent. It uses water from the irrigation system to cool the air, then it dumps that water to drain.

The heat exchanger normally runs any time a pump is running with the inverter, and it turns off 1 second after the inverter and all main pumps have stopped. The heat exchanger also runs any time the temperature inside the control panel exceeds the thermostat setting.

A solenoid valve, piped to the discharge manifold, opens to allow cool water to flow through the heat exchanger while it is running. The flow rate is controlled by a small pressure regulating valve located near the solenoid.

The water supplied to the heat exchanger may not exceed 85 degrees Fahrenheit, or overheating may occur. The flow passes through a Wye strainer that requires regular maintenance. It should be checked at least once a week, more often if your water contains substantial contaminants.

Heat Exchanger Pressure Regulator

This component is located on the discharge manifold, downstream of the heat exchanger solenoid. Set the regulator so that a slow steady stream of water (2 GPM) flows out of the heat exchanger outlet tube, while the system pressure is somewhere between the normal and energy mode set points.

Air-Conditioner
The air-conditioner is of the closed-loop, air-to-air type. It draws warm air into its top vent from inside the control panel, and it discharges cooled air from its bottom vent. It uses a compressed refrigerant to cool the air.

The air-conditioner has an integral thermostat. It runs any time the temperature inside the control panel exceeds the thermostat setting (80-90 degrees F).

**Heat Exchanger Troubleshooting**

<table>
<thead>
<tr>
<th>Problem: High temperature alarm (HT) on OIT. No water supply to heat exchanger.</th>
<th>Possible Cause: Wye strainer clogged.</th>
<th>Possible Cause: Clean as needed.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Possible Cause: Ball valve to the heat exchanger’s water regulating valve is shut off.</td>
<td>Possible Cause: Valve should be kept open any time the station is in operation.</td>
<td></td>
</tr>
<tr>
<td>Possible Cause: Blocked water supply or discharge tubing. Blocked tubing inside exchanger.</td>
<td>Remedy: Remove tubing and clear with compressed air. Blockages inside the heat exchanger may not clear easily. Replace exchanger and reduce sediment in water supply to prevent recurrence.</td>
<td></td>
</tr>
<tr>
<td>Possible Cause: Solenoid valve failure</td>
<td>Remedy: Ensure that the solenoid valve and small pressure regulating valve that supply water to the heat exchanger are functional. This solenoid is controlled by a signal from the Programmable Controller, and permits the flow of water any time an inverter is being used to run a pump or the panel temperature exceeds the thermostat setting. Ensure that the small pressure regulating valve mounted near the solenoid is not blocked.</td>
<td></td>
</tr>
</tbody>
</table>

**Problem:** High temperature alarm (HT) on OIT. Water supply is not blocked, but blower does not work

| Possible Cause: Thermostatic Switch failure. | Remedy: Manually reset the thermostat to its lowest setting. This should always cause the blower to start. Alternately, connect a jumper wire between the terminals of the switch. If either of these operations operates the blower, ensure that the thermostat is correctly set to keep panel temperature under 105 degrees F (40 Celsius). Replace the thermostat if faulty. |
| Possible Cause: Fan bearing | Remedy: Disconnect power to |
failure resulting in blower failure.  The heat exchanger. Remove blower fan and replace with a new unit. Caution: do not handle or carry the blower by inserting fingers into the blower opening where wheels are located. This could cause a wheel misalignment problem and create an out-of-balance condition.

**Possible Cause:** Loose or broken power wire to heat exchanger, thermostat, or blower.

**Remedy:** Locate faulty wire by visual inspection and continuity testing. Replace as necessary.

---

### Air Conditioner Troubleshooting

(Note: some pumping stations are equipped with heat exchangers instead of air conditioners) The air conditioner has an internal thermostat and is not controlled by the programmable controller. It runs any time the temperature inside the control panel cabinet exceeds the thermostat setting. It should be set to less than 105 degrees.

Important note: Major service on the air conditioners supplied with your SyncroFlo pumping station can be undertaken by any certified air conditioning technician.

### Air Conditioner Troubleshooting

| Problem: Air conditioner running, but VFD overheating; High Temperature Alarm (HT) displayed on OIT. | Possible Cause: Incorrectly set thermostat. | Remedy: Set thermostat so that the temperature inside the cabinet stays less than 105 degrees F (40 degrees C). The normal thermostat setting is 80-90 degrees F. |
| Possible Cause: Insufficient cooling caused by dirty air conditioner filter | Remedy: Disconnect power to the pumping station by turning the main power disconnect switch on the front of the panel to "off." Remove, wash, and reinstall the filter using the procedure described in the air conditioner manufacturer's Operator's |
Possible Cause: Other air conditioner failures, such as icing of the condenser coil, low refrigerant level, inoperative compressor or blower(s), or malfunctioning thermostat

Remedy: Should be repaired by a qualified HVAC service technician.

---

**Level Probes**

Level probes are used in “wet well” irrigation systems to ensure that the pumping station has adequate water. They do not ordinarily require maintenance. Probes can become encrusted with minerals or organic material as a result of normal operation. They should be removed and cleaned as necessary should this occur. They are made of stainless steel and can be cleaned with muriatic acid. If you suspect that the length of the level probes has been changed, compare their length to the design specifications listed on the System Data Sheet, included in your SyncroFlo Installation, Operation, and Maintenance manual.

---

**Motors, Contactors, and Relays**

Your pumping station has a variety of motors, contactors, and relays that serve various functions.

**WARNING: HIGH VOLTAGE. SHUT OFF POWER TO THE PUMPING STATION BEFORE TESTING OR SERVICING THESE COMPONENTS.**

Refer to “Troubleshooting Using the OIT” in Chapter 5 to diagnose most common electrical problems.

**Motors**

<table>
<thead>
<tr>
<th>Problem</th>
<th>Possible Causes</th>
<th>Remedy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Excessive motor vibration or overheating motors.</td>
<td>Bent shaft or worn motor. On older systems, these conditions may be an indication of normal wear-and-tear. On new systems, ensure that pumps are operating correctly and that on vertical turbine</td>
<td>Check system flow and pressure. Inadequate flow, closed valves, failed pumps or motors, power irregularities may cause motor overheating. Excessive vibration may be transmitted to the motor from a failed</td>
</tr>
</tbody>
</table>
systems, the turbine discharge head is bolted down evenly.

| Problem: Excessive noise from motors. | Possible Cause: Worn bearings. | Additional information about motors can be found in the manufacturer’s literature, reprinted in Chapter 12 of your SyncroFlo Installation, Operation, and Maintenance manual. Refer motor repair or rebuilding to a qualified shop. On vertical discharge turbine pumps, ensure that discharge head is bolted down evenly. |
| Problem: blue grease coming from motor. Grease looks new. | Possible Cause: motor manufacturer overgreased bearings. | Remedy: Self-correcting. If situation persists more than 6 months after initial startup, contact SyncroFlo |

**Contactors**

Contactors are specialized electrical relays that are used to start and stop motors. Normally two contactors are provided for each motor. Contactors use an electric coil to make or break an internal connection, or contact. While it is possible to disassemble and service contactors, often they are damaged beyond repair.

<p>| Problem: failed contactor | Possible Cause: Loose connection has caused arcing, resulting in overheating and melting of connectors. | Remedy: Replace contactor. Regularly inspect all contactors for clean, tight connections. |</p>
<table>
<thead>
<tr>
<th>Possible Cause</th>
<th>Remedy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lightning damage or overloaded motor has overloaded contactor, melting internal contacts.</td>
<td>Replace contactor.</td>
</tr>
<tr>
<td>Contactor has exceeded its service lifetime. Internal contacts are not making a good connection.</td>
<td>Replace contactor.</td>
</tr>
<tr>
<td>Failed coil (rare).</td>
<td>Coil may be serviced separately by a technician, but it is probably wiser to replace the entire contactor.</td>
</tr>
</tbody>
</table>

**Relays**

Many systems employ small auxiliary contacts that are mounted on the large motor contactors. These auxiliary contacts tell the Programmable Controller if a motor contactor is in the On or Off position. Most systems also use several other relays to control various functions.

Relays that have failed for whatever reason must be replaced.

**Motor overload relays** are usually adjustable. These relays should always be set to the full load current. Refer to the motor nameplate to determine the full load current. Do not include the service factor in setting this relay. For example, the relay for a 75 HP motor should be set to the amperage stamped on the motor data plate for the voltage being used. Note that more than one amperage rating may be listed on the motor nameplate, depending on the voltage used. Ensure that you use the amperage rating for the voltage that your system uses.

Many systems use a motor overload relay with a dial that must be pushed in, turned to the right, and locked to allow the motor overload alarm to allow auto-reset. Larger systems may not have this feature, and motors 75 HP and up should not be set for auto-reset.

**“Motor Saver” Power Monitor**

<table>
<thead>
<tr>
<th>Problem</th>
<th>Possible Cause</th>
<th>Remedy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Motor Saver failure: Status light red (older systems may have a different status light. Refer to the manufacturer’s literature,</td>
<td>Lightning strike or power surge.</td>
<td>Replace unit.</td>
</tr>
<tr>
<td><strong>Problem</strong>: Motor Saver shuts down system; system voltages seem to be correct.</td>
<td><strong>Possible Cause</strong>: Motor Saver adjusted incorrectly; power phase shift angle incorrect.</td>
<td><strong>Remedy</strong>: Adjust Motor Saver dial to match the nominal line voltage. For example, if your system runs at 460 volts, set the Motor Saver to 460 volts; check with your power provider for proper phasing from transformers.</td>
</tr>
</tbody>
</table>

---

**Operator Interface Terminal (OIT)**

This section may be useful in diagnosing OIT failures. For information about using the OIT, see Chapters 3 and 4.

The OIT has a replaceable battery but no other serviceable parts.

| **Problem**: OIT failure. | **Possible Cause**: Control panel doors were opened and water entered the OIT. The front face of the OIT is water resistant, but the rear of the unit is vulnerable to water. | **Remedy**: If you suspect that the OIT has been damaged by water, it must be replaced. This type of damage is not covered by the warranty. |
| **Possible Cause**: Poor connection between OIT and power supply or Programmable Controller. | **Remedy**: After shutting off power to the OIT and 24 V DC power supply, carefully inspect, clean, and tighten power and communication wires and cables to the OIT. |

**Problem**: Error Message reading “Cannot Connect to PCL”

**Possible Cause**: Communication cable not connected when OIT was energized (when system was turned on).

**Remedy**: Check communication cable, turn OIT power off; then turn power back on.

---

**Pressure Transducer**

The Pressure Transducer, located inside the control panel cabinet, transmits system pressure data to the system's control equipment. The output of the Pressure Transducer is a digital signal, making diagnosis of the unit difficult without specialized equipment.
Note: **Pressure transducers are quite fragile.** The can easily be damaged by over tightening their fitting or attachment screws, by dropping them, by freezing water, by immersion in water, or other events. Use caution when servicing or replacing.

No adjustments of the transducer itself are possible, but the transducer can be recalibrated or “zeroed” using the OIT. The only practical transducer field test is to check for output with the system running using the OIT.

<table>
<thead>
<tr>
<th>Problem: Pressure transducer failure</th>
<th>Possible Cause: Mechanical damage, electrical damage.</th>
<th>Ensure that the pressure transducer unit has power. A rough “pass/fail” test for the transducer is to check its output with a voltmeter, or better with an oscilloscope. Replace faulty units using the procedure below.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Problem: Pressure transducer failure</td>
<td>Possible Cause: Encrusted port or blocked tubing</td>
<td>Remedy: Remove transducer and clean port and tubing. Install using the procedure below.</td>
</tr>
</tbody>
</table>

### Pressure Transducer Removal and Installation

**Never disconnect or connect transducer power connection when the pumping station power is on.**

It is critical that the pressure transducer not be subjected to mechanical shock during removal, installation, or use. Two common causes of early transducer failure are incorrect handling and damage from freezing water (see winterizing instructions in your SyncroFlo Installation, Operation, and Maintenance manual.

**Always use two wrenches when disassembling or re-assembling the pressure transducer and its tube fitting connection.**

Remove a transducer by carefully disconnecting the fitting for the tubing that supplies the device with pressurized water using two wrenches; one to hold the pressure port and the other to loosen the compression nut of the tube fitting. The ball valve for the tubing should be set to the off position. Remove the two screws that hold the transducer to the control panel and lift the unit out of the panel.

Make a note of the position of any angle fittings or other extensions between the pressure tubing and the transducer fitting. These fittings will be installed on the new transducer in their final position to avoid damaging the transducer.

### Cleaning Pressure Transducer Tubing:
Used pressurized air or water to clear a blocked transducer tube.

The pressure transducer itself should not be immersed in water. Extreme care should be taken when cleaning a plugged transducer port to avoid putting stress on the transducer nipple.

**Installation:**

**Be extremely careful not to apply any twisting force to the pipe fitting nipple on the underside of the pressure transducer unit. Damage caused by improper procedures will not be covered under warranty.**

1. Begin the installation by replacing any angle fittings or extensions that may have been installed between the pressure transducer and the water supply tubing. Use Teflon tape or pipe sealant on the fittings. Angle fittings should be installed in the position that is as close as possible to their original position on the old transducer. It will not be possible to adjust the position later without damaging the transducer. **Always** use two wrenches when attaching any fitting to the pressure transducer. Use one wrench to install the fitting, and a second to hold the nipple on the transducer, making sure that no twisting force is applied to the nipple. The nipple is not firmly attached to the pressure transducer assembly and you will destroy the transducer if you apply torque to it.

2. Test the positioning of the angle fitting or extension by placing the transducer loosely into position in the control panel. Ensure that the angle fitting will line up easily with the tubing. If it is necessary to reposition the angle fitting, the pressure transducer should be removed completely from the cabinet and step 1 above should be repeated.

3. When the fitting is properly aligned, place the transducer into position and attach it to the cabinet. The attachment screws can be tightened without damaging the unit.

4. **Always** use two wrenches to attach the tubing. Use Teflon tape on fittings. Use one wrench to prevent the angle fitting from twisting (usually it is not possible to put the wrench directly on the pressure transducer fitting once it is installed in the cabinet). Use a second wrench to gently tighten the tubing fitting. It is not necessary to purge the tubing of air before installation.

5. **Turn off power to the pumping station** by setting the pump run switches to “off” and then setting the main disconnect switch on the control panel to the “off” position. The wire connector to the pressure transducer should never be plugged in with the power on. Gently plug in the connector. Restore power to the pumping station and set the pump run switches to “auto” for normal operation.
Pressure Transducer Installation, continued

6. With the ball valve to the pressure transducer tubing still in the closed position, use the OIT to calibrate the pressure transducer. The calibration procedure allows the pumping station to compensate for the altitudes at the location of the station. Zero pressure calibration is the only adjustment that can be made by the user. The procedure for calibration is outlined in tab 4 of your SyncroFlo Installation, Operation, and Maintenance manual.

7. Open the ball valve to allow pressurized water to enter the tubing to the pressure transducer. Press the gray button next to the “STATUS” label on the OIT to ensure that the transducer is transmitting pressure data.

Programmable Controller (PC)

The programmable controller is a solid-state, modular unit that has limited end-user serviceability. However, it has an internal battery that will fail after several years of service, and a replaceable program cartridge that can be replaced.

Normal operation is indicated when the “Power” light is green, (also a red power light should appear on the optional communication module), and the “Run” light is on. Input and output lights will be on when the PC is receiving input signals or when it has switched on an output device.

| Problem: Programmable Controller “BATT V” light is on. A “LB” low battery alarm may also appear on the OIT screen. | Possible cause: PC battery failure | Remedy: Replace battery using the procedure outlined below in the section “Replacing the Realtime Clock Battery.” This procedure is also in the manufacturer’s literature, reprinted in your SyncroFlo Installation, Operation, and Maintenance manual. |
| Problem: Programmable Controller “PROG E” light is on | Possible Cause: Program Error. | Remedy: If “BATT V” light is also flashing, replace battery (see above). If not, the PC may need to be replaced or reprogrammed. This error will also be triggered if the memory cassette was lost. |
removed or installed with the power on, which will irreparably damage the PLC.

<table>
<thead>
<tr>
<th>Problem: Programmable Controller “CPU E” light is on</th>
<th>Probable Cause: CPU error caused by faulty power supply, faulty ground, improper installation of an input or output device, or an input device has been installed which has a signal frequency shorter than the scan cycle of the PC.</th>
<th>Remedy: Attempt to reset the PC by switching the power to off, and then back to on. Check for loose or corroded connection to electrical ground. Check 24V DC power supply. If a non-standard input device has been installed, it must be replaced.</th>
</tr>
</thead>
</table>

PC Troubleshooting, continued

<table>
<thead>
<tr>
<th>Problem: PC appears to be functional; no error lights, but the PC fails to respond to an input or fails to control an output.</th>
<th>Probable Cause: Corroded contacts or loose contacts on an input or output line.</th>
<th>Remedy: Disconnect or switch off power to the PC. Inspect and carefully clean all input/output terminals on both the PC and the input or output devices.</th>
</tr>
</thead>
</table>

Problem: Overheating | Probable Cause: High temperature inside the control panel. | Remedy: Refer to the procedures in this manual for troubleshooting the air conditioner or heat exchanger. |

Replacing the Real Time Clock Battery

**Turn off** all power to the station before you attempt to replace the PC clock battery.

Next, open the control panel and find the PC. Remove the front cover of the PC module by carefully inserting a screwdriver or knife blade into the gap at the right side of the cover. The cover is held in place by two sets of tabs, one at the extreme right side of the cover and one set at the left. The battery can be gently removed from its socket and unplugged from the PC.

Insert a new battery. Plug the wire connector into its socket. Put the CPU cover back on, close the control panel door(s), and turn on the power.

Replacing the Program Cartridge
All programming for the PC is done by the factory. The program was tested and final adjustments were made at the factory, therefore changes in the field should not be necessary. If adjustments to the program are needed, they can be made by SyncroFlo and transmitted to you in a new program cartridge. SyncroFlo keeps a copy of the program at the factory, so any changes can be made and shipped quickly.

**Turn off** all power to the station, before you attempt to replace the PC program cartridge.

Next, open the control panel and find the PC. Carefully remove the front cover of the CPU (see “Replacing the Real Time Clock Battery” for instructions). To remove the cartridge, lift the removal handle out, then pull straight out. Insert the new cartridge into the socket, being careful to insert it firmly. Be sure the removal handle is folded down completely to the right of the cartridge. Put the PC cover back on, close the control panel door(s), and turn on the power.

**PC Switch Settings**

These switches are preset at the factory, so they should not need to be changed. If you want to check them, turn the power off first.

**RUN/STOP:** The switch to the left of the OIT communication cable, on the front of the PC enclosure under the plastic cover, should be set to the RUN position.

**Program Cartridge:** The switch on the program cartridge should be set to the “On” position. The PC cover must be removed to view this switch. See “Replacing the Program Cartridge” above for important instructions on removing and replacing the program cartridge.

**Communication Module**

An optional communication module is used to communicate with an IBM compatible computer so that the station can be monitored with the SyncroFlo EagleEye Software. If your station does not have a communication module, then one can be added by removing the small cover plate on the left end of the PC and plugging in the module.

The module should be wired for RS-422 communications. See the Mitsubishi FX-485ADP module owners manual for the proper connections. Assistance in choosing the necessary components for a communication link is available from the factory. You should obtain the assistance of a skilled technician or consultant (unless you have these skills) to install and configure the communication link.

**PC PROGRAM SETTINGS**
These values are permanently set at the factory in the PC program cartridge. They are provided here for information purposes only.

PM pump pressure start delay .......................................................... 2 seconds
PM pump minimum run time ............................................................ 1 minute
PM pump stop delay ........................................................................ 15 seconds
First main pump pressure start delay .............................................. 2 seconds
First main pump stop delay .............................................................. 30 seconds
Secondary main pump pressure start delay .................................... 5 seconds
Secondary main pump low system pressure start delay ................ 2 seconds
Secondary main pump 100% speed and low pressure start delay ...... 5 seconds
Secondary main pump 100% speed, flow, and pressure start delay ... 5 seconds
Accelerator override delay ................................................................. 30 seconds
Main pump minimum run times ........................................................ 5 minutes
Secondary main pump minimum run time override on high pressure delay 5 seconds
Secondary main pump stop delay ........................................................ 15 seconds
Main pump spin down delays ............................................................ 5 seconds
Minimum speed in inverter test or setup mode ................................. 0 percent
Heat exchanger off delay .................................................................. 1 second
Sequence shifting delays (after pump or inverter switches turned off) 5 seconds
Refill mode pressure check delay ...................................................... 2 seconds
Power failure alarm reset delay ......................................................... 30 seconds
Irregular power alarm reset delay ...................................................... 30 seconds
Low system pressure alarm delay ...................................................... 5 minutes
Low system pressure alarm delay per step in refill mode .................. 5 minutes
Low system pressure alarm delay total in refill mode ......................... 15 minutes
High system pressure alarm delay .................................................... 60 seconds
High flow rate alarm delay ............................................................... 5 minutes
Low level alarm delay ................................................................. 10 seconds
High panel temperature alarm delay ................................................ 5 minutes
Inverter trip alarm reset delay .......................................................... 30 seconds
Inverter trip alarm auto-reset limits .................................................. 3 trips in 15 minutes
Inverter line contactor on after inverter trip alarm delay .................... 2 seconds
Inverter failure alarm delay ............................................................. 1 minute
Inverter line contactor fault alarm delay ......................................... 5 seconds
Motor contactor fault alarm delays .................................................... 2 seconds
Pump failure alarm delays ............................................................... 10 seconds
Pressure transducer failure alarm delay ......................................... 30 seconds
Flow sensor failure alarm trips after .............................................. 10 main pump starts with no flow
PLC low battery alarm delay .......................................................... 10 seconds
PLC input failure alarm delay .......................................................... 1 minute
Display failure alarm delay ............................................................. 30 seconds
Alarm condition light flasher (on-off) ............................................... 3-1 seconds
Communication Data Format (11 Bit) ............................................. 8, Even,1
Communication Speed ................................................................. 2400 Baud
Strainer blowdown cycle start delay ............................................. 29 seconds
Strainer blowdown valve open time .......................................................... 20 seconds
Strainer blowdown valve close time .......................................................... 20 seconds

## Pumps

Note: Additional information on the pumps can be found in the manufacturer’s literature, reprinted in this Installation, Operation, and Maintenance manual.

<table>
<thead>
<tr>
<th><strong>Problem:</strong> Excessive water leakage around pump shaft stuffing box</th>
<th><strong>Possible Cause:</strong> Shaft packing loose.</th>
<th><strong>Remedy:</strong> Tighten packing. Use procedure in the SyncroFlo Installation, Operation, and Maintenance Manual.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Probable cause:</strong> Shaft packing age-hardened or compressed</td>
<td><strong>Remedy:</strong> Replace packing. Use procedure in the SyncroFlo Installation, Operation, and Maintenance Manual.</td>
<td></td>
</tr>
<tr>
<td><strong>Probable cause:</strong> Pump head shaft scored or cupped.</td>
<td><strong>Remedy:</strong> Replace headshaft, stuffing, box bearings, and packing. Use procedure in the SyncroFlo Installation, Operation, and Maintenance Manual.</td>
<td></td>
</tr>
<tr>
<td><strong>Problem:</strong> Excessive pump vibration.</td>
<td><strong>Possible cause:</strong> Discharge piping is binding, causing a strain in the piping.</td>
<td><strong>Remedy:</strong> Loosen the pump discharge head and piping. Realign to relieve strain.</td>
</tr>
<tr>
<td><strong>Possible cause:</strong> Plugged pump suction.</td>
<td><strong>Remedy:</strong> Inspect and clean suction strainer.</td>
<td></td>
</tr>
<tr>
<td><strong>Possible cause:</strong> Impeller partially plugged.</td>
<td><strong>Remedy:</strong> Remove and disassemble pump. Clean impeller.</td>
<td></td>
</tr>
<tr>
<td><strong>Possible cause:</strong> Pump worn.</td>
<td><strong>Remedy:</strong> Remove and rebuild or replace pump.</td>
<td></td>
</tr>
<tr>
<td><strong>Possible Cause:</strong> Pump column and shafting not plumb and properly aligned.</td>
<td><strong>Remedy:</strong> Shim station or pump to achieve proper level and alignment.</td>
<td></td>
</tr>
</tbody>
</table>

Note: Rebuilding or replacing pumps is best left to trained technicians

## Control Valves and Check Valves
Control Valves

Your pumping station is equipped with a number of butterfly or ball-valve type control valves. These require no regular maintenance other than “exercising” them regularly. If leaking, they should be rebuilt or replaced. Disassembly and rebuilding information is located in the manufacturer’s literature included under Chapter 12 of your SyncroFlo Operation, Installation, and Maintenance Manual.

Check Valves

Check valves require little or no maintenance, depending on water quality. However, if water quality is low, they may accumulate sediment on their seats which can cause leaking.

<table>
<thead>
<tr>
<th>Problem: Leakage can be heard from check valve area when pumping station is shut down.</th>
<th>Possible Cause: Check valve unable to close fully because of an obstruction on the valve seat, or because the resilient seat has separated from its seat location.</th>
<th>Remedy: Close isolation valves, remove check valve, disassemble, and clean seat. Refer to the manufacturer’s literature, reprinted in Chapter 12 of your SyncroFlo Installation, Operation, and Maintenance manual.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Problem: Newly installed check valve does not allow water to flow.</td>
<td>Possible Cause: Valve is installed backwards or isolation valve is closed.</td>
<td>Remedy: Ensure that the direction of flow as marked on the check valve matches the direction of flow through the pumping station. Most stations have check valves installed downstream of the pumps. Ensure that all water cut-off or isolation valves are open for proper station operation, as a closed valve may result in no-flow conditions that simulate a faulty check valve.</td>
</tr>
</tbody>
</table>

STATION RELIEF VALVE
The station relief valve limits the discharge pressure of the station while any main pump is running across-the-line (at full speed). The relief valve also protects the irrigation system from the shock created by a sudden halt in the flow rate, such as might occur following a power failure.

The relief valve should be set so that it maintains system pressure 10 to 15 PSI higher than the normal mode set point while a single main pump is running across-the-line. For an explanation of normal mode, see section 4. For instructions on checking the set points using the OIT, see section 3.

The pilot valve, piped to the side of the station relief valve, determines the pressure setting at which the station relief valve will operate. Turning the adjusting bolt clockwise increases the setting; turning it counterclockwise decreases the setting. A pressure gauge is provided below the pilot valve to aid in setting the relief valve.

Relief valve operation is also affected by its needle valves. As the needle valve is screwed in, the relief valve opens more readily, but closes more slowly. As the needle valve is unscrewed, the relief valve opens less readily, but closes more quickly. Fine tuning the needle valve is necessary to make sure the relief valve closes when the pressure returns to normal.

Some trial and error is required to adjust these settings. When the settings are correct, the relief valve works as follows: with the pressure maintenance pump running alone and at 0 GPM flow, some water may flow through the pilot valve or the relief valve will open slightly. With one or more main pumps running across-the-line at no flow, the relief valve should open more fully and maintain the proper pressure setting (as determined by the OIT). For testing purposes, close the station isolation valve to block all flow from the pumps. This will allow the pumps to reach full pressure at 0 GPM.

Note that the relief valve closes if the ball valve at its outlet tapping is closed. This feature is useful for setting or testing the relief valve. Use the following lists as guides if any problems occur.

**Troubleshooting the Relief Valve and Related Components**

<p>| Problem: System pressure low or relief valve does not close. Pressure not reaching the levels set on the OIT. | Possible Cause: Pilot valve set too low. | Remedy: Raise pilot valve setting. See procedures below. |
| Possible Cause: Needle valve screwed in (closed) too far. | Remedy: Adjust needle valve. See procedures below. |
| Possible Cause: Air inside relief valve cover. | Remedy: Use air bleed valve to remove. |</p>
<table>
<thead>
<tr>
<th><strong>Possible Cause</strong></th>
<th><strong>Remedy</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Air bleed valve open.</td>
<td>Close valve.</td>
</tr>
<tr>
<td>Station discharge valve closed.</td>
<td>Open valve.</td>
</tr>
<tr>
<td>Irrigation system not pressurized.</td>
<td>Ensure that there are no large breaks in irrigation system. If necessary, shut off one or more irrigation zones. OIT will automatically attempt to run station in Refill Mode to pressurize a drained system.</td>
</tr>
<tr>
<td>Ball valve(s) at Inlet and/or cover tapping(s) closed.</td>
<td>Ball valve should remain open during normal operation.</td>
</tr>
<tr>
<td>Strainer at the relief valve inlet tapping clogged.</td>
<td>Remove and clean strainer.</td>
</tr>
<tr>
<td>Obstruction under relief valve or pilot valve seat.</td>
<td>Disassemble relief valve and remove obstruction, or remove pilot valve and remove obstruction.</td>
</tr>
<tr>
<td>Leak in relief valve diaphragm.</td>
<td>Disassemble relief valve and replace diaphragm.</td>
</tr>
<tr>
<td>Bad relief valve or pilot valve seat.</td>
<td>Disassemble and replace relief valve seat, or disassemble and inspect pilot valve; replace pilot if seat is damaged.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Problem</strong></th>
<th><strong>Possible Cause</strong></th>
<th><strong>Remedy</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>System pressure too high or relief valve does not open</td>
<td>Pilot valve set too high</td>
<td>Adjust pilot valve. See procedures below.</td>
</tr>
<tr>
<td></td>
<td>Needle valve unscrewed (opened) too far</td>
<td>Adjust pilot valve. See procedures below.</td>
</tr>
<tr>
<td></td>
<td>Ball valve at outlet tapping closed</td>
<td>Ball valves should be open during normal operation.</td>
</tr>
<tr>
<td></td>
<td>Ball valve at cover tapping closed</td>
<td>Ball valves should be open during normal operation.</td>
</tr>
<tr>
<td></td>
<td>Inlet butterfly valve closed</td>
<td>Butterfly valves should be open during normal operation.</td>
</tr>
</tbody>
</table>
Station Relief Valve and Pilot Valve Adjustments

Refer to the OIT to determine what pressure settings have previously been set. For information on using the OIT, see section 3. The factory settings may have been changed. Factory settings are listed in the System Data Sheet, which is included in your SyncroFlo Installation, Operation, and Maintenance manual.

Station Relief Valve Diagram:

Note: On existing installations, first ensure that the station relief valve (1), pilot valve (3, not shown in its true position in the figure), needle valve (2, not shown in its true position in the figure), and the small “wye” strainer (5) for the pilot valve are and in good working order.

The Station Relief valve on a VFD Eagle pumping system is important to the protection of the irrigation piping.
Normally, the valve will open as the system pressure rises 15-20 psi above the “Normal Mode Set Point.” Once open, it should control the system pressure within a range of 10-15psi above the “Normal Mode Set Point.”

**The procedure to set the relief valve is as follows:**

1) Remove the lock nut from the speed control and turn the screw in (clockwise) until it bottoms out. Depending on the size of the valve typically 3", 4" or 6", the adjusting screw should be turned out 1 1/2, 2 or 3 turns respectively.

2) The control pilot, CRL, should be turned in until no more than 3/4" of threads are exposed. Use a correctly sized wrench to perform this adjustment and turn the screw slowly to avoid damaging the threads.

3) Close the station discharge isolation valve.

4) Turn on the pressure maintenance pump in the “hand” position.

5) Slowly unscrew the CRL adjusting screw until the valve opens and continue until the pressure indicated on the OIT is 12psi over the “Normal Mode Set Point.” Tighten the lock nuts.

6) Close the ball valve on the downstream side of the CRL forcing the relief valve closed. Once the pressure has risen to a high system condition, open the ball valve and confirm that the relief valve opens to once again reduce the system pressure.

The relief valve is now set approximately as it needs to be. However, fine tuning will need to be performed with the entire irrigation system connected to the pump station.

**Final adjustment is performed as follows:**

1) With the VFD operational, place one main pump in the “Hand” position with no flow demand in the field.

2) Using the OIT, press “speed control,” press “Toggle.” The pump that is running is now in “Manual Speed Control.”

3) Cursor right and increase the speed to 100%. Monitor the pressure and relief valve operation. It should rise as it did with the PM pump and open at or abut the system High Pressure Alarm Set-point. The pressure should then reduce to approximately 12 psi above “Normal Set Point.”

4) Adjust the CRL until this pressure is attained
5) Lower the pump speed until the valve closes being sure that it does before reaching “Normal Set Point.”

6) Increase the speed manually again until the valve opens then reduce it until it closes. The operation should be repeatable.

7) Small adjustments of the speed control and/or CRL may be necessary to fine tune the valve’s response. Make small adjustments slowly. Do not become frustrated at the valve response drifts. Go back to the original speed control and CRL setting if necessary and try again.

Each irrigation system performs differently. Elevation difference, various piping configurations and pressure control devices will cause different operation of the system relief valves. If proper control cannot be attained and all components are clean and functional, contact SyncroFlo Technical Service for assistance.

**Cleaning the Pilot Valve and Needle Valve Assemblies**

The pilot valve and needle valve assemblies should be regularly cleaned to ensure proper station operation. On most systems, the pilot valve and needle valve assemblies can be easily removed as a unit by closing their ball valves and disconnecting the inlet and outlet tubing. However, the pilot valve can be disassembled and serviced without removing it from the system.

Detailed servicing instructions are included in the manufacturer’s literature reprinted in your SyncroFlo Installation, Operation, and Maintenance manual.

The needle valve assembly occasionally requires cleaning. Remove the valve core and clean or polish the internal parts as necessary.

**Pilot Valve Wye Strainer**

A small “wye” strainer is usually fitted to these systems. With the ball valves leading to and from the pilot valve closed, remove the plug and remove the screen. Clean the screen. Open the supply valve briefly to purge the valve. Replace the screen and plug. Remember to reopen all ball valves. Bleed any accumulated air from the valve cover using the air bleed petcock provided.

**Station Relief Valve Servicing**

The station relief valve needs to be regularly serviced for proper operation, because sediment from the water supply can accumulate on top of the valve’s diaphragm, preventing valve movement.
Close the inlet ball valve to the pilot valve and remove the pipe plug in the top cover of the station relieve valve. Open the ball valve and allow water to flow for several minutes. Close the ball valve and replace the plug. Remember to reopen the ball valve.

Note that on some pumping stations, the relief valve is mounted so that the relief valve diaphragm is in a vertical position. In these cases it will not be adequate to clean the relief valve using the method described above. The top cover of the relief valve must be removed and the diaphragm carefully cleaned. This is an operation best left to a qualified technician. Refer to the manufacturer’s literature reprinted under tab 11 of your SyncroFlo Installation, Operation, and Maintenance manual.

### Variable Frequency Drive Problems

Your pumping station will be equipped with one or more electronic devices for speed control of one or more main pumps. This device is frequently referred to as an “inverter.” While it is sometimes known as a Variable Speed Drive, this manual used the term Variable Frequency Drive, because the drive is capable of controlling the speed of an AC motor by varying the frequency of the AC power.

The Inverter has its own diagnostic procedures. Most inverter failures will be detected by the inverter and a diagnostic code will be displayed on the LED monitor, located on the VFD’s front panel. A list of diagnostic codes can be found in the manufacturer's Instruction Manual, which is included in your SyncroFlo Installation, Operation, and Maintenance Manual.

To troubleshoot the VFD Inverter, use the troubleshooting flowchart found in the manufacturer's Instruction Manual, which is included in your SyncroFlo SyncroFlo Installation, Operation, and Maintenance Manual.

### Testing the VFD using the OIT

To test the inverter:
1. Turn the INVERTER MODE selector switch on the front panel to the “Off” position.
2. Reset any inverter alarms by pressing the RESET button.
3. Turn the INVERTER MODE selector switch to the TEST position. The inverter should run and respond to automatic or manual speed control. Refer to the station operation procedures in Chapter 3 under “Changing Settings.”
4. If no faults occur, turn the INVERTER MODE selector switch to the AUTO position to resume normal operation.

**Wye strainer**
<table>
<thead>
<tr>
<th>Problem: Wye strainer auto flush valve won't fully open or fully close (for stations with automatic wye strainer flush actuators only).</th>
<th>Possible Cause: Valve motor operator limit switches are out of adjustment</th>
<th>Remedy: Adjust limit switches.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Possible Cause: Strainer blowdown selector switch on control panel set to “off.”</td>
<td>Remedy: Set strainer blowdown selector switch to “on.” This is the correct setting for normal station operation.</td>
<td></td>
</tr>
<tr>
<td>Possible Cause: Faulty relay or ball valve motor.</td>
<td>Remedy: Check relay and ball valve motor and repair or replace as necessary.</td>
<td></td>
</tr>
<tr>
<td>Possible Cause: Bad connection on Programmable Controller or faulty Programmable Controller.</td>
<td>Remedy: After shutting off power to pumping station, inspect and carefully clean and tighten all PC terminals as necessary. If this does not correct the problem, refer to Programmable Controller troubleshooting.</td>
<td></td>
</tr>
</tbody>
</table>

| Problem: Low output to irrigation system; OIT indicates normal pressure but low flow. | Possible Cause: Plugged wye strainer. | Remedy: On systems with manual wye strainer valve, operate the blowdown valve to purge the strainer. On systems with automatic strainer valve, see troubleshooting section above. Remove strainer basket from Wye strainer body and clean as needed. |

**Service Notes**

Set the strainer blowdown selector switch to the “off” position when servicing the motorized ball valve (on systems equipped with this option). This cuts the power to the valve motor.

For more information about the wye strainer, refer to the manufacturer’s literature in the SyncroFlo Installation, Operation, and Maintenance manual, in Chapter 12.
5. Preventative Maintenance And Winterizing

If the station is located in a wet or dirty environment, or if the water being pumped is dirty, more frequent examinations and maintenance procedures should be followed.

The schedules below are represent the minimum recommended maintenance. Your system may require that these procedures be undertaken more frequently.

**Daily** – The station should be checked daily for proper operation.

- **Pressure and Flow Check**-- Using the OIT, check the performance of the system. A pumping station that is supplying water for part of a large irrigation system should have flow levels appropriate to the demand on the system. For example, in a system with four irrigation zones, the flow when only two zones are in operation should be about half the system capacity. You will have to learn from experience to estimate how much flow is appropriate given the operating conditions of your system.

- **General Inspection** – Look and listen to the system to ensure that every part is functioning properly. Listen for the starting and stopping of pumps at appropriate times. Look for leaks, excessive vibration, and unusual noises or smells, which may indicate problems with system components.

**Weekly** – In addition to the daily check above, do the following:

- Check pump packing leakage. The procedure for tightening the packing is provided in the pump manufacturer’s literature, reprinted in Chapter 8.
- Sweep down station and surrounding concrete foundation. Wipe down station with damp rag.

**Monthly** – In addition to the daily and weekly checks above, do the following:

- Remove and acid clean the pilot control valve strainer. The procedure for removing and replacing the strainer is provided in the valve manufacturer’s literature, reprinted in Chapter 10.

**Quarterly** – In addition to the daily, weekly, and monthly checks above, do the following:

- Inspect the station’s structural components for corrosion, wear and fatigue.
- Inspect and tighten all electrical terminations that can be isolated from primary
power source, (does not include motor lead connections).

Inspect and calibrate the pressure transducer. The procedure for calibration is included in the “Component Troubleshooting” section of Chapter 5.

Check operation of flow sensor. The procedure for removing, inspecting, and re-installing the flow sensor is included in the manufacturer’s literature in Chapter 12, and additional troubleshooting information is included in the “Component Troubleshooting” section of Chapter 5.

Close and re-open each isolation valves to ensure that they work properly. Open and close all drain valves to ensure that they work properly. Refer to the system diagram included in Chapter 1 to locate these valves.

Lubricate motors and pumps. Use the lubricants and procedures described in the motor and pump manufacturers’ literature, reprinted in Chapters 8 and 9.

Check the operation of the station. Shut the station down and allow the pumps to come to full stop. Restart the station and observe its performance as it reaches full system pressure. Note any deviation from normal operation, and refer to the appropriate troubleshooting section in Chapter 5.

**Annually** – In addition to the daily, weekly, monthly, and quarterly checks above, do the following:

Inspect the motor starter contacts by disassembling the starter contactors. If necessary, have a trained electrician perform this work. Replace contactors with badly pitted contacts or external connections.

Measure and record electrical system voltage at no load and near maximum electrical loading.

Using an ammeter, measure and record each pump motor current draw near shutoff head of pump and at normal pump operating pressure.

Disassemble, clean, and inspect the pilot valve. Adjust the valve using the procedure in the “Component Troubleshooting” section of Chapter 5. Additional information about the pilot valve is in the valve manufacturer’s literature, reprinted in Chapter 11.

Disassemble and clean or replace control valve pilot tubing.

Disassemble, clean and inspect the station relieve valve. Procedures for disassembly and reassembly are included in Chapter 11.
Disassemble, clean and inspect air release valve. Procedures for disassembly and reassembly are included in Chapter 12.

Touch up or repaint station as required.

Check the reservoir inlet screen (on stations with a wet well) using the following procedure:

Turn all pump power circuit breakers and H-O-A switches to the "Off" position. To inspect the screen, someone must swim down to the bottom of the wet well. Have the diver inspect reservoir inlet screen. Remove any silt buildup around screen. Remove any material clinging to screen mesh. Have the diver inspect the wet well. Remove any silt and/or foreign materials in the well.

Winterizing The Pump Station

The pump station is not designed or constructed to operate in freezing weather and should be winterized if extended freeze conditions are anticipated. Some of the most common types of freeze damage includes damage to the pilot valve assembly and the pressure transducer.

The recommended procedure for shutting down the station for the winter is as follows:

Turn all pump H-O-A switches to "Off" position.

Turn all pump power disconnects to "Off" position.

In systems with horizontal pumps, close the water inlet isolation valve(s).

Drain the system.

After all gauges read "zero":

Disconnect and remove all control valve hydraulic pilot assemblies. Store where there is no danger of freezing.

Open station relief valve cover air bleed cocks.
With a manual or electric pump, force into each control valve cover a mixture of 1/2 water and 1/2 antifreeze.

Disconnect the tubing and/or connections from the pressure transducer and blow out the tubing with compressed air.