PHASE TECHNOLOGIES

Engineering Specifications for

DXL SERIES

Variable Frequency Drives

1. GENERAL

This specification describes the features and design of a six-pulse frequency drive (VFD) for operating three-phase electric motors from either a single-phase or three-phase source. The VFD shall draw current and voltage from the utility source in a sinusoidal manner. The VFD shall have a soft-start feature to reduce current in-rush and line disturbance when starting motor loads.

1.1 Qualifications

The VFD shall be designed in accordance and comply with:

1.1.1 National Electrical Code (NEC)

1.1.2 Underwriters Laboratories (UL) Standard 61800-5-1

1.1.3 FCC Article 15, Section J

1.1.4 UL 508C

1.2 Manufacturing and Quality Assurance

1.2.1 The manufactured product shall be manufactured in Rapid City, USA.

1.2.2 The cost of components of the manufactured product that are mined, produced, or manufactured in the US is greater than 55% of the total cost of all components of the manufactured product, which satisfies the requirements of the Build America Buy America Act.

1.2.3 All printed circuit boards shall have a full functional test before being assembled in the VFD. The fully-assembled VFD shall then be subjected to a full-load test.

1.3 Submittals

1.3.1 The submittals shall include wiring diagrams for power and control wiring; cabinet drawings showing dimensions, weights, mounting details, and required clearances; and complete technical product description.

222 Disk Drive, Rapid City, SD 57701 phasetechnologies.com 605-343-7934

2. VFD DESIGN AND FUNCTION

2.1 The VFD shall be based on a six-pulse design, with a diode rectifying the incoming AC power to DC. The output module shall be a three-phase IGBT inverter that produces a three-phase pulse-width-modulated (PWM) voltage for operation of AC motor loads.

2.2 The VFD shall be designed to operate AC induction motors.

2.3 The VFD shall be capable of the following control modes:

2.3.1 Open loop V/f control

2.3.2 Vector torque control

2.4 VFD Operating Functions shall include:

2.4.1 Normal Operation: The VFD shall be equipped to accept analog or digital motor control signals for automatic operation of motor loads and shall be equipped to operate in manual mode, overriding automatic motor control.

2.4.2 Protective Functions: The VFD shall have the ability to automatically shut down to protect both the VFD and the load from damage. A graphic display shall allow the operator to identify the reason for shutdown from a variety of faults including:

2.4.2.1 Internal short in the VFD

2.4.2.2 Overheating of the VFD (thermal overload)

2.4.2.3 Low utility line voltage

2.4.2.4 Short between the output lines

2.4.2.5 Excessive load demand

2.4.2.6 High utility line voltage

2.4.2.7 Line to ground fault

2.4.2.8 Under current fault

2.4.2.9 Motor phase loss

2.4.2.10 High/low bus voltage

2.4.3 Automatic Restart Delay: The VFD shall be equipped with an adjustable restart time delay to prevent all loads on the utility from restarting simultaneously when power returns after an outage.

2.4.4 Automatic derates shall slow the drive down to avoid Over Temperature and Overcurrent faults. These derates can be turned off.

2.4.5 Switching frequency shall be programmable from 2kHz to 5 kHz.

2.4.6 Acceleration and Deceleration rates shall be programmable for up to three linear ramp speed adjustments.

2.4.7 Three programmable skip frequencies to avoid operating the load at unstable speeds.

2.4.8 A programmable cycle counter to prevent continuous short-cycling of load.

2.4.9 A micro SD card slot for reprogramming software and for importing/exporting parameters so that parameters can be transferred between drives.

2.5 Control I/O

2.5.1 A minimum of four discrete, programmable, inputs shall be provided.

2.5.2 Minimum of two 240VAC, 10 A rated programmable relays shall be provided, as well as two 120VAC, 250 mA rated programmable relays.

2.5.2.1 All relays shall be programmable to perform at minimum the following functions:

2.5.2.1.1 General warning and fault conditions

2.5.2.1.2 Provide reference when VFD output is engaged

2.5.2.1.3 Provide reference when VFD faults

2.5.2.1.4 Allow the system to operate in Lead/Lag or Multiplex modes

2.5.3 Minimum of two analog 4-20 mA inputs that will allow proportional speed control or PID control.

2.5.4 Minimum of one 0-10VDC input that will allow for proportional speed control

2.5.5 Minimum of one 0-10VDC output for analog feedback

2.5.6 Minimum of one 4-20 mA output for analog feedback

2.5.7 An optional I/O expansion board shall be available to increase:

2.5.7.1 Digital inputs to eight total

2.5.7.2 Relay outputs to eight total (four 240VAC, 10A; and four 120VAC, 250mA)

2.6 Keypad Operation

2.6.1 A keypad and a backlit graphic display, that communicates programmable parameters and VFD status in plain English.

2.6.2 A consistent user interface across all models and ratings.

2.7 Serial Communications

2.7.1 The following communication protocols:

2.7.1.1 Modbus RTU

2.7.1.2 Modbus IP

2.7.1.3 BACnet MS/TP

2.7.1.4 BACnet IP

2.7.2 An interface for sending commands and reading registers via personal computer.

3. SPECIFICATIONS

3.1 The VFD shall operate continuously at full output without de-rating while subjected to ambient temperatures of 0° to 40° C.

3.2 The VFD shall operate up to 95% relative humidity, non-condensing.

3.3 Standard duty models shall have an overload current capacity of 120% of rated current for one minute out of five minutes.

3.4 Heavy duty models shall have an overload current capacity of 150% of rated current for one minute out of five minutes.

3.5 The VFD shall operate continuously at full output without de-rating at elevation up to 3,300 feet MSL. VFD must be de-rated 0.25% for every 100 feet above 3,300 feet.

3.6 The VFD shall have an integrated DC choke on models 30 HP and larger.

3.7 Input Current Characteristics:

3.6.1 Input Voltage Range: The VFD shall operate from 1Φ or 3 Φ, 50/60 Hz, 200-240 VAC for 240 V models and 200-480 VAC for 480 V models.

3.8 Output Power Characteristics

3.7.1 The 3Φ output shall be variable voltage, variable frequency, pulse-width-modulated voltage

3.9 Efficiency: The VFD shall operate the rated load at 95% efficiency.

4. PHYSICAL REQUIREMENTS

4.1 Cabinet Construction: The enclosure shall be constructed with painted galvannealed (A60) steel and galvanized (G90) steel, 0.039 in. (1.0 mm) minimum thickness.

4.2 Enclosures will be provided with hanging brackets. A floor-mount kit can be purchased for some systems.

4.3 Corrosion Protection: All parts shall be of corrosion resistant material or plated or painted as corrosion protection.

4.4 The VFD shall be supplied in an Open Type enclosure or an indoor NEMA Type 1 enclosure.

4.5 Electrical Connections: The VFD shall include input and output terminals for hard-wired connections. The enclosure shall provide an area suitable for input and output conduit openings.

5. WARRANTY

5.1 The manufacturer shall guarantee the VFD to be free from material defects and workmanship for a period of two years from purchase.