



PC PUMP VFD System Technical Manual



IMPORTANT APPLICATION NOTES

SAFETY WARNINGS:

- It is the installer's responsibility to ensure the configuration and installation of the PC PUMP VFD System meets the requirements of any site specific, local and national electrical regulations.
- The PC PUMP VFD System operates from HIGH VOLTAGE, HIGH ENERGY ELECTRICAL SUPPLIES. Stored charge may be present in the system after the main power has been switched off.
- For safety reasons the enclosure door must be closed at all times.
- Some features of the PC PUMP VFD System may cause the motor to start automatically after power failure.

SERVICING WARNINGS:

- Service only by qualified personnel.
- Always isolate and allow to discharge before servicing.
- Never replace fuses with higher rating. Always replace fuses with proper rating.
- VFD uses static sensitive components. Use static safe procedures when handling these components.
- Never work on live equipment alone.
- Observe all recommended practices.

REVISION HISTORY

Date	Revision	Revision Comments

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1 INTRODUCTION TO THE PC PUMP VFD SYSTEM

1.1 THE PC PUMP VFD SYSTEM TYPES

Each system is unique to the application the units were designed for. This will result in minor differences between each model and the combinations of differences are virtually limitless. Therefore it is impossible to cover all the features in the PC PUMP VFD System in this manual. Please refer to the electrical drawing(s) and supplemental documents for details.

1.1.1 Variable Frequency Drive Type Options

The STELLAR TECH PC PUMP VFD System uses Mitsubishi variable frequency drives. For a detailed VFD software parameter description please refer to the VFD manufacturer's manual.

1.1.2 Enclosure Type Options

The PC PUMP VFD System may be manufactured with one of following enclosure types:

- NEMA 1
- NEMA 12
- NEMA 3R
- NEMA 4
- NEMA 4X
- or any other enclosure types requested.

Each enclosure type will be selected depending on the system requirements.

1.1.3 System Configuration Options

The PC PUMP VFD System may be manufactured with one of following System Configurations:

- Standard System
- Custom Configuration

Each System Configuration type will be selected depending on the system requirements.

2 UNPACKING, INSTALLATION, AND CONNECTION

2.1 UNPACKING OF YOUR PC PUMP VFD SYSTEM

2.1.1 Unpacking the PC PUMP VFD System

The PC PUMP VFD System is packed in a wooden crate for transportation. (NOTE: Some units may be shipped on a skid for local shipments)

Before unpacking, check that the PC PUMP VFD System has not been damaged during transportation. If the PC PUMP VFD System appears damaged file a report with the carrier immediately.

2.1.2 Disposal of Packaging

Packaging materials are made from cardboard, plastic, styrofoam, or wood and they can be recycled at your local recycling center.

2.2 INSTALLATION OF YOUR PC PUMP VFD SYSTEM

2.2.1 Installation Environment

The external ambient temperature of the enclosure must not exceed 40°C (104°F). The enclosure must have enough space around it to ensure adequate cooling.

Do not install the unit in the vicinity of any source of water, corrosive and conductive material, gas or debris. This can result in catastrophic failure if such material enters the enclosure. If the unit is installed in such an environment additional protection such as a drip shield or enclosure (i.e. NEMA 3R, 4, or 4X) must be provided.

2.2.2 Installation Methods

The PC PUMP VFD System may be of "Wall-Mount" or "Floor-Mount" type. In either case, the unit must be securely installed. Secure the unit to an area that can support the weight of the unit. Install supports for earthquake protection if necessary.

2.2.3 Spacing

There must be adequate space around the unit for cooling. Refer to the Figure 2.1 and Table 2.1 for the minimum spacing required. Regional regulations may require adequate room for the door to open completely.

- NOTE - Do not mount the PC PUMP VFD Package above a heat source such as heater, transformer, or another VFD. Failure to comply will cause cooling capacity of the top unit be greatly reduced and may cause premature failure.

Enclosure Type	Minimum Spacing Required			
	A	B	C	D
Force Ventilated (Wall Mounted)	12in (300mm)	24in (600mm)	24in (600mm)	6in (150mm)
Force Ventilated (Floor Mounted)	12in (300mm)	24in (600mm)	24in (600mm)	na
Non - Force Ventilated	6in (150mm)	12in (300mm)	24in (600mm)	12in (300mm)

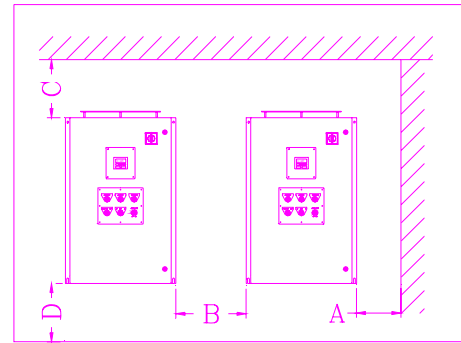


Table 2.1 Minimum Spacing Requirement

Figure 2.1 Spacing Diagram

2.3 CONNECTING THE PC PUMP VFD SYSTEM

WARNING: Ensure that the input power supply is isolated before wiring.

2.3.1 Power Wiring

- The PC PUMP VFD System may be designed to operate from a three-phase supply or a single-phase supply. Refer to the electrical drawing of the unit for the details.

- **NOTE** - Do not attempt to operate the PC PUMP VFD System with incorrect phase supply. Failure to comply may cause damage to the VFD and other electrical components.

- Provide fusing and/or circuit breaker to meet the local electrical regulations.
- Use wiring that meets or exceeds the electrical load capacity of the circuit. Refer to the local electrical regulations for the wire sizes.
- Power factor correction capacitors are not required on the input of the PC PUMP VFD System.
- **NEVER** install a power factor capacitor(s) between the PC PUMP VFD System output and the motor. If installed, it will result in VFD failure.
- A load isolation switch or contactor may be installed on the output of the PC PUMP VFD System. **NEVER** open or close the load isolation switch or the contactor while the PC PUMP VFD System is in operation. Opening or closing while the VFD is in operation may cause damage to the switchgear and/or VFD.
- If multiple motors are to be operated from a single VFD, make sure individual motor protection is provided. If your PC PUMP VFD System was ordered with Multi-Motor output option it will have separate thermal overload relays and over-current protection (fuses) for each motor (unless only one motor will be operating at a time).
- Input and output power wiring must be installed in separate conduits.
- **NEVER** install output cables from multiple VFDs together in the same conduit. This may cause nuisance VFD trips and may result in damage to the VFD.

2.3.2 Control Wiring

Use wiring that meets or exceeds the electrical load capacity of the circuit. Refer to the local electrical regulations for the wire sizes.

NEVER install the control wiring in the same conduit with power wiring. This may cause stray high voltages to be present in the control circuit and may damage to the VFD.

Input and output control wiring of the PC PUMP VFD System may be 10Vdc, 24Vdc, 24Vac and or 120Vac. Provide appropriate wiring and relays. **Please refer to electrical drawing for the details and correct voltage inputs.**

Proper installation using shielded wire is recommended for DC control wiring to prevent noise problems. Avoid installing control wires parallel to the power wiring. Install control wires a minimum of 100mm (4in) away from the power wiring, crossing only at right angles.

Included in most packages is a A2PCM Pump Control Module. This module is factory programmed. The programming varies depending upon application. In most cases the Module controls the start delay after power outages or shutdowns.

3 COMMISSIONING

3.1 COMMISSIONING REPORT

The commissioning report, as completed by the factory approved commissioning personnel, must be returned to STELLAR TECH to register for a 12 month warranty extension. You can return it by mail or fax to:

STELLAR TECH ENERGY SERVICES
Attn: Technical Services Department
#4 – 6160 40th Street SE
Calgary, AB T2C 1Z3
CANADA

Phone: (403) 279-8367
FAX: (403) 279-8368

3.2 PRE-POWER-UP CHECKS

Before powering the PC PUMP VFD System ensure the following mechanical and electrical conditions:

- Make sure that all electrical connections are tight. These may loosen during shipment or during operation due to vibration. This in turn may cause poor electrical connection resulting in a “Hot Spot” giving rise to a failure after power up.
- Make sure that the VFD and all the electrical connections are free of debris.
- Make sure that the rated output current of the unit is greater than the motor FLA. VFDs are current rated devices, not horsepower rated. Some older motors may have higher than typical FLA.
- Make sure that supply voltage, VFD rated voltage and motor voltage match.
- Make sure that power factor correction capacitors are **NOT** installed between the VFD and the motor. Power factor capacitors connected on the VFD output will cause VFD damage
- Make sure that no power factor correction capacitors are installed within 100m (300ft) of input to the VFD without a line reactor. They may cause nuisance overvoltage trips.
- Make sure that the PC PUMP VFD System is installed with an ambient temperature no greater than 40°C (104°F). There must be free space around the PC PUMP VFD System for cooling as per the unit’s dimensional drawing. Refer to Section 2.2.3 of this manual for minimum spacing requirement.
- Make sure that the VFD is installed with humidity level within 10–90% non-condensing.
- Make sure that the motor and the load rotate freely. Check for bad bearings, correct belt tension, belt alignment, and/or shaft alignment.
- For 380Vac / 460Vac or 575Vac installations make sure that the motor specification for the cable length and carrier frequency limitations are within recommended limits. A load reactor or an output filter can be installed if necessary.

3.3 POWERED CHECKS

3.3.1 Power Supply Check

Without applying power to the VFD check the supply line voltages:

- L1 – L2
- L1 – L3
- L2 – L3

They should be within 3% of each other and within 10% of the PC PUMP VFD System's nameplate rating.

If the line voltage is determined to be within tolerance, apply the power to the VFD.

3.3.2 Software Programming

The VFD(s) used in the PC PUMP VFD System have been pre-programmed at the STELLAR TECH factory to suit the application. This default software setting is different from the VFD manufacturer's default setting.

Check and program all the necessary software parameters such as acceleration & deceleration time, application (constant & variable torque), carrier frequency, motor voltage, and motor overload protection level. Incorrect software programming may result in equipment malfunction or damage. Record any changes to the software for future reference.

3.3.3 Before Running The Motor

Check to make sure that the system can be operated at full speed (60Hz) without causing damage to the other equipment or endangering personnel.

3.3.4 Motor Rotation Check

Check the rotational direction. If the rotational direction is incorrect, follow the procedure below to correct.

Rotation is correct in the VFD mode	Rotation is incorrect in the VFD mode
No wiring changes are required	Swap two phases at both input and output of the unit

3.3.5 Motor Current

Check the motor current. Depending on the digital clamp-on ammeter, readings may not be accurate in the VFD mode due to harmonic frequency content of the output waveform. Use the VFD current monitor display for accurate reading. The motor should not draw more than its FLA rating during steady-state conditions.

3.3.6 Input and Output Signals

Check both the input and the output signals for correct and accurate operation.

- **Note** - Input and output signals available on the PC PUMP VFD System will depend on the model ordered.

3.3.7 Operator Switches and Indicator Lights

Check all operator switches and indicator lights for correct operation.

- **Note** - Operator switches and indicator lights available on the PC PUMP VFD System will depend on the model ordered.

3.3.8 If Something Does Not Work

If something does not work or if you require technical assistance, STELLAR TECH ENERGY SERVICES provides support over the phone, 8:00 – 4:30pm CMT, Monday to Friday, except statutory holidays; or you can fax at:

Stellar Tech Energy Services
Attn: Technical Services Department
#4 – 6160 40th Street SE
Calgary, AB T2C 1Z3
CANADA

Phone: (403) 279-8367
FAX: (403) 279-8368

3.4 COMMISSIONING WRAP-UP

To complete the commissioning of the PC PUMP VFD System, check the following:

- Record final software parameter setting
- The following literature provided with each PC PUMP VFD System:
 - PC PUMP VFD system wiring diagram
 - VFD operation manual
 - Instruction manuals for other devices
- Record any physical and electrical changes to the system
- Complete the STELLAR TECH PC PUMP VFD System Commissioning Report

4 STANDARD PC PUMP VFD SYSTEMS

4.1 INTRODUCTION

Most of our Standard PC PUMP VFD Systems are equipped with the Keypad, ON/OFF switch, 'VFD RUNNING' pilot light, 'TIME DELAY ON' pilot light and 'VFD FAULT' pilot light. This section guides you through the basic operation of this type of VFD system.

- **Note** - All STELLAR TECH PC PUMP VFD Systems are custom built for your specific needs. Your unit may be equipped with additional features not mentioned in this manual.

4.2 MODES OF OPERATION FOR "ON / OFF" SELECTOR SWITCH

This unit is equipped with "ON / OFF" selector switch. This switch enables and disables operation of the system.

4.2.1 Operation in "OFF" position

In this mode, the VFD will be energized but no operation will be performed. This mode is used when software programming of the VFD is required or to stop the operation.

4.2.2 Operation in "ON" position

The "Run Command" is initiated as soon as the "ON / OFF" switch is set to the "ON" position. This command is input to the A2PCM Pump Control Module. The timer within the A2PCM will start counting down the time preset (factory set to 2400) in the A2PCM and the 'TIME DELAY ON' pilot light will be illuminated. At the completion of the timer delay the 'TIME DELAY ON' pilot light will be off and the 'VFD RUNNING' light will be illuminated. Speed can be set on the keypad. For speed and time adjustment please see **APPENDIX B - QUICK START GUIDE**

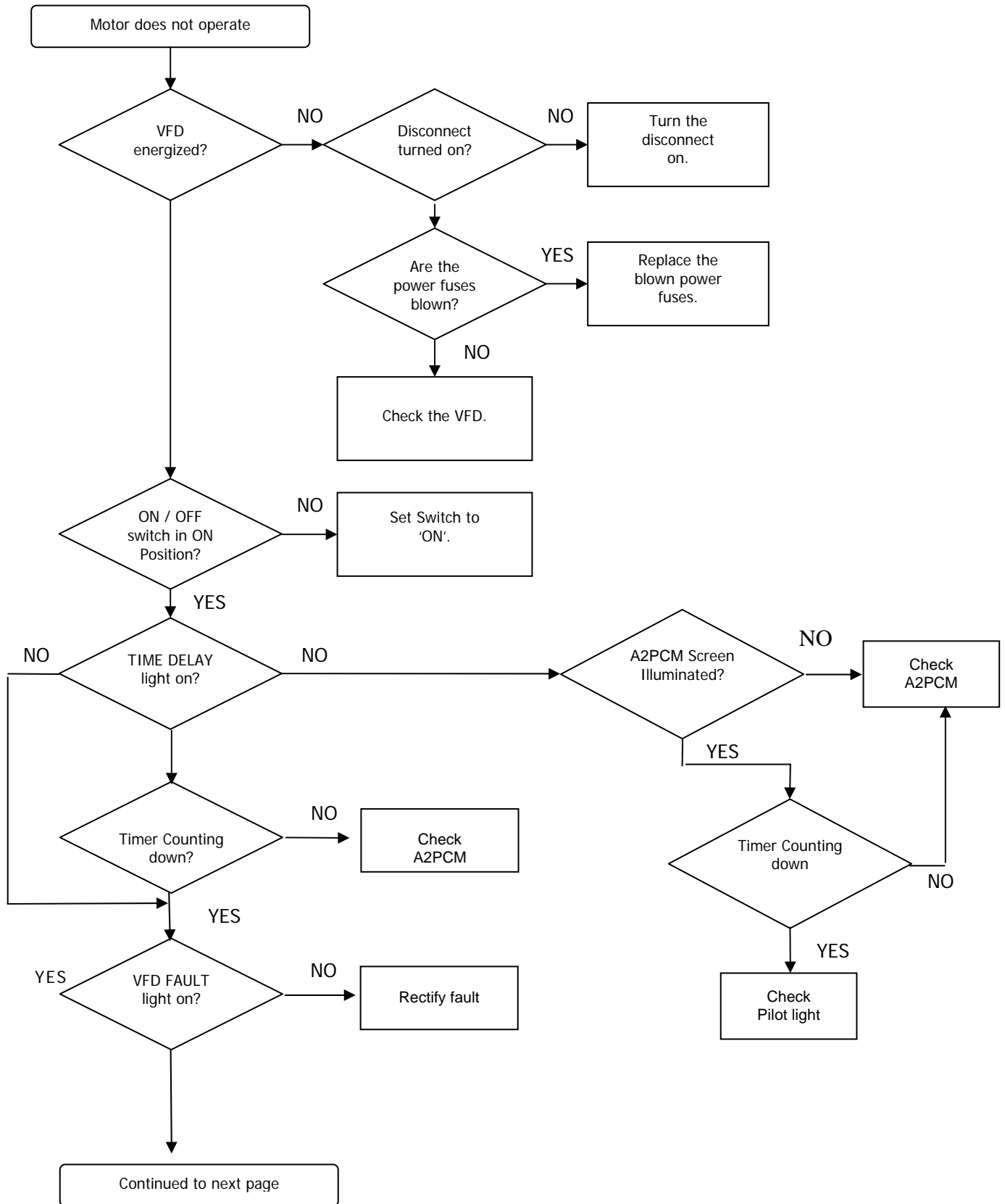
4.3 TROUBLESHOOTING

This section guides you to troubleshoot the STELLAR TECH Standard PC PUMP VFD System. To troubleshoot the VFD unit itself please refer to the VFD troubleshooting manuals for each VFD model.

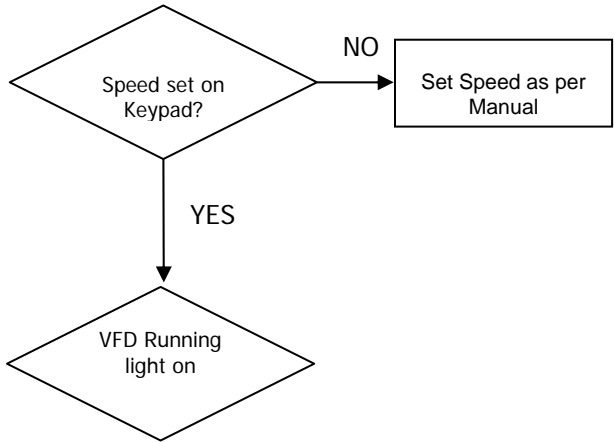
!! WARNING !!

Some troubleshooting procedures require the system to be energized and its door to be opened to perform the test. There are multiple circuits that may be under power at any given time. Follow standard safety procedures to prevent any damage to the equipment or personal injuries.

4.3.1 When the motor does not operate.



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5 PC PUMP VFD SYSTEM WITH CUSTOM OPTIONS

CUSTOM OPTIONS ARE NOT INCLUDED IN THIS PACKAGE

6 ROUTINE MAINTENANCE

To maintain reliable operation, the PC PUMP VFD System must be routinely checked. The following is the maintenance procedure used under normal conditions. If the installation environment is severe, such as dusty conditions or vibrating mounting fixture, more frequent maintenance is recommended.

WARNING Be sure the input power supply is isolated before carrying out any maintenance.

6.1 Every six (6) months if operated continuous or every three (3) months if operated less than 24 hours a day

- Check power wire connections at the following locations. Tighten if necessary.
 - VFD terminals
 - Line and load reactors, if equipped
 - Contactors, if equipped
 - Output filter, if equipped
 - Disconnect, if equipped
 - Thermal overload, if equipped
 - Input and output terminals, if equipped
 - Pump Control Module terminals
- Check ventilation filter, if equipped. Clean or replace it if necessary.
- Check the VFD heat-sink for cleanliness. In a dusty environment, the heat-sink may become clogged which can cause overheating.
- Check the indicator lights if they are the incandescent-type bulbs. Replace if necessary.

If the equipment is operated less than 24 hours a day, heating and cooling will cause expansion and contraction of the components. This increases the possibility of connections becoming loose.

6.2 Every twelve (12) months

Same checks as indicated in Section 6.1, plus:

- Check the VFD cooling fans and package cooling fans if equipped. If it is making too much noise (i.e. squeaking, grinding, etc), replace it.
- Check electrolytic capacitors (i.e. DC bus capacitors, power supply capacitors) for leakage or bulging. Replace if necessary.

7

WARRANTY

7.1 WARRANTY TERMS

Warranty is granted only under normal installation and handling conditions. The warranty shall cover the repair of only the PC PUMP VFD System that was installed.

7.2 WARRANTY PERIOD

7.2.1 Standard Warranty

Standard warranty period is 18 months after the date of shipment from Stellar Tech Energy Services Inc. manufacturing facility or 12 months after the date of installation with the submission of the commissioning report, whichever comes first.

7.2.2 Extended Warranty

Extended warranty may have been purchased already. Please refer to your order for the actual warranty details.

- **Note** - Extended warranty may only be purchased at the time of ordering.

7.3 NOT COVERED BY WARRANTY

Service in the following cases, even within the warranty period, shall be charged to the purchaser:

- Malfunction or damage caused by improper operation, misuse, modification or improper repair.
- Malfunction or damage caused by a drop after purchase and during transportation.
- Malfunction or damage caused by fire, earthquake, flood, lightning or other natural disasters.
- Malfunction or damage caused by abnormal input voltage or contamination.

7.4 ON-SITE WARRANTY REPAIRS

When service is required for the product at your work site, all expenses associated with field repair shall be charged to the purchaser.

- **NOTE** - If "On-Site Warranty" option has been purchased at the time of ordering the unit, all costs will be covered.

APPENDIX A: PC PUMP VFD SYSTEM COMMISSIONING REPORT

Please provide as much information as possible. Any fields with asterisk (*) must be filled.

COMMISSIONED DATE:	YYYY/MM/DD*
--------------------	-------------

COMMISSIONED BY:	COMPANY*	TECHNICIAN'S NAME*
	PHONE*	FAX
	CELLULAR / PAGER	E-MAIL

PROJECT:	COMPANY*	SITE
	ADDRESS	
	SITE CONTACT	PHONE

APPLICATION	
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SYSTEM INFO	SERIAL NUMBER*	SYSTEM ID TAG
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MOTOR INFO	MANUFACTURER*	VOLTAGE Vac	HORSEPOWER hp
	MODEL NUMBER*	FLA A	FREQUENCY Hz

SUPPLY POWER	L1* Vac	L2* Vac	L3* Vac	DC-BUS* Vdc
--------------	---------	---------	---------	-------------

LOAD CURRENT	T1* A	T2* A	T3* A	VFD DISPLAY A
--------------	-------	-------	-------	---------------

ROTATION	OK?*
----------	------

OPERATOR SWITCHES	OK?*	INDICATOR LIGHTS	OK?*	CONTROL SIGNALS	OK?*
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NOTES

Commissioning of this PC PUMP VFD System has been completed.

Signature: _____

Date: _____

APPENDIX B: QUICK START GUIDE

Start-up

1. Connect Line 380V / 3 phase / 50Hz. or 460 / 3 phase / 60Hz. to terminals R(L1), S(L2), T(L3) on the VFD
2. **DO NOT** connect motor to the VFD at this time.
3. Ensure that 'ON / OFF' switch is in '**OFF**' position.
4. **Close** Disconnect Switch
5. Adjust timer as per **APPENDIX C** for testing purposes
6. Turn 'ON / OFF' switch to '**ON**' position
7. Time Delay On pilot light will be illuminated for the duration of the time delay set (item #5)
8. 'VFD RUNNING' pilot light is illuminated after time delay
9. Turn 'ON / OFF' switch to '**OFF**' position
10. **Open** Disconnect Switch to isolate main power. Wait for VFD capacitors to discharge
11. Connect motor leads to terminals U, V, W on the VFD
12. Close Disconnect Switch
13. Turn 'ON / OFF' switch to '**ON**' position
14. Check motor for correct rotation. (see 3.3.4)
15. Turn 'ON / OFF' switch to '**OFF**' position
16. Adjust timer as per **APPENDIX C** for operational time. (2400 seconds)
17. Turn 'ON / OFF' switch to '**ON**' position.
18. 'TIME DELAY ON' pilot light will be illuminated for the preset time
19. Motor will start and ramp up to preset speed.
20. 'VFD RUNNING' pilot light is illuminated after time delay


APPENDIX C: DELAY ON Timer Setting

6.7 Delay Block

The function block delays the signal to an output for a set length of time. The On or Off delays can be set individually or in combination. Ex. The On Delay Time is set to 5 seconds. The Delay Block Input signal comes ON; five seconds later the Delay Block Output will come ON. The Output signal stays ON as long as the Input signal is ON. The Output signal turns OFF at the same time the Input signal turns OFF. The Clear Input will turn the Output OFF and cancel the current operation. The Clear pin over-rides the Input pin if both signals are ON simultaneously.

The On Delay option will delay the Output from turning ON for a set time after the Input comes ON. The Off Delay will delay the Output from turning OFF for a set time after the Input has turned OFF.

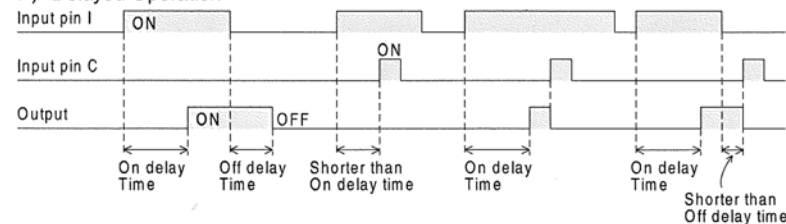
Table 6.8: Delay Timer Function Block

Function	Set Item	Description
	I	Input pin for delay timer operation
	C	Clear input pin resets the state of the output regardless of the input given.
	FB	Time units: 10ms, 100ms or 1s (*Note)
	Output	<p>The following items are applicable for the delay function block:</p> <ol style="list-style-type: none"> 1) The lag time setting for energising the output from a given input signal can be given a controlled delay time; The starting value has a range from 0s to 32767s 2) The lag time setting for deenergising the output from a given input signal can be given a controlled delay time; The starting value has a range from 0s to 32767s 3) If the clear signal of the input pin C is turned on while the delay function block is in operation consequentially the current value of the ON delay timer and OFF delay timer resets to "0." Thus, the output is turned OFF. 4) The following items are available for other function blocks: <ol style="list-style-type: none"> a) On Delay b) Current On Delay c) Off Delay d) Current Off Delay

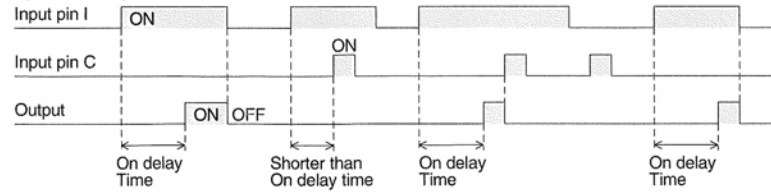


Note: The ON/OFF delay time cannot be less than one scan time for the controller; otherwise, the Delay Function Block will not perform its assigned task for the time specified. Users can monitor the scan time from the $\alpha 2$ Series Controller. Scan time is dependent on the user-program; therefore, caution is needed as and when time units are selected.

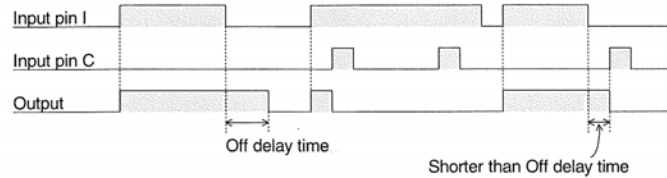
1) Delayed Operation



2) ON delay timer



3) OFF delay timer



Setup of the Delay Function Block directly from the α2 Series Controller

- 1) Allocate the input pin to be used for the function block.
- 2) Press the "OK" key with the cursor in the function block. The function block edit screen is displayed as shown.

```
B001:DL
>Time unit:
  Setup FB
  Change No
  Delete FB
```

- 3) Press the "OK" key to set the Time unit for the delayed output.

```
Time unit
> 10 ms
  100 ms
  1 s
```

- 4) Press the "OK" key having selected the value for the delayed time unit and return to the function block edit screen. Using the "▲" and "▼" keys highlight the Setup FB and press the "OK" key. The screen displayed is shown.

```
B001:DL
>OnDelay
  OffDelay
```

- 5) Select the On or Off Delay using the "▲" and "▼" Keys and press the "OK" key. The Delay time can be entered using the "+" or "-" keys.

```
B001:DL
  OnDelay
  T= 0.1s
  t= 0.0s
```

- 6) Press the "OK" key to accept the time figures and subsequently press the "ESC" key to return to the function block edit screen.

Specifications and contents are subject to change without notice.

Manufactured by:



#4 – 6160 40th Street SE, Calgary, AB, CANADA T2C 1Z3
Phone:(403) 279-8367 FAX:(403) 279-8368