Set Up Instructions for DVFP

Inspect the packaging of the equipment to confirm that nothing was damaged during shipping.

Remove the system from the packaging. Make sure everything is included and without damage. Below is a checklist with everything you should have received. The system will already be assembled and should arrive in one piece.

_____ 1) Pump (Figure 1)
_____ 2) Variable Frequency Drive (VFD) (Figure 2)
_____ 3) Pressure Tank (Figure 3)
_____ 4) Plumbing

Figure 1: Pump **Figure 2: VFD** **Figure 3: Pressure Tank**

Call Diamond H2O right away if anything is missing. Contact the freight company **immediately** if anything is damaged. Diamond H2O will not be liable for any damage received after shipping.

Packaged By: _____ Date: _____

Received By: _____ Date: _____

Table 1: System Specifications

Model Number	Motor (HP)	Suction	Discharge	Input Voltage	Wire Size[1] Input (AWG)	Circuit Breaker[2]	Generator (kVA)[3]
DVFP-10	1	2	1 ½"	230 V	14	15	3.4
DVFP-20	2	2	1 ½"	230 V	12	25	5.5
DVFP-30	3	2	1 ½"	230 V	12	25	5.5
DVFP-50	5	2	1 ½"	230 V	10	50	12.6

1. AWG will change depending on length of wire (values are for a max 300ft from input). 14 AWG wire can be used for any system using less than 100ft of wire from power supply.
2. With properly-sized circuit breakers, the Drive is protected from short circuit on the input and the output.
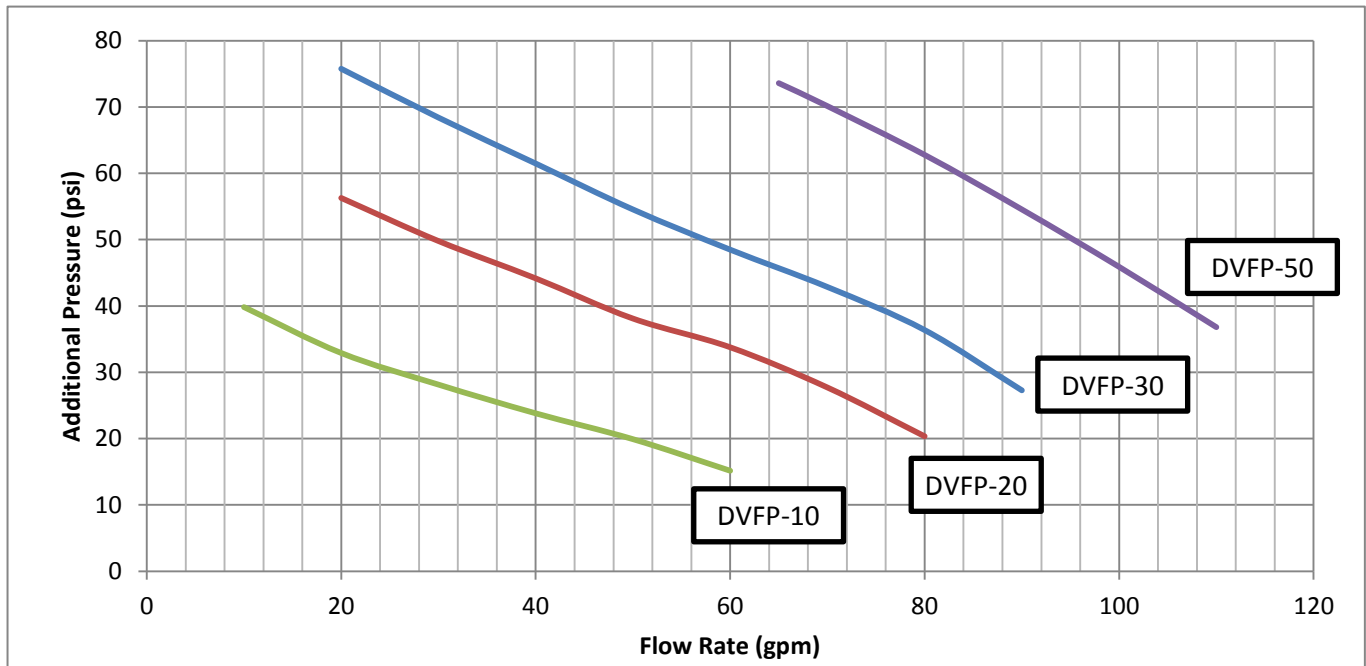3. Minimum 240V generator size.

Figure 4: DFVP Sizing Recommendations

Warnings

- All installation, service work, and inspections must be done by a **qualified electrician**. Risk of high-voltage electrical shock from EMI/RFI filter inside drive. Can shock, burn or kill if the front cover of the PENTEK INTELLIDRIVE is open or removed while power is connected to the Drive or the Drive is running. The front cover of the Drive must be closed during operation.
- Make all wiring connections, then close and fasten the cover before turning on power to drive.
- NEVER open the box when power is connected to Drive.
- **Before doing any service or maintenance inside Drive or when connecting or disconnecting any wires inside Drive:**
    A. DISCONNECT power.
    B. WAIT 5 minutes for retained voltage to discharge.
    C. Open box.
- Before starting any wiring or inspection procedures, check for residual voltage with a voltage tester.
- **NEVER…**
    - connect power wiring to Drive before mounting the box.
    - handle or service Drive with wet or damp hands. Always make sure hands are dry before working on Drive.
    - reach into or change the cooling fan while power is applied to Drive.
    - touch the printed circuit board when power is applied to Drive.

Warnings continued...

- Do not modify equipment.
- Do not use power factor correction capacitors as they will damage both motor and PENTEK INTELLIDRIVE.
- Do not remove any parts unless instructed to do so in Owner's Manual.
- Do not use a magnetic contactor on Drive for frequent starting/stopping.
- Do not install or operate Drive if it is damaged or parts are missing.
- Before starting Drive that has been in storage, always inspect it and test operation.
- Do not carry out a megger (insulation resistance) test on the control circuit of the Drive.
- Do not allow loose foreign objects which can conduct electricity (such as screws and metal fragments) inside Drive box at any time. Do not allow flammable substances (such as oil) inside Drive box at any time.
- Ground Drive according to the requirements of the National Electrical Code Section 250, IEC 536 Class 1, or the Canadian Electrical Code (as applicable), and any other codes and ordinances that apply.

Setup Instructions

1. **Place the System near a water source and a power source.**
   Decide where you would like to place the system. Ideally, it should be very close to the water source and within 25 feet of a circuit breaker. The VFD should be mounted on the wall with a few inches of clearance on every side of the VFD. This will allow free air flow to the unit.

2. **Connect the Pump to the Water Source**
   System piping should be at least one commercial pipe size larger than pump connections and flow velocity should not exceed eight (8) feet per second. In pool installation, flow velocity should not exceed six (6) feet per second. The inlet of the pump is shown in Figure 4.
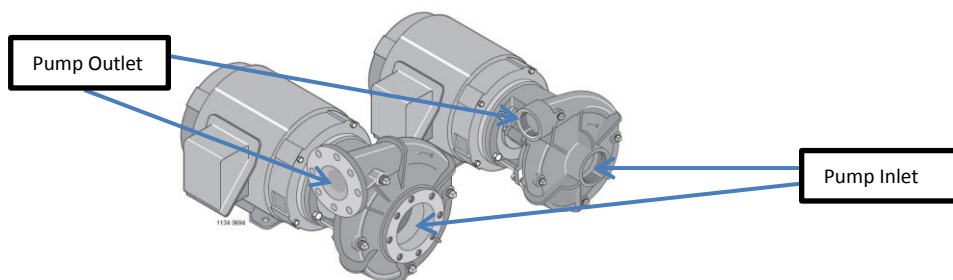   **Follow all local codes.**

Pump Outlet

Pump Inlet

Figure 5: Pump Diagram

A. Pipe or tube a line from the Water Source to the Pump Inlet.
   a. Take Care to align piping with pump case. Misalignment or excessive pipe strain can cause distortion of pump components resulting in rubbing, breakage, and reduced pump life.
B. Make sure there is no pressure on the connections.
   a. Support the pipe so it doesn't affect the connection to the pump.
   b. Check the pump alignment.
C. Follow the recommendations in Figure 6 when attaching the piping.
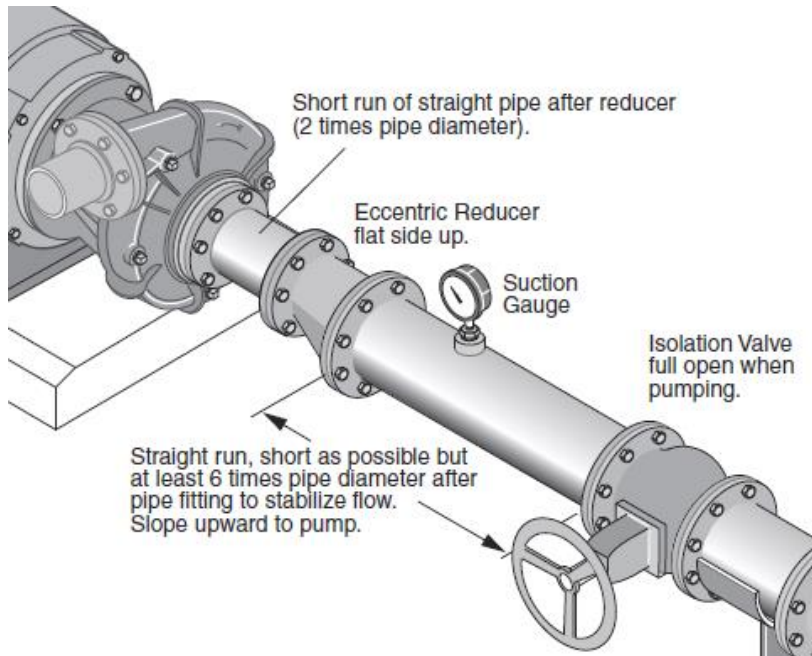
Figure 6: Plumbing recommendations

3. Connect the variable frequency drive (VFD) to the circuit breaker.
A. Carefully remove the cover from the VFD Enclosure
B. Inspect the system to verify the wiring is set up correctly.
   1. Check that the pump is wired to the U, V, and W lines of the VFD controller.
   2. Check that three wires are connected from the R, S, and T lines of the VFD Controller to the Fuse block.
   3. Check that three wires are connected from the fuse block to the rotary disconnect.
   4. Check that input voltage is 230V 3-Phase and is connected to the rotary disconnect.
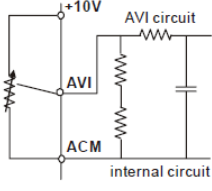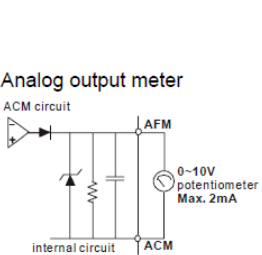
2.

4. 230V Power Supply

3.

Ground

1. U (T1), V (T2), W (T3)

pg. 5
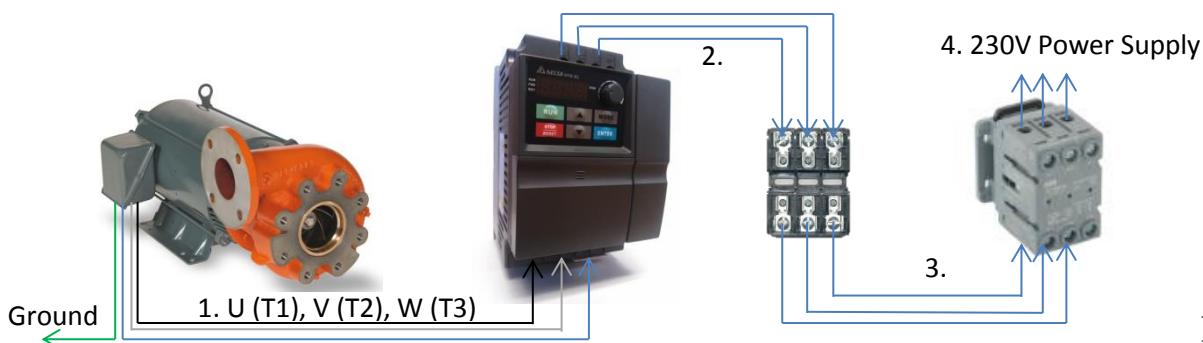
C. Connect the positive (red, DIN terminal 1) wire of the pressure transducer to the 10V terminal of the VFD, the negative (black, DIN terminal 2) wire to the AVI terminal of the VFD, and the ground wire of the pressure transducer to a ground.
D. Set the AVI/ACI switch to ACI.
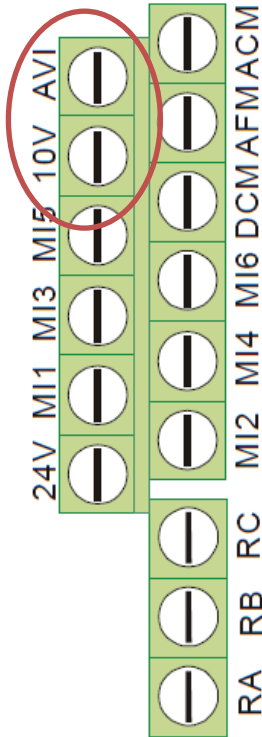
Terminal Symbol	Terminal Function	Factory Settings (NPN mode) ON: Connect to DCM	
MI1	Forward-Stop command	ON: Run in MI1 direction OFF: Stop acc. to Stop Method	
MI2	Reverse-Stop command	ON: Run in MI2 direction OFF: Stop acc. to Stop Method	
MI3	Multi-function Input 3	Refer to Pr.04.05 to Pr.04.08 for programming the Multi-function Inputs.	
MI4	Multi-function Input 4		
MI5	Multi-function Input 5	ON: the activation current is 5.5mA. OFF: leakage current tolerance is 10 μ A.	
MI6	Multi-function Input 6		
+24V	DC Voltage Source	+24VDC, 50mA used for PNP mode.	
DCM	Digital Signal Common	Common for digital inputs and used for NPN mode.	
RA	Multi-function Relay output (N.O.) a	Resistive Load: 5A(N.O.)/3A(N.C.) 240VAC 5A(N.O.)/3A(N.C.) 24VDC	
RB	Multi-function Relay output (N.C.) b	Inductive Load: 1.5A(N.O.)/0.5A(N.C.) 240VAC	
RC	Multi-function Relay common	1.5A(N.O.)/0.5A(N.C.) 24VDC Refer to Pr.03.00 for programming	
+10V	Potentiometer power supply	+10VDC 3mA	
AVI	Analog voltage Input (AVI circuit diagram)	Impedance: 47kΩ Resolution: 10 bits Range: 0 ~ 10VDC/4~20mA = 0 ~ Max. Output Frequency (Pr.01.00) Selection: Pr.02.00, Pr.02.09, Pr.10.00 Set-up: Pr.04.14 ~ Pr.04.17	
ACM	Analog control signal (common)	Common for AVI= and AFM	
AFM	Analog output meter (ACM circuit diagram)	0 to 10V, 2mA Impedance: 47Ω Output current: 2mA max Resolution: 8 bits Range: 0 ~ 10VDC Function: Pr.03.03 to Pr.03.04 **NOTE** The voltage output type for this analog signal is PWM. It needs to read value by the movable coil meter and is not suitable for A/D signal conversion.	

NOTE: Control signal wiring size: 18 AWG (0.75 mm^2) with shielded wire.

pg. 6

E. Connect the power to the VFD.
1. The VFD only accepts 230V three phase input power. Have a qualified electrician alter the supply voltage to 230V/3Ph before connecting the input power to the drive.

4. Set the Pressure Tank Pressure

The pressure tank should be set to 70% of the desired line pressure. For example, if the desired pressure was 60psi, the pressure tank should be set to 42psi.

5. Program the DVFP

❶ **Status Display**
Display the driver's current status.

❷ **LED Display**
Indicates frequency, voltage, current, user defined units and etc.

❸ **Potentiometer**
For master Frequency setting.

❹ **RUN Key**
Start AC drive operation.

❺ **UP and DOWN Key**
Set the parameter number and changes the numerical data, such as Master Frequency.

❻ **MODE**
Change between different display mode.

❼ **STOP/RESET**
Stops AC drive operation and reset the drive after fault occurred.

The VFD for the DVFP is programmed using a set of parameters. Each parameter is represented with a group and a number separated by a decimal. There are 11 groups of parameters. Each group is listed on the next page.

Group   Number

<u>**Parameter Groups**</u>

Group 0:   User Parameters
Group 1:   Basic Parameters
Group 2:   Operation Method Parameters
Group 3:   Output Function Parameters
Group 4:   Input Function Parameters
Group 5:   Multi-Step Speed Parameters
Group 6:   Protection Parameters
Group 7:   Motor Parameters
Group 8:   Special Parameters
Group 9:   Communication Parameters
Group 10:   PID Control Parameters

The VFD has 6 display modes. You can cycle through these modes by pressing the [MODE] button.

The display modes from left to right are the AC drive Master Frequency (F), the output frequency at terminals U/T1, V/T2, and W/T3 (H), the output current at terminals U/T1, V/T2, and W/T3 (A), the User Defined Unit (where U = F x Pr.00.05) (U), the forward/reverse display (Frd), and the parameter setting display.

The [▲] and [▼] keys can be used to adjust the each display. For example, in the Master Frequency display mode, you may increase or lower the master frequency.

To program a parameter:
A. Hit [ENTER] from any display mode
B. Use the [▲] and [▼] keys to select the parameter group, then hit [ENTER]
C. Use the [▲] and [▼] keys to select the parameter number, then hit [ENTER]
D. Use the [▲] and [▼] keys to select the parameter value, then hit [ENTER]
E. The display will either show "End" for success or "Err" for error.

To Exit programing, hit [MODE] until you reach the display mode.

The program guide in section 6 defines all of the parameters. Only a few will need to be changed for the DVFP Series. This section will show what needs to be programmed from factory settings. The programming guide in Table 2 shows which parameters will need to be changed.

pg. 8

Table 2: Parameters for DVFP set to 60psi

Group	Number	Explanation
00.03	3	Start-up display is the content of user-defined unit.
00.04	8	User-defined: Simultaneous display of PID set-point and feedback signal.
00.13	1000 (100.0)	It is used to set the position of decimal point of Pr00.13 (user-defined value 1 which corresponds to max. frequency). Set Pr00.13 to 1000 and Pr00.14 to 1,
00.14	1	100.0 will be displayed (Corresponding to 100 psi).
1.00	60Hz	
1.01	60Hz	Berkley 5HP, 3600 RPM, 230/460 V, 3Ph, 1-1/2" out x 2" NPT in
1.02	230V	
1.09	0.5s	Acceleration Time 1, adjust according to system requirement. Set as short as possible without OC.
1.10	5.0s	Deceleration Time 1, adjust according to system requirement. Set as short as possible without OV.
1.12	5.0s	**Deceleration Time 2** When the pressure reaches the set point (deviation <Pr10.22 for Pr10.23 time), the AC Motor Drive will decelerate to stop and this deceleration time is the setting of Pr01.12. Do not set shorter than Pr01.10! See also Pr10.22 and Pr10.23.
2.00	0	Frequency source command is digital keypad UP/DOWN.
2.01	0	Operation command by digital keypad RUN/STOP keys.
10.00	1	PID set point is set by the digital keypad (set Pr02.00=0 or 4).
10.01	3	Negative PID feedback from external terminal ACI (4~20mA).
10.02	1.2	
10.03	0.7s	Adjust according to application requirement.
10.04	0s	
10.10	1.0	Because the feedback pressure sensor is 0~100psi but used in the 0~100psi range, the gain must be 100/100=1.0.
10.12	50.0%	When the pressure feedback value is less than 10psi (absolute value |60psi-100psi*50%|) for longer than 15s, the AC Motor Drive will act according to
10.13	15.0s	Pr10.20.
10.18	100.0	PID control detection signal reference is set to 100psi. For display purpose only.
10.19	1	Parallel PID calculation mode is suitable for constant pressure water supply control.
10.20	3	Due to water supply suspension or in case of an abnormal feedback value, the pump will ramp to stop and restart after 1800sec=30min. This action is repeated
10.21	1800s	until the feedback value is normal again.
10.22	10%	**Constant pressure control parameters**
10.23	10s	When the deviation (difference between feedback value and set point) exceeds 5% of the set-point, in this case 60psi*10%=6psi, or when the feedback value is >54psi for longer than 10s, the AC Motor Drive will decelerate to stop with the deceleration time acc. to Pr1.12. When the feedback value becomes <54psi again, the AC Motor Drive will start to run.
10.24	20%	**Liquid leakage control parameters**
10.25	4%	When the AC Motor Drive is in constant pressure status and the feedback changes less than 60psi*4%=2.4psi in 2 seconds, the AC Motor Drive will not run until the feedback value becomes lower than 60psi- 20%*60psi=50psi. When the AC Motor
10.26	2s	Drive is in constant pressure status and the feedback changes more than 60psi*4%=2.4psi in 2 seconds, the AC Motor Drive will start to run, also if the level of 50psi is reached or not.

Once all of the parameters have been updated, the target pressure needs to be set. Cycle through the display modes until the user display is reached (shown below). The set point (in psi) will be shown on the left, and the feedback value (in psi) will be shown on the right. Here, you can adjust the target pressure to your value by using the ▲ and ▼ keys. The system has been set to read between 0-100psi. Use the arrow keys to set the value to 60.

Set Point   Feedback Value
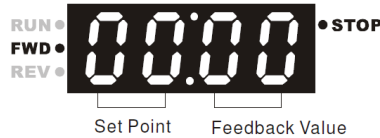
6. Start up the system for the first time.

Prime the Pump

The pump must be primed (completely filled with water) before it is turned on. Running the pump without water could cause the pump to overheat and get damaged. The DVFP was designed to be added to a pressurized water line. To prime the pump:

A. Open the air vent (or pipe plug) in the highest tapped opening in the pump case.
B. Open the inlet isolation valve, allowing water to fill the pump slowly and completely to force all the air out through the vent.
C. Rotate the shaft slowly to allow any trapped air in the impeller to escape.
D. Close the vent opening when water without air emerges.

7. Start the system

A. Once the system has been programmed and installed correctly, press the **RUN** button to start the system.

B. Once the system is running, very little maintenance should be required. Press the **STOP RESET** button if anything does not run correctly.

6. Program Guide

⚟: The parameter can be set during operation.

Group 0 User Parameters

Parameter	Explanation	Settings	Factory Setting	Customer
00.00	Identity Code of the AC motor drive	Read-only	##	
00.01	Rated Current Display of the AC motor drive	Read-only	#.#	
00.02	Parameter Reset	0: Parameter can be read/written 1: All parameters are read only 8: Keypad lock 9: All parameters are reset to factory settings (50Hz, 230V/400V or 220V/380V depends on Pr.00.12) 10: All parameters are reset to factory settings (60Hz, 220V/440V)	0	
⚟00.03	Start-up Display Selection	0: Display the frequency command value (Fxxx) 1: Display the actual output frequency (Hxxx) 2: Display the content of user-defined unit (Uxxx) 3: Multifunction display, see Pr.00.04 4: FWD/REV command	0	
⚟00.04	Content of Multi-function Display	0: Display the content of user-defined unit (Uxxx) 1: Display the counter value (c) 2: Display the status of multi-function input terminals (d) 3: Display DC-BUS voltage (u) 4: Display output voltage (E) 5: Display PID analog feedback signal value (b) (%) 6: Output power factor angle (n)	0	

pg. 11

Parameter	Explanation	Settings	Factory Setting	Customer
		7: Display output power (P)		
		8: Display PID setting and feedback signal		
		9: Display AVI (I) (V)		
		10: Display ACI (i) (mA)		
		11: Display the temperature of IGBT (h) (°C)		
⚡00.05	User-Defined Coefficient K	0. 1 to 160.0	1.0	
00.06	Software Version	Read-only	#.##	
00.07	Reserved			
00.08	Password Input	0 to 9999	0	
00.09	Password Set	0 to 9999	0	
00.10	Reserved			
00.11	Reserved			
00.12	50Hz Base Voltage Selection	0: 230V/400V 1: 220V/380V	0	
00.13	User-defined Value 1 (correspond to max. frequency)	0 to 9999	0	
00.14	Position of Decimal Point of User-defined Value 1	0 to 3	0	

Group 1 Basic Parameters

Parameter	Explanation	Settings	Factory Setting	Customer
01.00	Maximum Output Frequency (Fmax)	50.00 to 600.0 Hz	60.00	
01.01	Maximum Voltage Frequency (Fbase)	0.10 to 600.0 Hz	60.00	
01.02	Maximum Output Voltage (Vmax)	115V/230V series: 0.1V to 255.0V 460V series: 0.1V to 510.0V	220.0 440.0	
01.03	Mid-Point Frequency (Fmid)	0.10 to 600.0 Hz	1.50	

Chapter 4 Parameters | VFD-EL

Parameter	Explanation	Settings	Factory Setting	Customer
01.04	Mid-Point Voltage (Vmid)	115V/230V series: 0.1V to 255.0V	10.0	
		460V series: 0.1V to 510.0V	20.0	
01.05	Minimum Output Frequency (Fmin)	0.10 to 600.0 Hz	1.50	
01.06	Minimum Output Voltage (Vmin)	115V/230V series: 0.1V to 255.0V	10.0	
		460V series: 0.1V to 510.0V	20.0	
01.07	Output Frequency Upper Limit	0.1 to 120.0%	110.0	
01.08	Output Frequency Lower Limit	0.0 to100.0 %	0.0	
✓01.09	Accel Time 1	0.1 to 600.0 / 0.01 to 600.0 sec	10.0	
✓01.10	Decel Time 1	0.1 to 600.0 / 0.01 to 600.0 sec	10.0	
✓01.11	Accel Time 2	0.1 to 600.0 / 0.01 to 600.0 sec	10.0	
✓01.12	Decel Time 2	0.1 to 600.0 / 0.01 to 600.0 sec	10.0	
✓01.13	Jog Acceleration Time	0.1 to 600.0 / 0.01 to 600.0 sec	1.0	
✓01.14	Jog Deceleration Time	0.1 to 600.0 / 0.01 to 600.0 sec	1.0	
✓01.15	Jog Frequency	0.10 Hz to Fmax (Pr.01.00) Hz	6.00	
01.16	Auto acceleration / deceleration (refer to Accel/Decel time setting)	0: Linear Accel/Decel 1: Auto Accel, Linear Decel 2: Linear Accel, Auto Decel 3: Auto Accel/Decel (Set by load) 4: Auto Accel/Decel (set by Accel/Decel Time setting)	0	
01.17	Acceleration S-Curve	0.0 to 10.0 / 0.00 to 10.00 sec	0.0	
01.18	Deceleration S-Curve	0.0 to 10.0 / 0.00 to 10.00 sec	0.0	
01.19	Accel/Decel Time Unit	0: Unit: 0.1 sec 1: Unit: 0.01 sec	0	

Group 2 Operation Method Parameters

Parameter	Explanation	Settings	Factory Setting	Customer
✗02.00	Source of First Master Frequency Command	0: Digital keypad UP/DOWN keys or Multi-function Inputs UP/DOWN. Last used frequency saved. 1: 0 to +10V from AVI 2: 4 to 20mA from ACI 3: RS-485 (RJ-45) communication 4: Digital keypad potentiometer	1	
✗02.01	Source of First Operation Command	0: Digital keypad 1: External terminals. Keypad STOP/RESET enabled. 2: External terminals. Keypad STOP/RESET disabled. 3: RS-485 (RJ-45) communication. Keypad STOP/RESET enabled. 4: RS-485 (RJ-45) communication. Keypad STOP/RESET disabled.	1	
02.02	Stop Method	0: STOP: ramp to stop; E.F.: coast to stop 1: STOP: coast to stop; E.F.: coast to stop 2: STOP: ramp to stop; E.F.: ramp to stop 3: STOP: coast to stop; E.F.: ramp to stop	0	
02.03	PWM Carrier Frequency Selections	2 to 12kHz	8	
02.04	Motor Direction Control	0: Enable forward/reverse operation 1: Disable reverse operation 2: Disabled forward operation	0	
02.05	Line Start Lockout	0: Disable. Operation status is not changed even if operation command source Pr.02.01 is changed. 1: Enable. Operation status is not changed even if operation command source Pr.02.01 is changed. 2: Disable. Operation status will change if operation command source Pr.02.01 is changed.	1	

Parameter	Explanation	Settings	Factory Setting	Customer
		3: Enable. Operation status will change if operation command source Pr.02.01 is changed.		
02.06	Loss of ACI Signal (4-20mA)	0: Decelerate to 0 Hz 1: Coast to stop and display "AErr" 2: Continue operation by last frequency command	1	
02.07	Up/Down Mode	0: by UP/DOWN Key 1: Based on accel/decel time 2: Constant speed (Pr.02.08) 3: Pulse input unit (Pr.02.08)	0	
02.08	Accel/Decel Rate of Change of UP/DOWN Operation with Constant Speed	0.01~10.00 Hz	0.01	
⊁02.09	Source of Second Frequency Command	0: Digital keypad UP/DOWN keys or Multi-function Inputs UP/DOWN. Last used frequency saved. 1: 0 to +10V from AVI 2: 4 to 20mA from ACI 3: RS-485 (RJ-45) communication 4: Digital keypad potentiometer	0	
⊁02.10	Combination of the First and Second Master Frequency Command	0: First Master Frequency Command 1: First Master Frequency Command+ Second Master Frequency Command 2: First Master Frequency Command - Second Master Frequency Command	0	
⊁02.11	Keypad Frequency Command	0.00 to 600.0Hz	60.00	
⊁02.12	Communication Frequency Command	0.00 to 600.0Hz	60.00	
02.13	The Selections for Saving Keypad or Communication Frequency Command	0: Save Keypad & Communication Frequency 1: Save Keypad Frequency only 2: Save Communication Frequency only	0	

Parameter	Explanation	Settings	Factory Setting	Customer
02.14	Initial Frequency Selection (for keypad & RS485)	0: by Current Freq Command 1: by Zero Freq Command 2: by Frequency Display at Stop	0	
02.15	Initial Frequency Setpoint (for keypad & RS485)	0.00 ~ 600.0Hz	60.00	
02.16	Display the Master Freq Command Source	Read Only Bit0=1: by First Freq Source (Pr.02.00) Bit1=1: by Second Freq Source (Pr.02.09) Bit2=1: by Multi-input function	##	
02.17	Display the Operation Command Source	Read Only Bit0=1: by Digital Keypad Bit1=1: by RS485 communication Bit2=1: by External Terminal 2/3 wire mode Bit3=1: by Multi-input function	##	
02.18	User-defined Value 2 Setting	0 to Pr.00.13	0	
02.19	User-defined Value 2	0 to 9999	##	

Group 3 Output Function Parameters

Parameter	Explanation	Settings	Factory Setting	Customer
03.00	Multi-function Output Relay (RA1, RB1, RC1)	0: No function 1: AC drive operational 2: Master frequency attained 3: Zero speed 4: Over torque detection 5: Base-Block (B.B.) indication 6: Low-voltage indication 7: Operation mode indication 8: Fault indication 9: Desired frequency attained 10: Terminal count value attained	8	

pg. 16

Chapter 4 Parameters | VFD-EL

Parameter	Explanation	Settings	Factory Setting	Customer
		11: Preliminary count value attained		
		12: Over Voltage Stall supervision		
		13: Over Current Stall supervision		
		14: Heat sink overheat warning		
		15: Over Voltage supervision		
		16: PID supervision		
		17: Forward command		
		18: Reverse command		
		19: Zero speed output signal		
		20: Warning(FbE,Cexx, AoL2, AUE, SAvE)		
		21: Brake control (Desired frequency attained)		
		22: AC motor drive ready		
03.01	Reserved			
03.02	Desired Frequency Attained	0.00 to 600.0Hz	0.00	
⇗03.03	Analog Output Signal Selection (AFM)	0: Analog frequency meter 1: Analog current meter	0	
⇗03.04	Analog Output Gain	1 to 200%	100	
03.05	Terminal Count Value	0 to 9999	0	
03.06	Preliminary Count Value	0 to 9999	0	
03.07	EF Active When Terminal Count Value Attained	0: Terminal count value attained, no EF display 1: Terminal count value attained, EF active	0	
03.08	Fan Control	0: Fan always ON 1: 1 minute after AC motor drive stops, fan will be OFF 2: Fan ON when AC motor drive runs, fan OFF when AC motor drive stops 3: Fan ON when preliminary heatsink temperature attained	0	
03.09	Reserved			

Parameter	Explanation	Settings	Factory Setting	Customer
03.10	Reserved			
03.11	Brake Release Frequency	0.00 to 20.00Hz	0.00	
03.12	Brake Engage Frequency	0.00 to 20.00Hz	0.00	
03.13	Display the Status of Relay	Read only	##	

Group 4 Input Function Parameters

Parameter	Explanation	Settings	Factory Setting	Customer
✗04.00	Keypad Potentiometer Bias	0.0 to 100.0 %	0.0	
✗04.01	Keypad Potentiometer Bias Polarity	0: Positive bias 1: Negative bias	00	
✗04.02	Keypad Potentiometer Gain	0.1 to 200.0 %	100.0	
04.03	Keypad Potentiometer Negative Bias, Reverse Motion Enable/Disable	0: No negative bias command 1: Negative bias: REV motion enabled	0	
04.04	2-wire/3-wire Operation Control Modes	0: 2-wire: FWD/STOP, REV/STOP 1: 2-wire: FWD/REV, RUN/STOP 2: 3-wire operation	0	
04.05	Multi-function Input Terminal (MI3)	0: No function 1: Multi-Step speed command 1 2: Multi-Step speed command 2	1	
04.06	Multi-function Input Terminal (MI4)	3: Multi-Step speed command 3 4: Multi-Step speed command 4 5: External reset	2	
04.07	Multi-function Input Terminal (MI5)	6: Accel/Decel inhibit 7: Accel/Decel time selection command 8: Jog Operation	3	

Chapter 4 Parameters | VFD-EL

Parameter	Explanation	Settings	Factory Setting	Customer
04.08	Multi-function Input Terminal (MI6)	9: External base block 10: Up: Increment master frequency 11: Down: Decrement master frequency 12: Counter Trigger Signal 13: Counter reset 14: E.F. External Fault Input 15: PID function disabled 16: Output shutoff stop 17: Parameter lock enable 18: Operation command selection (external terminals) 19: Operation command selection(keypad) 20: Operation command selection(communication) 21: FWD/REV command 22: Source of second frequency command	4	
04.09	Multi-function Input Contact Selection	Bit0:MI1 Bit1:MI2 Bit2:MI3 Bit3:MI4 Bit4:MI5 Bit5:MI6 0:N.O., 1:N.C. P.S.:MI1 to MI3 will be invalid when it is 3-wire control.	0	
04.10	Digital Terminal Input Debouncing Time	1 to 20 (*2ms)	1	
04.11	Min AVI Voltage	0.0 to 10.0V	0.0	
04.12	Min AVI Frequency	0.0 to 100.0%	0.0	
04.13	Max AVI Voltage	0.0 to 10.0V	10.0	
04.14	Max AVI Frequency	0.0 to 100.0%	100.0	

pg. 19

Parameter	Explanation	Settings	Factory Setting	Customer
04.15	Min ACI Current	0.0 to 20.0mA	4.0	
04.16	Min ACI Frequency	0.0 to 100.0%	0.0	
04.17	Max ACI Current	0.0 to 20.0mA	20.0	
04.18	Max ACI Frequency	0.0 to 100.0%	100.0	
04.19 | 04.25	Reserved			
04.26	Display the Status of Multi-function Input Terminal	Read only. Bit0: MI1 Status Bit1: MI2 Status Bit2: MI3 Status Bit3: MI4 Status Bit4: MI5 Status Bit5: MI6 Status	##	
04.27	Internal/External Multi-function Input Terminals Selection	0~4095	0	
✗04.28	Internal Terminal Status	0~4095	0	

Group 5 Multi-Step Speed Parameters

Parameter	Explanation	Settings	Factory Setting	Customer
✗05.00	1st Step Speed Frequency	0.00 to 600.0 Hz	0.00	
✗05.01	2nd Step Speed Frequency	0.00 to 600.0 Hz	0.00	
✗05.02	3rd Step Speed Frequency	0.00 to 600.0 Hz	0.00	
✗05.03	4th Step Speed Frequency	0.00 to 600.0 Hz	0.00	
✗05.04	5th Step Speed Frequency	0.00 to 600.0 Hz	0.00	

Parameter	Explanation	Settings	Factory Setting	Customer
✗05.05	6th Step Speed Frequency	0.00 to 600.0 Hz	0.00	
✗05.06	7th Step Speed Frequency	0.00 to 600.0 Hz	0.00	
✗05.07	8th Step Speed Frequency	0.00 to 600.0 Hz	0.00	
✗05.08	9th Step Speed Frequency	0.00 to 600.0 Hz	0.00	
✗05.09	10th Step Speed Frequency	0.00 to 600.0 Hz	0.00	
✗05.10	11th Step Speed Frequency	0.00 to 600.0 Hz	0.00	
✗05.11	12th Step Speed Frequency	0.00 to 600.0 Hz	0.00	
✗05.12	13th Step Speed Frequency	0.00 to 600.0 Hz	0.00	
✗05.13	14th Step Speed Frequency	0.00 to 600.0 Hz	0.00	
✗05.14	15th Step Speed Frequency	0.00 to 600.0 Hz	0.00	

Group 6 Protection Parameters

Parameter	Explanation	Settings	Factory Setting	Customer
06.00	Over-Voltage Stall Prevention	115/230V series: 330.0V to 410.0V 460V series: 660.0V to 820.0V 0.0: Disable over-voltage stall prevention	390.0V 780.0V	
06.01	Over-Current Stall Prevention during Accel	0:Disable 20 to 250%	170	
06.02	Over-Current Stall Prevention during Operation	0:Disable 20 to 250%	170	
06.03	Over-Torque Detection Mode (OL2)	0: Disabled 1: Enabled during constant speed operation. After the over-torque is detected, keep running until OL1 or OL occurs.	0	

Parameter	Explanation	Settings	Factory Setting	Customer
		2: Enabled during constant speed operation. After the over-torque is detected, stop running.		
		3: Enabled during accel. After the over-torque is detected, keep running until OL1 or OL occurs.		
		4: Enabled during accel. After the over-torque is detected, stop running.		
✐06.04	Over-Torque Detection Level	10 to 200%	150	
06.05	Over-Torque Detection Time	0.1 to 60.0 sec	0.1	
06.06	Electronic Thermal Overload Relay Selection	0: Standard motor (self cooled by fan) 1: Special motor (forced external cooling) 2: Disabled	2	
06.07	Electronic Thermal Characteristic	30 to 600 sec	60	
06.08	Present Fault Record	0: No fault 1: Over current (oc) 2: Over voltage (ov) 3: IGBT Overheat (oH1) 4: Reserved 5: Overload (oL) 6: Overload1 (oL1) 7: Motor over load (oL2)	0	
06.09	Second Most Recent Fault Record	8: External fault (EF) 9: Current exceeds 2 times rated current during accel.(ocA) 10: Current exceeds 2 times rated current during decel.(ocd) 11: Current exceeds 2 times rated current during steady state operation (ocn) 12: Ground fault (GFF) 13: Reserved		

pg. 22

Parameter	Explanation	Settings	Factory Setting	Customer
06.10	Third Most Recent Fault Record	14: Phase-Loss (PHL) 15: Reserved 16: Auto Acel/Decel failure (CFA) 17: SW/Password protection (codE) 18: Power Board CPU WRITE failure (cF1.0) 19: Power Board CPU READ failure (cF2.0) 20: CC, OC Hardware protection failure (HPF1)		
06.11	Fourth Most Recent Fault Record	21: OV Hardware protection failure (HPF2) 22: GFF Hardware protection failure (HPF3) 23: OC Hardware protection failure (HPF4) 24: U-phase error (cF3.0)		
06.12	Fifth Most Recent Fault Record	25: V-phase error (cF3.1) 26: W-phase error (cF3.2) 27: DCBUS error (cF3.3) 28: IGBT Overheat (cF3.4) 29: Reserved 30: Reserved 31: Reserved 32: ACI signal error (AErr) 33: Reserved 34: Motor PTC overheat protection (PtC1) 35-40: Reserved		

Group 7 Motor Parameters

Parameter	Explanation	Settings	Factory Setting	Customer
✗07.00	Motor Rated Current	30 %FLA to 120% FLA	FLA	
✗07.01	Motor No-Load Current	0%FLA to 99% FLA	0.4*FLA	

Parameter	Explanation	Settings	Factory Setting	Customer
⟋07.02	Torque Compensation	0.0 to 10.0	0.0	
⟋07.03	Slip Compensation	0.00 to 10.00	0.00	
07.04 | 07.09	Reserved			
07.10	Accumulative Motor Operation Time (Min.)	0 to 1439 Min.	0	
07.11	Accumulative Motor Operation Time (Day)	0 to 65535 Day	0	
07.12	Motor PTC Overheat Protection	0: Disable 1: Enable	0	
07.13	Input Debouncing Time of the PTC Protection	0~9999(*2ms)	100	
07.14	Motor PTC Overheat Protection Level	0.1~10.0V	2.4	
07.15	Motor PTC Overheat Warning Level	0.1~10.0V	1.2	
07.16	Motor PTC Overheat Reset Delta Level	0.1~5.0V	0.6	
07.17	Treatment of the Motor PTC Overheat	0: Warn and RAMP to stop 1: Warn and COAST to stop 2: Warn and keep running	0	

Group 8 Special Parameters

Parameter	Explanation	Settings	Factory Setting	Customer
08.00	DC Brake Current Level	0 to 100%	0	
08.01	DC Brake Time during Start-Up	0.0 to 60.0 sec	0.0	

Chapter 4 Parameters | VFD-EL

Parameter	Explanation	Settings	Factory Setting	Customer
08.02	DC Brake Time during Stopping	0.0 to 60.0 sec	0.0	
08.03	Start-Point for DC Brake	0.00 to 600.0Hz	0.00	
08.04	Momentary Power Loss Operation Selection	0: Operation stops after momentary power loss 1: Operation continues after momentary power loss, speed search starts with the Master Frequency reference value 2: Operation continues after momentary power loss, speed search starts with the minimum frequency	0	
08.05	Maximum Allowable Power Loss Time	0.1 to 5.0 sec	2.0	
08.06	Base-block Speed Search	0: Disable speed search 1: Speed search starts with last frequency command 2: Starts with minimum output frequency	1	
08.07	B.B. Time for Speed Search	0.1 to 5.0 sec	0.5	
08.08	Current Limit for Speed Search	30 to 200%	150	
08.09	Skip Frequency 1 Upper Limit	0.00 to 600.0 Hz	0.00	
08.10	Skip Frequency 1 Lower Limit	0.00 to 600.0 Hz	0.00	
08.11	Skip Frequency 2 Upper Limit	0.00 to 600.0 Hz	0.00	
08.12	Skip Frequency 2 Lower Limit	0.00 to 600.0 Hz	0.00	
08.13	Skip Frequency 3 Upper Limit	0.00 to 600.0 Hz	0.00	
08.14	Skip Frequency 3 Lower Limit	0.00 to 600.0 Hz	0.00	
08.15	Auto Restart After Fault	0 to 10 (0=disable)	0	
08.16	Auto Reset Time at Restart after Fault	0.1 to 6000 sec	60.0	

Parameter	Explanation	Settings	Factory Setting	Customer
08.17	Auto Energy Saving	0: Disable 1: Enable	0	
08.18	AVR Function	0: AVR function enable 1: AVR function disable 2: AVR function disable for decel. 3: AVR function disable for stop	0	
08.19	Reserved			
✎08.20	Compensation Coefficient for Motor Instability	0.0~5.0	0.0	

Group 9 Communication Parameters

Parameter	Explanation	Settings	Factory Setting	Customer
09.00	Communication Address	1 to 254	1	
09.01	Transmission Speed	0: Baud rate 4800bps 1: Baud rate 9600bps 2: Baud rate 19200bps 3: Baud rate 38400bps	1	
09.02	Transmission Fault Treatment	0: Warn and keep operating 1: Warn and ramp to stop 2: Warn and coast to stop 3: No warning and keep operating	3	
09.03	Time-out Detection	0.1 ~ 120.0 seconds 0.0: Disable	0.0	
09.04	Communication Protocol	0: 7,N,2 (Modbus, ASCII) 1: 7,E,1 (Modbus, ASCII) 2: 7,O,1 (Modbus, ASCII) 3: 8,N,2 (Modbus, RTU)	0	

pg. 26

Chapter 4 Parameters | VFD-EL

Parameter	Explanation	Settings	Factory Setting	Customer
		4: 8,E,1 (Modbus, RTU)		
		5: 8,O,1 (Modbus, RTU)		
		6: 8,N,1 (Modbus, RTU)		
		7: 8,E,2 (Modbus, RTU)		
		8: 8,O,2 (Modbus, RTU)		
		9: 7,N,1 (Modbus, ASCII)		
		10: 7,E,2 (Modbus, ASCII)		
		11: 7,O,2 (Modbus, ASCII)		
09.05	Reserved			
09.06	Reserved			
09.07	Response Delay Time	0 ~ 200 (unit: 2ms)	1	

Group 10 PID Control Parameters

Parameter	Explanation	Settings	Factory Setting	Customer
10.00	PID Set Point Selection	0: Disable PID operation 1: Keypad (based on Pr.02.00) 2: 0 to +10V from AVI 3: 4 to 20mA from ACI 4: PID set point (Pr.10.11)	0	
10.01	Input Terminal for PID Feedback	0: Positive PID feedback from external terminal AVI (0 ~ +10VDC) 1: Negative PID feedback from external terminal AVI (0 ~ +10VDC) 2: Positive PID feedback from external terminal ACI (4 ~ 20mA) 3: Negative PID feedback from external terminal ACI (4 ~ 20mA)	0	
✎10.02	Proportional Gain (P)	0.0 to 10.0	1.0	
✎10.03	Integral Time (I)	0.00 to 100.0 sec (0.00=disable)	1.00	

Parameter	Explanation	Settings	Factory Setting	Customer
⚡10.04	Derivative Control (D)	0.00 to 1.00 sec	0.00	
10.05	Upper Bound for Integral Control	0 to 100%	100	
10.06	Primary Delay Filter Time	0.0 to 2.5 sec	0.0	
10.07	PID Output Freq Limit	0 to 110%	100	
10.08	PID Feedback Signal Detection Time	0.0 to 3600 sec (0.0 disable)	60.0	
10.09	Treatment of the Erroneous PID Feedback Signals	0: Warn and RAMP to stop 1: Warn and COAST to stop 2: Warn and keep operation	0	
10.10	Gain Over the PID Detection Value	0.0 to 10.0	1.0	
⚡10.11	Source of PID Set point	0.00 to 600.0Hz	0.00	
10.12	PID Feedback Level	1.0 to 50.0%	10.0	
10.13	Detection Time of PID Feedback	0.1 to 300.0 sec	5.0	
10.14	Sleep/Wake Up Detection Time	0.0 to 6550 sec	0.0	
10.15	Sleep Frequency	0.00 to 600.0 Hz	0.00	
10.16	Wakeup Frequency	0.00 to 600.0 Hz	0.00	
10.17	Minimum PID Output Frequency Selection	0: By PID control 1: By minimum output frequency (Pr.01.05)	0	
10.18	PID Control Detection Signal Reference	1.0 to 99.9	99.9	
10.19	PID Calculation Mode Selection	0: Series mode 1: Parallel mode	0	

pg. 28

Chapter 4 Parameters | VFD-EL

Parameter	Explanation	Settings	Factory Setting	Customer
10.20	Treatment of the Erroneous PID Feedback Level	0: Keep operating 1: Coast to stop 2: Ramp to stop 3: Ramp to stop and restart after time set in Pr.10.21	0	
10.21	Restart Delay Time after Erroneous PID Deviation Level	1 to 9999 sec	60	
✎10.22	Set Point Deviation Level	0 to 100%	0	
10.23	Detection Time of Set Point Deviation Level	0 to 9999 sec	10	
✎10.24	Offset Level of Liquid Leakage	0 to 50%	0	
✎10.25	Liquid Leakage Change Detection	0 to 100% (0: disable)	0	
✎10.26	Time Setting for Liquid Leakage Change	0.1 to 10.0 sec (0: disable)	0.5	
10.27 | 10.33	Reserved			

pg. 29

Troubleshooting Pump

SYMPTOM	PROBABLE CAUSE																	
	GROUP I ELECTRICAL									GROUP II MECHANICAL						GROUP III SYSTEM		
	A	B	C	D	E	F	G	H	I	A	B	C	D	E	F	A	B	C
Pump runs, but no water delivered										X		X				X	X	
Not enough water delivered			X	X					X	X	X		X			X	X	
Not enough pressure			X	X					X	X	X		X			X	X	
Excessive vibration									X	X	X			X			X	X
Abnormal noise										X	X	X		X	X		X	X
Pump stops	X	X	X	X	X	X	X	X										
Overheating		X	X	X					X		X		X	X	X			X

CAUSE	CORRECTIVE ACTION
I. ELECTRICAL	
A. No voltage in power system	Check phase-to-phase on line side of starter contactor. Check circuit breaker or fuses.
B. No voltage on one phase (Three Phase Units)	Check phase voltage on line side of starter contactor. Isolate open circuit (circuit breaker, fuse, broken connections, etc.)
C. Low voltage at motor	Running voltage across each leg of motor must be ±10% of nominal voltage shown on nameplate.
D. Motor leads improperly grouped for voltage	Refer to lead grouping diagram on motor nameplate.
E. Control failure	Check control device, starter contactor, H-O-A selector switch, etc., for malfunction.
F. Thermal overload switch open	Check phase-to-phase on line side of starter contactor.
G. Installation failure	Check motor or windings to ground with megohmmeter.
H. Open windings	Check leg-to-leg with ohmmeter.
I. Frequency variation	Check frequency of power system. Must be less than 5% variation from motor nameplate rating.
II. MECHANICAL	
A. Flow through pump completely or partially obstructed	Locate and remove obstruction. Refer to Repair Instructions for disassembly.
B. Wrong direction of rotation	Reverse rotation of three phase motor by interchanging any two leads. See manufacturer's Instructions for reversing single phase motor.
C. Pump not primed	Reprime. Inspect suction system for air leaks.
D. Internal leakage	Check impeller for wear of controlled clearances (See Repair Instructions).
E. Loose parts	Inspect. Repair.
F. Stuffing box not properly adjusted	Adjust gland.
III. SYSTEM	
A. Pressure required by system at design flow rate exceeds pressure rating of pump	Compare pump pressure and flow rate against pump characteristic curve. Check for closed or partially closed valve in discharge piping system. Reduce system pressure requirement. Increase pressure capability of pump.
B. Obstruction in suction piping	Locate and remove obstruction.
C. Pressure rating of pump exceeds pressure requirement of system at design flow rate	Compare pump pressure and flow rate against pump characteristic curve. Inspect discharge piping system for breaks, leaks, open by-pass valves, etc. If necessary, reduce flow rate by partially closing discharge valve.