

Field Troubleshooting Guide
For Models BF20, BF30, BF50
HS20, HS30 & HS50

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1. Safety Instructions

TO AVOID SERIOUS OR FATAL PERSONAL INJURY OR MAJOR PROPERTY DAMAGE, READ AND FOLLOW ALL SAFETY INSTRUCTIONS IN MANUAL AND ON EQUIPMENT.

THIS MANUAL IS INTENDED TO ASSIST IN THE INSTALLATION AND OPERATION OF THIS UNIT AND MUST BE KEPT WITH THE UNIT.



This is a SAFETY ALERT SYMBOL. When you see this symbol on the pump, the controller or in the manual, look for one of the following signal words and be alert to the potential for personal injury or property damage.



Warns of hazards that WILL cause serious personal injury, death or major property damage.



Warns of hazards that CAN cause serious personal injury, death or major property damage.



Warns of hazards that CAN cause personal injury or property damage.

NOTICE:

INDICATES SPECIAL INSTRUCTIONS WHICH ARE VERY IMPORTANT AND MUST BE FOLLOWED.

THOROUGHLY REVIEW ALL INSTRUCTIONS AND WARNINGS PRIOR TO PERFORMING ANY WORK ON THIS CONTROLLER.

MAINTAIN ALL SAFETY DECALS.



This controller is not designed for use around swimming pools, open bodies of water, hazardous liquids, or where flammable gases exist.



Do not use GFCI input power. This will cause nuisance faults.



Disconnect and lockout electrical power before installing or servicing any electrical equipment.



ELECTROCUTION HAZARD. CONTROLLER INPUT GROUND TERMINAL (GND) AND ALL EXPOSED METAL PIPING, INCLUDING PRESSURE TRANSDUCER CASE, MUST BE CONNECTED TO THE SERVICE ENTRANCE GROUND TERMINAL.

⚠ WARNING

All electrical work must be performed by a qualified technician. Always follow the National Electrical Code (NEC), or the Canadian Electrical Code, as well as all local, state and provincial codes. Code questions should be directed to your local electrical inspector. Failure to follow electrical codes and OSHA safety standards may result in personal injury or equipment damage. Failure to follow manufacturer's installation instructions may result in electrical shock, fire hazard, personal injury or death, damaged equipment, unsatisfactory performance, and may void manufacturer's warranty.

2. Identifying System Components

⚠ WARNING

Electrocution Hazard. Disconnect power from controller and wait 5 minutes for hazardous voltage inside to discharge before opening cover or touching any wires.

Figure 1: Controller Diagram

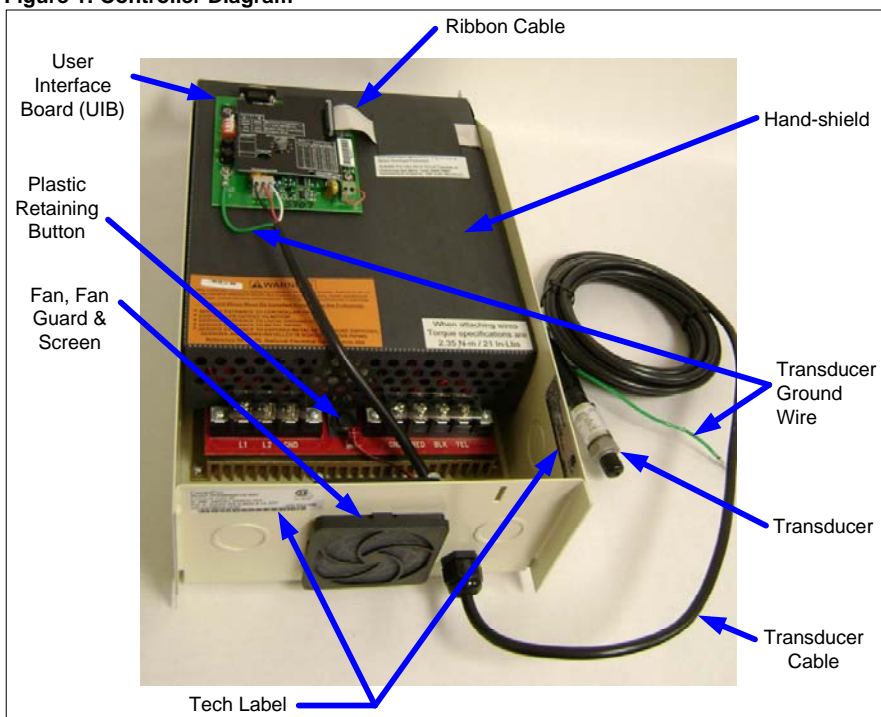


Figure 2 shows where to find the S/N and Software version on the Tech Label. Controllers built after 4/09 have duplicate labels on both the inside and the outside. Prior to that there is only the label on the outside.

Figure 2: S/N Label (Tech Label)



The serial number shown is broken down as follows:

```

E G 10 002 0 25700
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
+-----> Sequence number = 25700
+-----> R = Re-run thru mfg line e.g. reprogrammed
+-----> HP = 2
+-----> Mfg Year = 2010
+-----> Month G = July (*see note)
+-----> E = Mfg Plant

```

*Letter to month conversion: A,B,C,D,E,F,G,H,J,K,L,M = Jan, Feb, Mar, ... , Dec. Note that “I” is skipped.

3. Avoiding Over Voltage Damage From Generator

The maximum rated voltage of the controller is 265VAC. Some generators exceed this value by quite a bit. Voltages in excess of 265VAC will damage the controller.

To avoid damaging the controller, measure the generator voltage when nothing is connected to it. IF IT EXCEEDS 265VAC, DO NOT CONNECT THE CONTROLLER.

4. Two Red Blinks – Dry Well

4.1 Verify water level in well stays above suction inlet of pump.

4.2 If have R05B/C/D/E or F software - Update to R05H software

Use programmer kit 9K575 to update to R05H software. Be sure label on programmer says R05H

There is no update available for R03/4 software

4.3 Verify suction screen on pump is not plugged

4.4 Incorrect setting of “MAXIMUM SPEED” switch.

Be sure to set the “MAXIMUM SPEED” switch to 80 Hz when using mismatched pumps (water ends) and motors.

4.5 Lower setting of “MOTOR OVERLOAD SETTING” switch.

Ensure the Motor Overload Setting Switch is not set higher than the Service Factor Amps (SFA) listed on the motor nameplate. If set correctly and Dry Well is still tripping then try lowering the setting one click at a time until Dry Well stops tripping.

If the Motor Overload Setting switch is lowered too far, pump performance will begin to drop.

In controls with R05H or later software, it is possible to disable the Dry Well error completely (refer to the Advanced Settings in the instruction manual). The Dry Well protection should only be disabled for applications where a Dry Well condition is impossible such as pumping from a lake.

The controller will automatically restart according to the chart below.

Dry Well Fault reset table:

- Fault 1 (Start Point) - resets after 1 minute
 - Fault 2 - resets after 10 minutes
 - Fault 3 - resets after 20 minutes
 - Fault 4 - resets after 30 minutes
 - Fault 5 - resets after 60 minutes
 - Fault 6, 7, 8, ... Will repeat every 60 minutes.
- If power supply is disconnected, Dry Well will default back to the start point.

In controls with R05D or later software, the dry well restart time can be set to a fixed, 1 minute, duration.

Figure 3: Dry Well Restart Time

Dry Well Restart Time	Pushbuttons to Hold Down	DIP Switch to Flip	Direction to Flip DIP Switch
Increasing 1/10/20/30/60 min.*	Both	Top	Left to Right
Fixed 1 min.			Right to Left
*Factory Default			

4.6 Check for flow restrictions between pump and transducer.

Check valve stuck closed?

4.7 Air bound pump

Check if pump is air bound. Backpressure on check valve may be preventing air-bound pump from purging air. If problem is recurring, consider drilling air bleed holes in the discharge head check valve disc and in drop pipe below bottom check valve.

4.8 Set Dry Well Trigger to Default & Calibrate Dry Well Power Level

Applies to R04K/L/M and R05E or later software only. Ensure Dry Well Trigger conditions are set to factory default by pressing both pushbuttons for 10 or more seconds.

If Dry Well persists, calibrate Dry Well Power Level by holding down both pushbuttons until LED turns orange. This will calibrate the power level at which Dry Well fault occurs. Hold the pushbuttons for at least 3 seconds to get the LED to turn orange. The controller requires the pump to be running at least at 75% of full speed before allowing calibration. If the LED does not turn orange ensure the Max Speed switch is in the correct position (usually 60Hz). It may be necessary to flow more water and/or temporarily increase the pressure setting to get the pump speed to 75%. If power is not calibrated, the controller will use a default value based on the setting of the motor overload setting dial.

4.9 Lower Set-point so Pump can “Keep-Up”

Low pressure (below 75% of the set-point) is one of the conditions for Dry Well. Verify set-point is not higher than pump can maintain.

To ensure pump can maintain setpoint, try lowering the setpoint pressure. Do this by pushing and holding the Decrease pressure pushbutton until pressure begins to noticeably drop. Then let go of pushbutton.

4.10 Pump/Motor Failure

Pump or motor could be starting to fail. Controller is telling the motor to go full speed but for whatever reason, it is no longer pumping effectively and thus is not loading the controller. Test pump and motor using a separate controller to verify.

5. Three Red Blinks - Pressure Sensor Error

If the transducer signal (DC volts between black & white transducer wires) is outside the allowable range, a Sensor Error is displayed. Once the voltage returns to within the acceptable range, the error will clear automatically.

The acceptable range depends on which UIB is used.

Older UIB's before Switch Input was added:	0.4 – 4.5VDC
Newer UIB's (since 5/09) with Switch Input:	0.3 – 4.5VDC.

5.1 Vacuum at transducer & High Elevation

Too much vacuum at the sensor will cause a sensor error. Older UIB's are more sensitive to vacuum than newer ones. Look at the acceptable transducer signal voltage ranges above. Older UIB's would indicate a sensor error when the signal dropped below 0.4V whereas newer ones would not trip until 0.3V. The sensitivity to vacuum increases with elevation. If vacuum/elevation is the problem and the UIB is the older style (without Switch Input), then replacing it with a 9K533 UIB repair part will likely solve the problem.

A sensor error caused by vacuum/high elevation will often occur after a power outage. It usually has nothing to do with the power outage but rather, that the water pressure is lost and a slight vacuum sets-up at the transducer. To just get the system going, unscrew the transducer to relieve the vacuum. To fix permanently, correct the plumbing to prevent the problem or, if the UIB is the older style, you can also update the UIB to a 9K533.

5.2 Transducer cable not fully connected

Unplug and re-plug in the transducer cable at the transducer end. Check for loose wires where the transducer cable connects to the circuit board by tugging on each wire. It's also possible a wire could be broken in the cable.

5.3 Transducer cable mis-wired

Check that the wires are connected to the correct terminals on the UIB. The UIB is marked with "B R W" to show where to connect the Black, Red and White transducer wires.

5.4 User Interface Board (UIB) failed

The **DC** voltage between the Red and Black transducer wires should be 5VDC. If it isn't, try unplugging the cable from the transducer. If it is still not 5VDC replace the UIB. If software is R03 or earlier replace the UIB with 9K553 otherwise use 9K552.

If unplugging the transducer cable caused the 5VDC to come back, then try replacing the transducer first. Use transducer 9K518 for BF20 & BF30. Use 9K519 for BF50.

5.5 Transducer failed

With the transducer cable connected to the circuit board, measure the DC voltage between the black and white wires of the transducer cable at the transducer connector. The voltage measured should be between 0.5Vdc and 4.5Vdc . If it's a little low like between 0.3V and 0.5V, see 5.1 above regarding vacuum/elevation. Otherwise, replace the transducer. Use transducer 9K518 for BF20 & BF30. Use 9K519 for BF50.

6. Four Red Blinks - Bound Pump Error

6.1 Motor Overload setting not correct.

Verify Motor Overload is set as high as possible without exceeding the Service Factor Amps (SFA) of the motor. Look carefully at the dial, the highest setting is just to the left of the 12 O'clock position. The 12 O'clock position is the lowest setting. It is easy to place this switch in the wrong position. Figure 4 below shows SFA values for commonly used motors.

Figure 4: Motor SFA Values

Service Factor Amps 3 Phase Motors				
	230 Volt, 3Ø		200V, 3Ø	
HP	CentriPro SFA	Franklin SFA	CentriPro SFA	Franklin SFA
3/4	4.0	3.8	4.5	4.4
1	4.7	4.7	5.5	5.4
1.5	6.1	5.9	7.2	6.8
2	7.6	8.1	8.8	9.3
3	10.1	10.9	12.0	12.5
5	17.5	17.8	20.2	20.5

6.2 Too Fast Acceleration (Software Ramps)

If software in controller is R05B/C/D/E/F or G updating it to R05H could prevent bound pump errors. There is no update available for R03/4 software

6.3 Poor or Open Connection at Inductor Board Connectors

This applies only to BF50's with software R04 or earlier only. These BF50's were manufactured up through April 2009 (S/N ED09 and earlier).



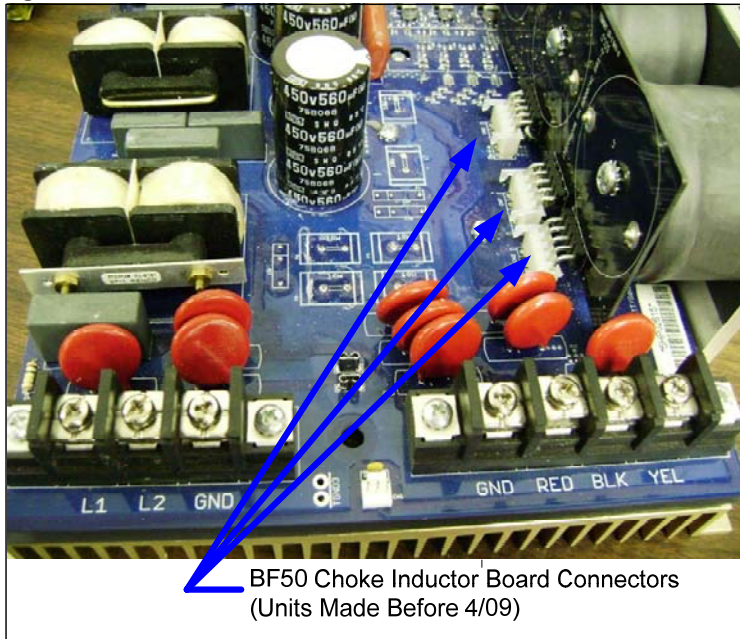
WARNING

Electrocution Hazard. Disconnect power from controller and wait 5 minutes for hazardous voltage inside to discharge before opening cover or touching any wires.

Look at the choke board connectors located under the hand-shield. To open the hand-shield, remove the (4) screws holding the UIB and pull out the Plastic Retaining Button using pliers.

If any of the white inductor board connectors (Figure 5) are turning brown or black that indicates a poor connection. This can cause "single phasing" of the motor and a bound pump or open lead error. There is no repair possible. The controller would need to be replaced.

Figure 5: BF50 Choke Board Connectors



BF50 Choke Inductor Board Connectors
(Units Made Before 4/09)

6.4 Wrong software Loaded

Loading R05 software into a controller that has R04 on the Tech Label will cause the controller to run the motor poorly, if at all, and will likely cause a bound pump or short circuit error.

6.5 Current Sensors on Main Board Drifting

This applies only to BF50's with S/N EL09 or earlier. If after running for a period of time under heavy load the amps or performance begins to drop erratically then it is likely the current sensors are bad. There is no repair. The controller would need to be replaced.

6.6 Wrong Motor Connected



WARNING

Electrocution Hazard. Disconnect power from controller and wait 5 minutes for hazardous voltage inside to discharge before opening cover or touching any wires.

The BF20, BF30 & BF50 controllers must be used with 3 phase 200-230V motors only. To verify the right motor is connected, disconnect the 3 motor wires from the control and measure the resistance between them.

The resistances phase to phase for a good 3 phase motor are all the same. If the measured resistances are not the same within a couple ohms, then it is a single phase motor, a damaged 3 phase motor or the wires are damaged.

Using an Ohmmeter set to the lowest scale, measure between two wires at a time. In addition to the motor winding resistance, you will be measuring the motor cable resistance.

Once it has been determined that the motor is 3 phase (phase to phase resistances all the same), then determine if it is the right voltage. Use the following motor and wire resistance charts to estimate the phase to phase resistance you should have. Do this by adding the motor resistance to the wire resistance.

Please note, the wire resistances shown include the wire out to and back from the motor so they are double what is typically shown in wire resistance charts. This is to make the math easy.

Figure 6: Motor & Wire Resistances

3 Phase CentriPro Submersible Motors Phase to Phase Resistance (Ohms)				Wire Resistance per 100 Ft	
HP	Motor Nameplate Voltage			Gauge	Resistance (Ohms)
	200V	230V	460V		
1	3.7	4.6	18.3	14	0.520
1 1/2	2.2	3.1	12.7	12	0.200
2	1.7	2.1	8.4	10	0.130
3	1.1	1.5	6.2	8	0.082
5	0.6	1.05	3.8	4	0.052
				2	0.032
Wire Resistance per 1000 Ft					
				0	0.197
				00	0.156
				000	0.124
				0000	0.098
Note: To simplify calculations, these resistances include both the wire out to and back from the motor. They are therefore twice the value of single length of wire normally found in wire resistance charts					

Example:

Well is 200 Ft from controller. Pump is set 300 Ft down the well. Buried cable is #12AWG, drop cable is #10AWG. Pump is supposed to be 2HP 230V 3phase.

Resistance measured between any two phase wires should be the same. Expected resistance is:

Motor		2.10 ohms
Buried cable	$200/100 \times 0.20 =$	0.40 ohms
<u>Drop cable</u>	<u>$300/100 \times 0.13 =$</u>	<u>0.39 ohms</u>
Total		2.89 ohms

If the motor in the well is actually single phase the resistances would not be the same between the wires. If it is 460V, the resistance would be about 9.2 ohms rather than about 3 ohms.

The resistances of the 200-230V motors versus the 460V motors is quite a lot so you don't have to be precise to make this judgment.

6.7 Electrical failure of the motor or motor cable.

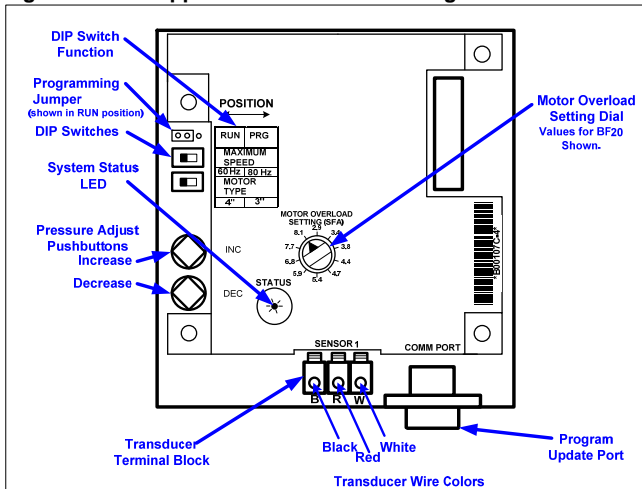
Verify cable and motor resistance as described in 6.6.

6.8 Mechanical binding from debris in pump.

6.9 3" Motor Selected

If UIB is the one pictured here in Figure 7, then make sure 4" motor is selected.

Figure 7: UIB Supplied w/BF Controls through 4/2009



7. Five Red Blinks - Short Circuit Error

7.1 Too Fast Acceleration (Software Ramps)

If software in controller is R05B/C/D/E/F or G updating it to R05H could prevent bound pump errors. There is no update available for R03/4 software.

7.2 Wrong software Loaded

Loading R05 software into a controller that has R04 on the Tech Label will cause the controller to run the motor poorly, if at all, and will likely cause a bound pump or short circuit error.

7.3 Failed Controller

With no motor wires connected to the controller, turn the power on and verify the controller displays 8 red blinks (open lead). If the controller displays 5 or 6 red blinks then replace controller.

8. Six Red Blinks - Ground Fault Error



WARNING Electrocutation Hazard. Disconnect power from controller and wait 5 minutes for hazardous voltage inside to discharge before opening cover or touching any wires.

8.1 Motor GND wire mis-wired

If this is the first time turning on the system, check to ensure the motor ground wire is connected to the "GND" terminal on the controller. In other words, make sure no ground wires are connected to the RED, BLK or YEL motor terminals.

8.2 Failed Controller

With no motor wires connected to the controller, turn the power on and verify the controller displays 8 red blinks (open lead). If the controller displays 5 or 6 red blinks then replace controller.

8.3 Insulation Failure in Motor Wires or Motor Itself

The wires connected to the RED, BLK & YEL terminals of the controller should have no conductivity to ground. Test the motor wires and motor insulation as follows:

- a. Remove the three motor wires from the RED, BLK & YEL terminals of the controller. Leave the ground wires from the service entrance and the motor connected to the GND terminals of the controller.
- b. Measure the resistance between each of the disconnected RED, BLK & YEL wires and the GND terminal of the controller. Preferably, use a megohmmeter for this measurement.

⚠ WARNING **Electrocution Hazard. A megohmmeter produces lethal voltage. Only a qualified electrician should use this instrument. Prevent others from touching wires while using a megohmmeter.**

⚠ CAUTION **The high voltage from the megohmmeter can damage the controller. Be sure the RED, BLK and YEL wires are NOT connected to the controller whenever using the megohmmeter.**

- c. If all readings are above 200K ohms, then the insulation in the motor wires and motor are OK. Otherwise, proceed to step (c) to determine where the insulation has failed; in the buried cable, drop cable or the motor.
- d. Leaving the RED, BLK and YEL wires disconnected at the controller, disconnect them also at the well head. Leave the green GND wire connected at the well head. Repeat the measurement done in step b. If resistance is below 200k ohms then the buried cable has an insulation failure.
- e. At the well head, measure the resistance between the disconnected RED, BLK & YEL wires going down the well and the ground wire. If all readings are above 200K ohms, then the wires and motor in the well are OK. Otherwise pull the pump/motor so the cable and motor can be tested separately.

9. Seven Red Blinks – Temperature Error

This fault can be caused by too high or low of a temperature. The ambient temperature limits are -4°F to 122°F. When the temperature returns to acceptable limits the controller will restart automatically.

9.1 Too Hot - Check the fan

When the controller is hot AND displaying 7 red blinks, the fan should be on. If the fan is not running under those conditions check the DC voltage on the Red & Black fan wires. If there is not 12VDC then unplug the fan and check again. If it still is not there then the controller must be replaced. If 12VDC is there, then replace the fan only. Fan repair kit is P/N 9K525.

PLEASE NOTE: The fan does not run all the time. When the controller is not hot, the fan will only turn on for a couple seconds each time the pump starts.

Vacuum the screen if it is dirty.

9.2 Too Hot – Shield from direct sunlight

Shield controller from direct sunlight.

9.3 Too Hot – Cover Missing

The cover must be installed for the fan to be effective. The cover, together with the hand-shield, force the air to flow across the main board components and the through the heat sink fins.

9.4 Too Cold

Take steps to ensure controller temperature does not drop below -4°F.

10. Eight Red Blinks – Open Lead Error

10.1 Have R05B/C/D/E/F or G software - Update to R05H software

Use programmer kit 9K575 to update to R05H software. Be sure label on programmer says R05H

There is no update available for R03/4 software

10.2 Check continuity of Motor Wires



WARNING **Electrocution Hazard. Disconnect power from controller and wait 5 minutes for hazardous voltage inside to discharge before opening cover or touching any wires.**

Disconnect the three motor wires (leave motor ground wire connected). Measure the resistance between each of the three possible pairs: Red & Black, Red & Yellow and Black & Yellow. The resistance values should all be the same and less than 25 ohms. If not, investigate why. Section 6.6 has additional information on motor and cable resistances.

Make sure motor ground wire is not mixed up with motor phase wires.

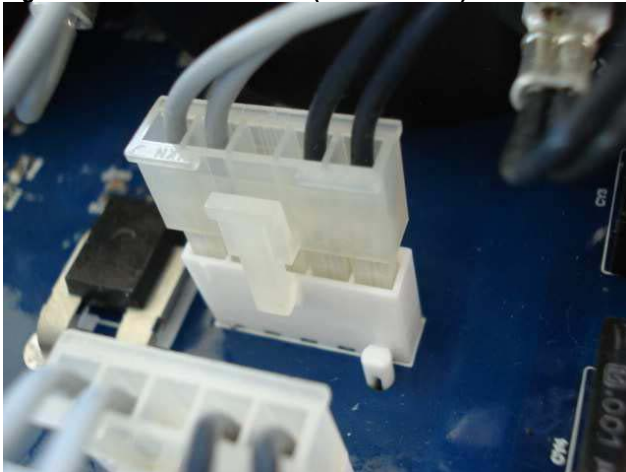
10.3 Poor or Open Connection at Inductor Board Connectors

See section 6.3

10.4 Connectors on Main Board Not Plugged In

Applies to units with R05 software only. Look at the white plastic connectors located under the hand-shield and verify they are completely plugged in. In the image shown, the connector is not fully seated. To open the hand-shield, remove the (4) screws holding the UIB and pull out the Plastic Retaining Button using pliers.

Figure 8: Main Bd Connectors (R05 and Later)



11. Nine Red Blinks – Broken Pipe Error

11.1 Low Pressure

This fault is caused by the pressure being 20 PSI below the set point for 30 seconds. If it is normal for the system to operate like this then the broken pipe protection switch should be turned off to prevent the error.

12. Ten Red Blinks – Calibration Error (factory only)

This code is not supposed to occur in the field. It indicates “calibration fail” during manufacturing. Calibration is initiated at the factory by shorting pins 2 & 3 of the COMM Port (2nd and 3rd holes from the left in the row of holes closest to the operator).

If this error occurs in the field, it may be caused by moisture or some other contamination on the User Interface Board causing those two signals to be shorted together. Replacing the UIB may solve the problem. Use 9K553 on older controls having only 2 DIP switches and 9K552 for controls having 4 DIP switches.

13. Eleven Red Blinks – Wrong Software (EEPROM Read Error)

This code will occur if R04 software is loaded into a controller with R05 on the Tech Label. Fix by loading the correct software.

14. Rapid Continuous Red Blinks – Calibration Pass (factory only)

See 12.

15. Solid Red – Replace Controller

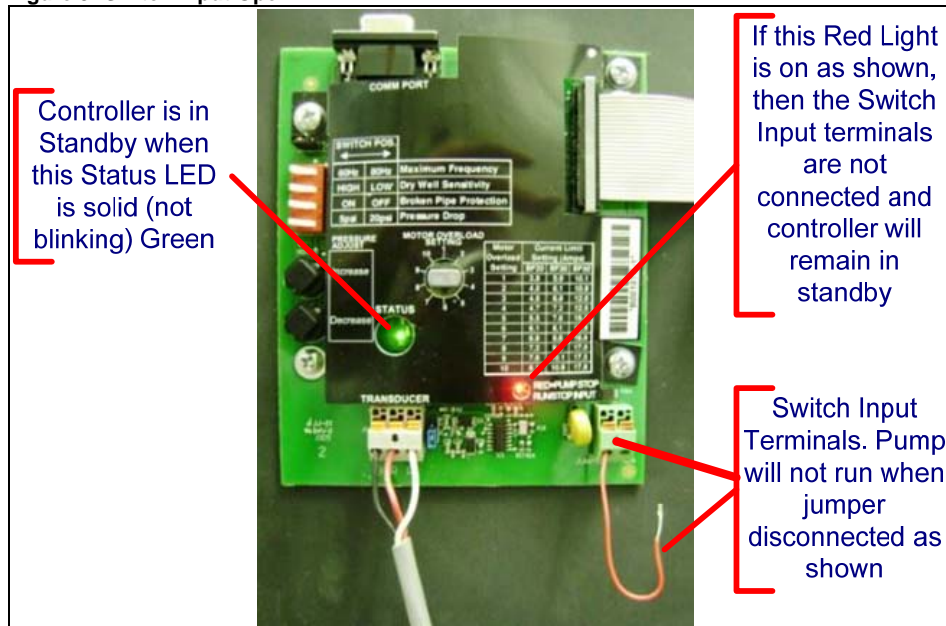
15.1 Have R05B/C/D/E/F or G software - Update to R05H software

There is no update available for R03/4 software

16. Won't Run, Solid Green Light

16.1 Switch input must be closed for pump to run

Figure 9: Switch Input Open



16.2 System pressure must be far enough below set-point to trigger restart

Set pressure drop switch to 5psi drop. Controllers built before 4/09 don't have this switch and are permanently set to 5psi drop. Open valves to allow pressure to go to zero.

If pump still does not start be sure transducer pressure is zero.

If Transducer jumper is in top position so no transducer is needed, then connect a transducer anyway but don't install the transducer in the pipe.



Explosion Hazard. Running pump with transducer not in pipe where it can sense pressure will cause the pump to run at full speed until switch input is opened or power is disconnected. This can create an explosion hazard of the pressure tank.

Protect tank and piping against overpressure by installing a properly sized pressure relief valve (PRV) able to pass full pump flow at the maximum working pressure of the tank. In finished basements or where PRV blow-off can cause property damage, pipe the PRV to a suitable drain

If pump still does not start, verify voltage across the white and black transducer wires is 0.5V when pressure at transducer is zero. If it isn't, replace transducer.

16.3 Failed UIB

User interface board may have failed in such a way that controller cannot detect low pressure. If UIB has two DIP switches, replace with 9K553 else, if it has 4 DIP switches, replace with 9K552.

16.4 Low voltage

Measure voltage across power input terminals L1 & L2. Voltage must be above 196VAC for pump to start.

16.5 Main Board Failure

If none of the reasons above apply, then the main board has probably failed. Controller must be replaced.

17. Won't Stop

For system to go into standby, pump, tank and check valve must work together to capture and hold peak pressure. The peak pressure must be above the set-point. A problem with the tank, check valve or a leak somewhere can prevent this from happening.

17.1 Tank Pre-Charge Not Correct

Incorrect tank pre-charge is one of the most common reasons for poor pressure control. Set tank pre-charge pressure according to following table. System pressure must be drained before measuring/setting pre-charge pressure.

Figure 10: Tank pre-charge

UIB Press Drop Switch Setting	Tank Pre-charge
5 PSI*	20 PSI Below Set-point Pressure
20 PSI	30 PSI Below Set-point Pressure

*Or if older controller where no pressure drop switch exists

17.2 Leaks in System

To test for a leak, turn power off to the controller and check system pressure. Tap on gauge to ensure it has settled. Wait 5 minutes and check the gauge again. Again tap on it to prevent it from sticking. Pressure should not drop at all. If it does, the leak must be found and fixed before proceeding.

17.3 Spring Check Valve Missing or Not Working

A spring check valve is needed between the tank and the pump. This valve is needed to ensure peak pressure is captured. A spring check valve closes immediately when flow stops. Check valves without a spring don't work because they require flow to reverse in order to close. The flow reversal causes pressure to drop.

17.4 Set-point too High

Push and hold the Decrease pressure pushbutton until pressure begins to noticeably drop. Then let go of pushbutton close valves and wait to see if pump stops. If pump stops it indicates that set-point was set higher than the controller/pump/motor could achieve.

18. Cycling too often

18.1 Tank pre-charge not correct

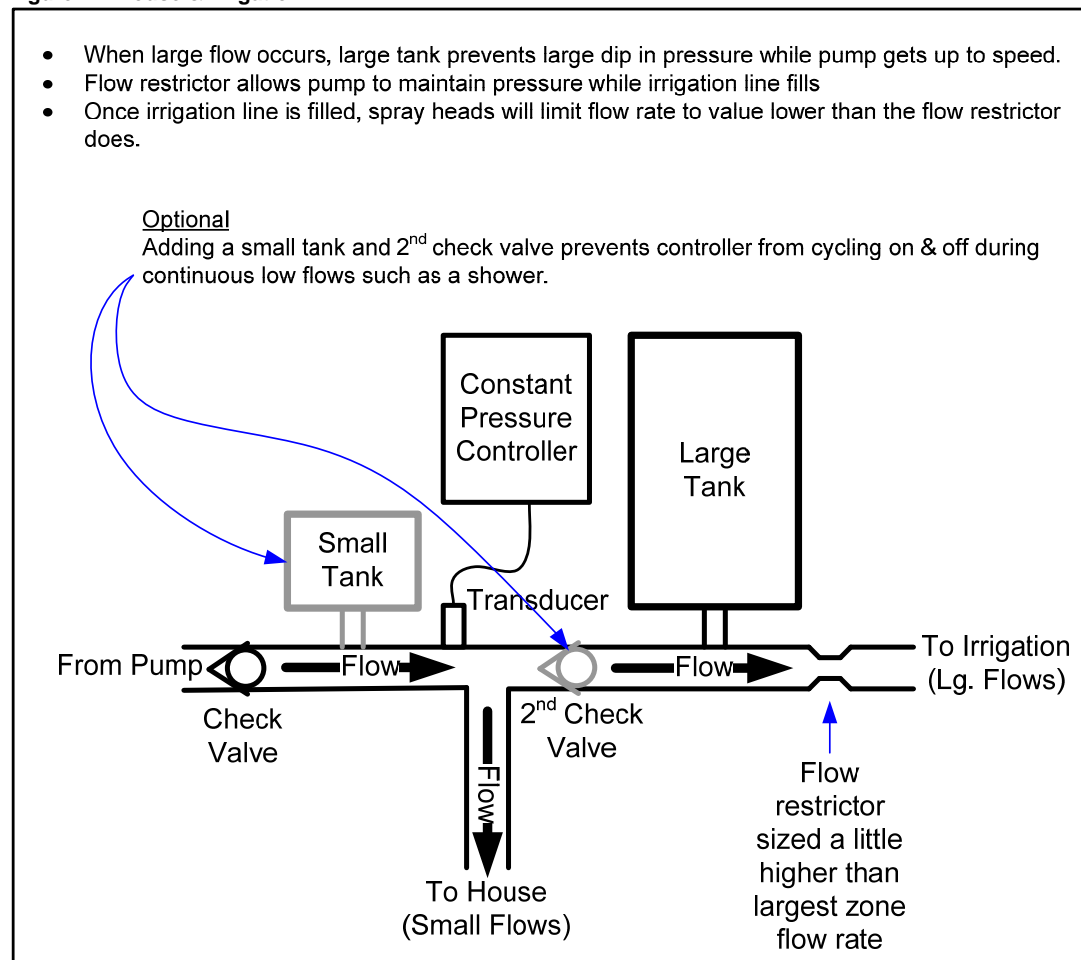
See 17.1

18.2 Tank too large

When an oversized tank is used, the controller will cycle on and off at low flow rates such as when running a sprinkler or shower. For a typical residential water system not having rapid jumps in flow the tank should be sized as shown in 24.

If the application has both low flow and rapid jumps in flow, then a two tank solution as shown in Figure 11 may be appropriate.

Figure 11: House & Irrigation



18.3 Pump Head Too High for Application

If at minimum speed (30Hz) the pump produces pressure close to or higher than the set-point, then it will overshoot the set-point and cycle off. To stop the cycling, raise the set-point or change to a lower pressure pump. Pump pressure at 30Hz is ¼ the shut-off pressure at 60Hz.

18.4 Supply voltage low or is a Poor Connection

Verify voltage on terminals L1 & L2 does not drop below 196VAC when pump turns on. If it does, check for loose connections at controller input or somewhere upstream of the controller.

19. Dry Well Not Tripping When Pump Runs Out of Water

The controller comes from the factory set to trip on Dry Well if BOTH pressure AND power drop.

- Pressure has to drop below 75% of set-point (37.5PSI for set-point of 50PSI)
- Power has to drop below a threshold value chosen based on the position of the Motor Overload Setting dial.

If either of these doesn't drop enough when the pump loses prime, then a dry well error will not be triggered

This situation (failure to trip on Dry Well) can occur when the pressure storage tank is so large that pressure takes a long time to drop or the power used by the pump does not drop enough when prime is lost.

Power not dropping when prime is lost is common for low flow high HP pumps like a 7GS20.

In controls with software prior to R04K/L/M or R05E, the only option is to try increasing the Motor Overload Setting to see if a power threshold where Dry Well will trip can be found. A small pressure tank would also be needed to help ensure pressure drops but there is no guarantee these can be made to work.

In controls with software R04K/L/M or R05E the Dry Well trigger conditions can be set to power only or pressure only as shown in the following figure. Instruction manual has more description on advanced settings.

Figure 12: Trigger conditions for Dry Well

No Water/Loss of Prime Trigger Condition	Pushbutton to Hold Down	DIP Switch to Flip	Direction to Flip DIP Switch
Low Pressure + Low Power*	Top	Top	Left to Right
Low Pressure Only			Right to Left
Low Power Only	Bottom		Left to Right
Disabled			Right to Left
*Factory Default			

20. No light

20.1 Low voltage

Measure voltage across input power terminal L1 & L2. Light does not turn on until this voltage is above 85VAC.

20.2 Ribbon Cable

Turn off power supply and check to ensure ribbon cable (see **Electrocution Hazard. Disconnect power from controller and wait 5 minutes for hazardous voltage inside to discharge before opening cover or touching any wires.**

Figure 1) is fully plugged-in at both ends.

20.3 Programming jumper in PRG position

Verify RUN/PRG jumper is in RUN position (covering left two pins) – See If the Transducer Jumper was used, be sure to note which two pins it was connected to. It is very important that it be returned to the same two pins. Failure to put the jumper on the correct pins can result in high pressure and possibly a pressure tank explosion.

Protect tank and piping against overpressure by installing a properly sized pressure relief valve (PRV) able to pass full pump flow at the maximum working pressure of the tank. In finished basements or where PRV blow-off can cause property damage, pipe the PRV to a suitable drain

Figure 22. If it was in the wrong position, power must be turned off for 5 minutes before restarting.

20.4 Main Board Failure

If none of the reasons above apply, then the main board has probably failed. Controller must be replaced.

21. Pressure Too Low

21.1 Pump is too Small

First compare actual performance against published data to determine if the pump is just too small for the demand.

21.2 Have R04G/H/J or R05D or later software (except R05H)

These versions of software have the problem where if you touch either pushbutton it will lock in the current pressure as the set-point. Experience has shown that this often causes a problem by locking in a too low set-point. To get the system running, reset the set-point to the factory default of 50PSI by doing the following:

- Disconnect the jumper on the switch input so controller stays in standby (solid green light)
- While in standby, press and hold both the Increase & Decrease pressure adjust pushbuttons for at least 10 seconds. This will reset the set-point to 50PSI.
- Reconnect jumper and **DON'T TOUCH PUSHBUTTONS** until system comes up to pressure.

At earliest convenience, update software to R05H using programmer kit 9K575. Be sure label on programmer says R05H. There is no update available for R03/4 software

21.3 Have R05H software

This is the latest software

Reset set-point pressure as indicated under 21.2

21.4 Motor running backwards



WARNING **Electrocution Hazard. Disconnect power from controller and wait 5 minutes for hazardous voltage inside to discharge before opening cover or touching any wires.**

Open some valves and note water pressure and current to the motor. Leave valves exactly where they are and turn power off. Swap any two motor wires. Turn power back on and note pressure and current again. Which ever wire positions provides the best pressure at the least amps is the one where the motor is turning in the right direction.

21.5 Low supply voltage

Measure supply voltage while pump is running. Supply voltage should be within +/- 10% of motor nameplate voltage. If motor is rated 230V, the supply voltage needs to be within 207-253V. If motor is rated 200V supply voltage needs to be within 180-220V.

21.6 Wrong software Loaded

Loading R05 software into a controller that has R04 on the Tech Label will cause the controller to run the motor poorly, if at all, and will likely cause a bound pump or short circuit error.

21.7 Current Sensors on Main Board Drifting

See section 6.4

21.8 Controller Too Hot

If the controller reaches it's thermal limit, it will gradually slow the motor in an attempt to reduce heating while continuing to supply water. Be sure cover is on. The cover helps direct the air flow from the fan across the heat sink.

21.9 Suction Screen Plugged

Debris can clog pump suction screen.

21.10 Static Level Drop

Pump may not be able to maintain set-point pressure as static level drops.

21.11 Motor Overload Setting Too Low

Set Motor Overload as high as possible without exceeding the motor nameplate Service Factor Amps (SFA). See Figure 4: Motor SFA Values

21.12 Pump Maximum Speed Set Too Low

For pump/motor applications where 80Hz maximum speed is required, be sure 60/80Hz switch is in the 80Hz position.

21.13 Wrong Motor

Verify motor is the right type and size. If original packaging from motor is no longer available to look at then use motor & wire resistance data in section 6.6 to determine what motor is in the well. Motor should be same voltage as voltage going into the controller +/-15%.

21.14 Restriction Between Pump And Transducer

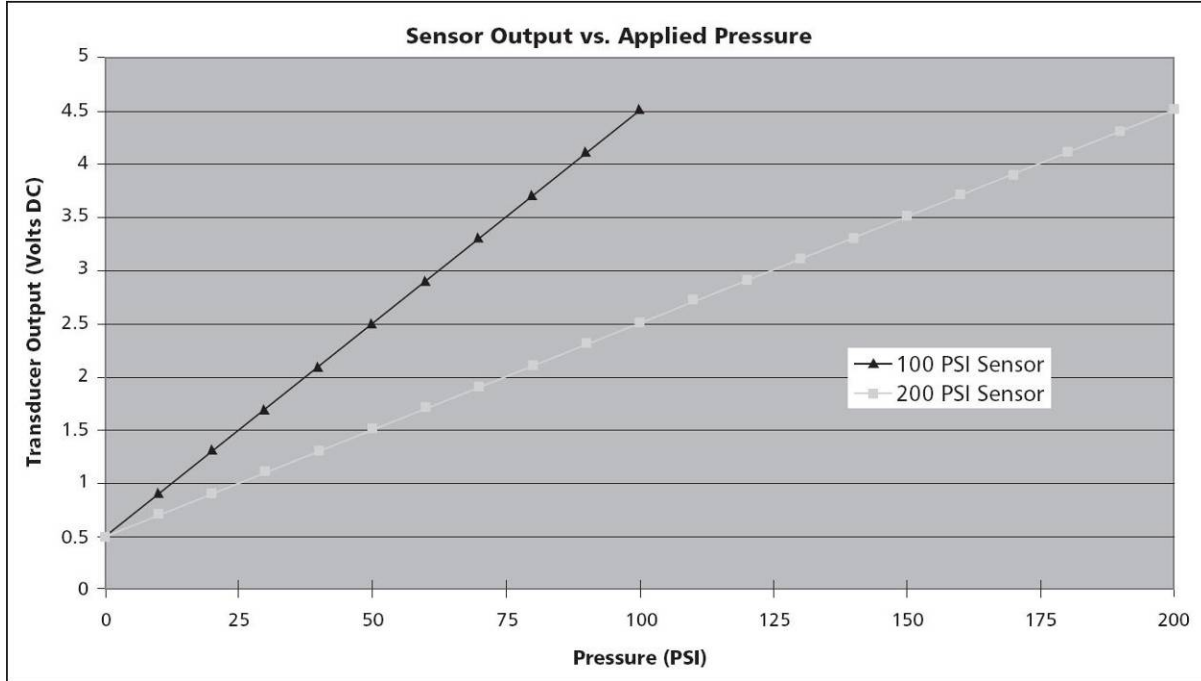
There could be a restriction in the pipe between the well and the transducer. To isolate and test the performance of just the pump, motor and controller, unhook the pit-less adaptor and hang it

on the side of the well casing. The system can be run in this state to verify maximum flow. Adding a valve and pressure gauge will allow a complete test to be done.

21.15 Pressure transducer failed

Check output of pressure transducer and compare to Figure 13.

Figure 13: Transducer Pressure Vs Voltage



21.16 Verify Using Right Transducer

For a BF50, the correct transducer is 9K519 (Transducer 9K518 would limit maximum pressure to 50PSI). See Figure 14.

Figure 14: Controller Pressure Range Versus Transducer

Transducer	Controller		
	BF20	BF30	BF50
9K518	20 - 85		5 - 50 10 - 50
9K519	40 - 170		10 - 100 20 - 100
9K520	60 - 255		15 - 150 30 - 150

22. Pressure Too High

22.1 Verify Using Right Transducer

For a BF20 & BF30, the correct transducer is 9K518 (Transducer 9K519 would cause a doubling in pressure). See Figure 14.

22.2 Verify Transducer is “Seeing” Pressure

If gauge displaying the high pressure is not located right at transducer then it may be seeing a higher pressure than the transducer is seeing. Put a gauge at the transducer.

23. Pressure Oscillations

23.1 Wrong Tank Size or Pre-Charge Pressure

Set tank pre-charge per section 17.1

23.2 Have R05B/C/D/E/F or G software - Update to R05H software

R05H has best pressure performance. Use programmer kit 9K575 to update to R05H software. Be sure label on programmer says R05H.

23.3 Have R04K, R04L or R04M software

There is no update available for R03/4 software

23.4 Transducer clogged

Ensure transducer is no-clog style. 9K518 for BF20/30, 9K519 for BF50.

23.5 Pump Head too High for Application

See section 18.3

23.6 Reduce Size of Pressure Variation

This is available in software R04K/L/M/R05E or later only. See Advanced Settings in the Instruction Manual.

Figure 15: Size of Pressure Variation

Pressure Variation	Pushbutton to Hold Down	DIP Switch to Flip	Direction to Flip DIP Switch
1 PSI	Top	2nd From Top	Right to Left
2 PSI*			Left to Right
3 PSI	Bottom		Left to Right
*Factory Default			

24. Excessive Pressure Drop When Flow Starts

24.1 Tank too Small, Pre-charge too High, Peak Flow too High

If tank is too small or the pre-charge too high, it won't have enough stored water under pressure to supply system until the pump gets up to speed.

For typical residential applications where changes in flow are not too fast, size the tank according the following table. Too small of a tank will result in the pressure dropping to zero before the pump can start. Too large of a tank will cause the controller to cycle on and off. If the application has both low flows and rapid jumps in flow, consider the system described in 18.2.

Figure 16: Tank Sizing

Table 1: Tank Sizing Selection			
Maximum Pump GPM	Recommended Tanks		
	Total Volume	Order No.	or Order No.
10	2	V6P	TP6P
23	4.5	V15P	TP15P
41	8.2	V25P	TP25P
70	13.9	V45	TP45
100	19.9	V60	TP60

Verify tank pre-charge according to 17.1

If it's a particular demand that is causing a problem like filling a sprinkler zone, a flow limiter placed in front of the zone could prevent the tank from bottoming out. See 18.2

24.2 Transducer clogged

Ensure transducer is no-clog style. 9K518 for BF20/30, 9K519 for BF50.

25. How to determine Setpoint

To determine the controller's pressure setpoint value, do the following.

- Make the controller go into standby (solid green light) by closing all faucets.
- Bleed the pressure off slowly while watching the pressure gauge. Some gauges tend to stick so tap on it to ensure it tracks the dropping pressure accurately.
- Setpoint pressure is 3 PSI higher than the gauge reading at which the pump starts. For example, if the pump starts at 47 PSI, then the setpoint is 50 PSI.

26. Fan not working

The fan is not supposed to run all the time. See section 9.1

27. Why Can't I Use of GFCI?

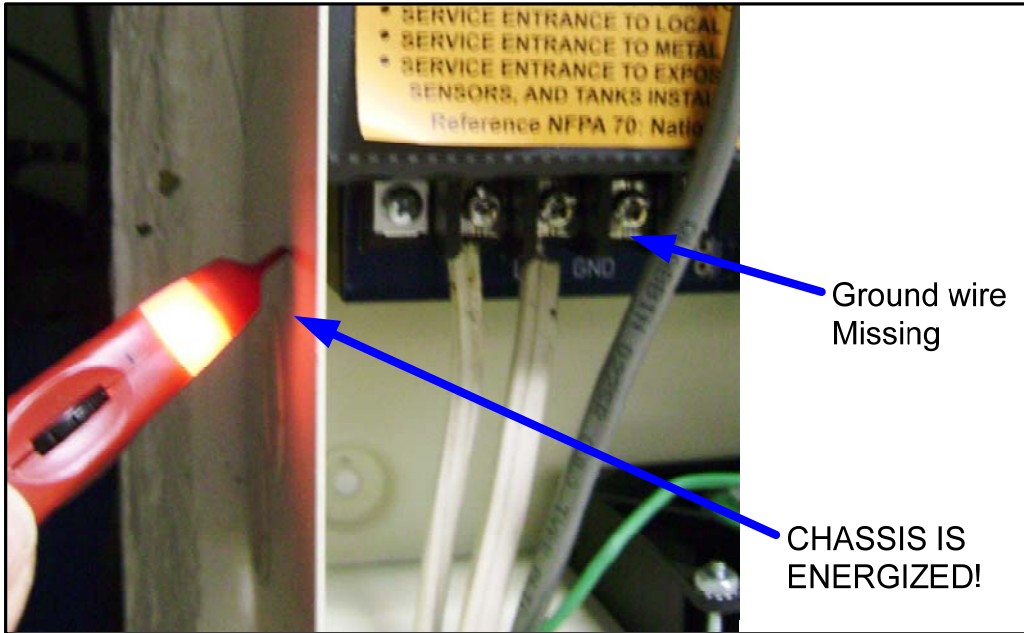
The emissions filters in the controller that reduce conducted and AM radio interference do so by shunting part of this high frequency noise to ground. This means that there is current flow in the ground wire. The current is usually around 12-16mA. A GFCI trips when more than 4mA is detected on ground.



WARNING

Electrocution Hazard. Failure to ground the system as described below will result in the chassis of the controller becoming energized.

Figure 17: Chassis Energized due to Missing Ground Wire



Verify all ground conductors are in place. Proper grounding is needed to ensure safety, protect the equipment and to prevent radio interference. NEC, Article 250 requires:

- A ground wire connecting the service entrance and local ground rod.
- A ground wire connecting the service entrance and controller GND terminal.
- A ground wire connecting the controller GND terminal and motor ground.
- A ground wire connecting the service entrance and any metal piping, pressure switches, pressure transducers, and pressure tanks.

28. Radio/Telephone Interference

28.1 Ensure Proper Grounding

See 27

28.2 Keep Motor Wires Separate From All Other Wiring

Keep motor wires 12" away from other wiring. Avoid running motor wires alongside other wiring. If wires must cross, do so at a 90° angle.

28.3 Check motor wires for insulation damage

Radio interference can be caused by current leaking to ground through damaged motor cable insulation. Use a megohmmeter to test the motor wire insulation as described in section 8.

28.4 Additional Measures

In cases where the above steps do not fully solve radio interference problems, a reactor can be connected in series with the motor wires. When deciding on a location for the reactor, be aware that it emits a whining noise, is not rated for outdoor use and needs to be located close to the controller.

Controller Model	Load Reactor P/N
BF20 (8.1A output)	KLR12BTB1 (12A)

BF30 (10.9A output) KLR12BTB1 (12A)

BF50 (17.8A output) KLR25BTB1 (25A)

29. Controller Making Buzzing Noise

29.1 BF20 & BF30 Controllers Date Codes prior to EJ07

BF20 and 30 controllers prior to EJ07 had inductors secured with nylon screws. These screws sometimes allowed the inductors to buzz. A repair kit P/N 9K524 is available with better screws that will reduce the noise.

29.2 Controllers w/R05 Software and Date Codes prior to EG10.

Starting with S/N Date code of EG10, output inductor windings are epoxied to reduce unit to unit variation in noise. No repair is possible in the field for controls that do not have the epoxy.

30. What if I Use an Old UIB on a newer Controller?

If an old style UIB with just two DIP switches is used on a controller having R04 or R05 software, then Broken Pipe protection is always on and 5PSI drop is always selected.

31. What if I use a new UIB on an old Controller?

You may use a UIB having 4 DIP switches on an older controller having R03 or earlier software ONLY IF THE BOTTOM 2 DIP SWITCHES ARE KEPT IN THE LEFT (open) POSITION.

32. Repair Parts

Figure 18: Repair Parts List

Description	Part #	Comment
100 PSI Transducer	9K518	Use with BF20, BF30
200 PSI Transducer	9K519	Use with BF50
BF20/30 Inductor Screw Kit to Reduce Hum Noise	9K524	Use with S/N EJ07 or earlier only
Fan Repair Kit	9K525	Verify problem is the fan see 9.1
10' Transducer Cable w/Ground wire and clamp	9K545	
15' Transducer Cable w/Ground wire and clamp	9K546	Factory supplied length starting 5/09
25' Transducer Cable w/Ground wire and clamp	9K547	Factory supplied length up until 4/09
50' Transducer Cable w/Ground wire and clamp	9K548	
100' Transducer Cable w/Ground wire and clamp	9K549	
150' Transducer Cable w/Ground wire and clamp	9K576	
200' Transducer Cable w/Ground wire and clamp	9K577	Lengths beyond 200' not tested
UIB for use with S/W Rev R04 or 5	9K552	
UIB for use with S/W Rev R01, 2 or 3	9K553	Works the same as 9K552 if bottom 2 DIP switches are in left position.
Programmer to update to current version of R05 S/W	9K575	Only use with controller having "S/W Rev R05..." on the Tech Label.
Pressure switch 20-120 PSI range	9K589	For overpressure protection connect to Switch Input on UIB.

33. Programmer Operating Instructions

33.1 Programmer Description

The programmer is used to update the software in a controller. It is a re-usable tool. There is no limit to how many controllers can be updated with one programmer. Programmers are made

with a specific software version in them. The version is shown prominently on the programmer label. The programmer pictured here has version R04J in it.

Figure 19: Programmer



33.2 Use the Correct Software for the Controller

Check the Tech Label on the controller (**Electrocution Hazard. Disconnect power from controller and wait 5 minutes for hazardous voltage inside to discharge before opening cover or touching any wires.**)

Figure 1 and Figure 2) to determine what software was originally loaded into the controller. **Only use software that is compatible.** Figure 20 shows what software versions are compatible with which models. In general, you would only want to use the latest version. For example, if you had a BF20 with R03G on the Tech Label, you would want to update it with R04K. **Using the wrong software will cause the controller to malfunction.** If the wrong software is mistakenly loaded, just reload the correct software.

Figure 20: Software Compatibility – Controls built after 9/07

Model	Software Versions
BF20	03D, 03G, 04A, 04D, 04G, 04K
BF30	03E, 03H, 04B, 04E, 04H, 04L
BF50	03A, 03B, 03C, 03F, 03J, 04C, 04F, 04J, 04M
ANY	05B, 05C, 05D, 05E, 05F, 05G, 05H

R05H is the only software update currently available..

33.3 Software Update Procedure



Electrocution Hazard. Disconnect power from controller and wait 5 minutes for hazardous voltage inside to discharge before opening cover or touching any wires.

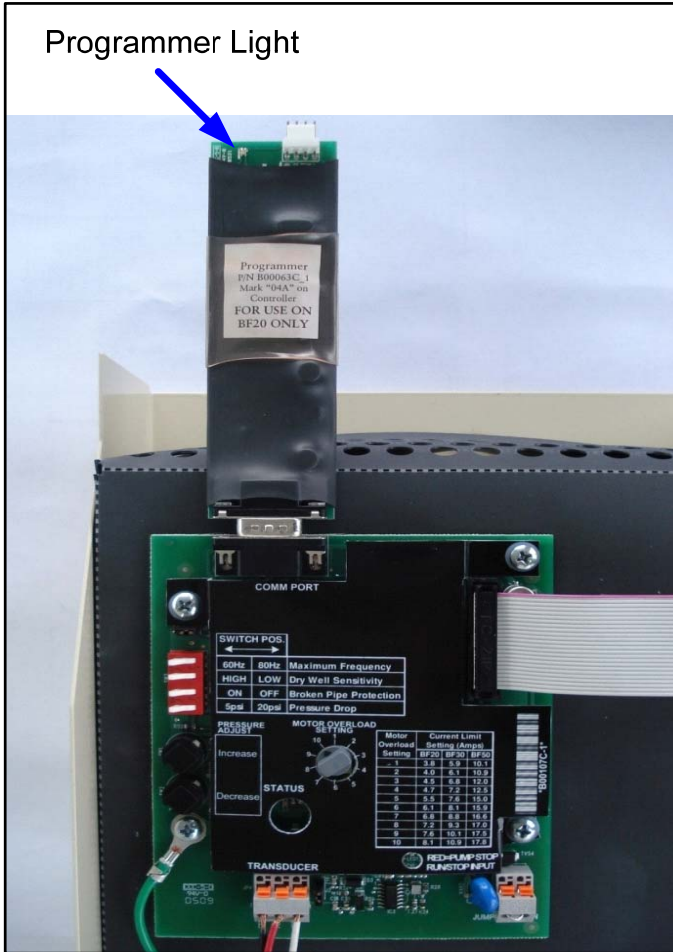
33.3.1 Disconnect Power to Controller & Wait

Disconnect power from controller and wait 5 minutes for dangerous voltages to discharge inside controller. Light

33.3.2 Connect Programmer to Controller

Open controller by removing screw at the bottom of the cover and sliding the cover up and off. Plug programmer into the COMM PORT as shown.

Figure 21: Programmer Connected to Controller



33.3.3 Plug RUN/PRG Jumper in PRG Position

If the Transducer Jumper was used, be sure to note which two pins it was connected to. It is very important that it be returned to the same two pins. Failure to put the jumper on the correct pins can result in high pressure and possibly a pressure tank explosion.

Protect tank and piping against overpressure by installing a properly sized pressure relief valve (PRV) able to pass full pump flow at the maximum working pressure of the tank. In finished basements or where PRV blow-off can cause property damage, pipe the PRV to a suitable drain

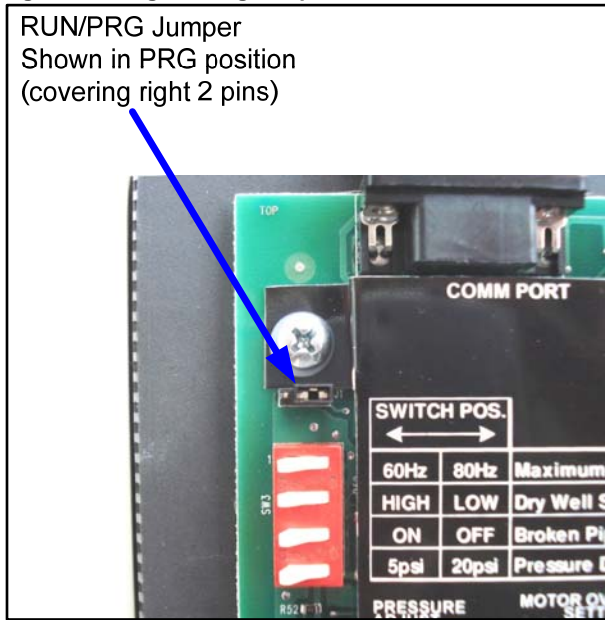
Figure 22 shows the location of the RUN/PROGRAM jumper. Place this jumper as shown so it is covering the right two pins (program position). If a jumper is not handy, the blue Transducer Jumper near the transducer terminal block can be borrowed temporarily.



WARNING If the Transducer Jumper was used, be sure to note which two pins it was connected to. It is very important that it be returned to the same two pins. Failure to put the jumper on the correct pins can result in high pressure and possibly a pressure tank explosion.

Protect tank and piping against overpressure by installing a properly sized pressure relief valve (PRV) able to pass full pump flow at the maximum working pressure of the tank. In finished basements or where PRV blow-off can cause property damage, pipe the PRV to a suitable drain

Figure 22: Programming Jumper



33.3.4 Power the Controller & Wait For Programming to Finish

Connect power to controller. Programmer light should blink green. Programming is finished when light stops blinking and stays on steady green (about 15 seconds). If light doesn't do as described, then see programmer troubleshooting 33.3.8.

33.3.5 Disconnect Power & Remove Programmer

The steady green light indicates programming is complete. Now turn off power and wait for light on programmer to go out. When it goes out it is safe to remove the programmer.

33.3.6 Remove RUN/PRG Jumper

Move the RUN/PRG jumper back to the left 2 pins or, if it was borrowed from the Transducer Jumper then be sure to put it back there.

⚠ WARNING If the Transducer Jumper was used, be sure to note which two pins it was connected to. It is very important that it be returned to the same two pins. Failure to put the jumper on the correct pins can result in high pressure and possibly a pressure tank explosion.

Protect tank and piping against overpressure by installing a properly sized pressure relief valve (PRV) able to pass full pump flow at the maximum working pressure of the tank. In finished basements or where PRV blow-off can cause property damage, pipe the PRV to a suitable drain.

33.3.7 Update Controller Label to Indicate New Soft. No.

Using a permanent marker, update the Tech Label(s) on the controller with the software number shown on the programmer label. Then, replace the controller cover.

Figure 23: Updating Tech Label with S/W Rev



33.3.8 Troubleshooting Programmer

While Programming

No light, orange light, or red light on programmer

- Verify controller has 230VAC at terminals L1 & L2 at bottom left hand of circuit board.
- Programmer not fully plugged in. Turn off power to controller and wait 1 minute. Make sure programmer is fully plugged in and start over at 33.3.4 above.

Continuous Red Blinking on Controller

- Be sure jumper is covering right 2 pins as shown in If the Transducer Jumper was used, be sure to note which two pins it was connected to. It is very important that it be returned to the same two pins. Failure to put the jumper on the correct pins can result in high pressure and possibly a pressure tank explosion.

Protect tank and piping against overpressure by installing a properly sized pressure relief valve (PRV) able to pass full pump flow at the maximum working pressure of the tank. In finished basements or where PRV blow-off can cause property damage, pipe the PRV to a suitable drain

- Figure 22. Verify position of jumper and retry programming starting at 0

After Programming

No light on Controller

- Verify the RUN/PROG jumper was removed (33.3.6).

10 Red Blinks

- This occurs when R04 software is loaded into a controller that is supposed to have R05 software. If the Tech Label says R05, Don't load R04 into it. If this occurs, just reloading R05 software will fix it.