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| **Date** | **Customer** | **Job Name** | **P.O. / S.O.** |
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Variable Frequency Drive (VFD)

## Z1000U Matrix

## Mechanical Specification Submittal

**(For Protected IP00/Open Chassis Rated Drives)**

# GENERAL

The Z1000U Matrix is a high performance PWM (pulse-width-modulated) AC drive. Three-phase input line power is converted to a sine-coded, variable frequency output, which provides optimum speed control of any conventional squirrel cage induction motor. The use of Bidirectional Switches, with a carrier frequency range of 4 kHz to 10 kHz, permits quiet motor operation.

This drive has one control logic board for all horsepower ratings. Printed circuit boards employ surface mount technology, providing both high reliability, and small physical size. The dual 32 bit microprocessors deliver the computing power necessary for complete three phase motor control in building automation systems.

Operating Principle: VFD input three phase power is directly converted to variable AC output power. The main circuit consists of a compact input filter and bidirectional switches. Using pulse width modulation (PWM) inverter technology, produces an output waveform in a series of variable-width pulses. Unique firmware algorithms optimize motor magnetization through control of voltage, current and frequency applied to generate a nearly sinusoidal output waveform.

The Z1000U Matrix drive has superior harmonic mitigation of less than 5% THD.

# STANDARDS

UL 508C (Power Conversion)

CSA 22.2 No. 14-95 (Industrial Control Equipment)

UL 1995 (Plenum)

CE mark 2006/95/EC LVD

CE mark 2004/108/EC

IEC 61800-5-1 (LVD)

EN 61800-3 : 2004

IEC 529

IEEE C62.41

BACnet (BTL) Listed

UL, cUL listed; CE marked

# ENVIRONMENTAL & SERVICE CONDITIONS

Ambient service temperature:

 Open Chassis (IP00): -10°C to 50°C (14°F to 122°F)

Ambient storage temperature: -20°C to 60°C (-4°F to 140°F)

Humidity: 0 % to 95 %, non-condensing

Altitude: to 1000 meters (3300 feet), higher by derating

Service factor: 1.0

Vibration/Shock: 10 to 20 Hz: 9.8 m/s² 20 to 55 Hz: 5.9 m/s² (2☐0028 to 2☐0081 and 4☐0011 to 4☐0077), 2.0 m/s² (2☐0104 to 2☐0248 and 4☐0096 to 4☐0414)

Plenum mounting capable (IP20)

RoHS Compliant

# QUALITY ASSURANCE

In circuit testing of all printed circuit boards is conducted, to ensure proper manufacturing.

Final printed circuit board assemblies are functionally tested, via computerized test equipment.

All fully assembled controls are computer tested with induction motor loads to assure unit specifications are met.

The average MTBF (Mean Time Between Failure) is 28 years

# CONSTRUCTION

Matrix technology employs a main power circuit consisting of input line fuses, a compact input filter and a system of 9 bi-directional switches that are arranged in a matrix, to convert a three-phase AC input voltage directly into a three-phase AC output voltage. It eliminates the need for a rectifying and DC smoothing circuit, that are used in traditional AC drive “inverters”. This results in a compact drive with power regenerative capability and reduced harmonic distortion.

# CONSTRUCTION (continued)

Power and control electronics housings:

Open Chassis (IP00):

 208 V, 7.5 thru 75 HP

 240 V, 10 thru 100 HP

 480 V, 7.5 thru 350 HP

Microprocessor based control circuit

Non-Volatile memory (NV RAM); all programming memory is saved when the VFD is disconnected from power.

Current transformers detect the output current for motor control and protective functions

Digital operator keypad and display, with copy function, provides local control and readout capability:

 Hand/Off/Auto commands

 Speed Reference command

 Reset command

Easy to remove heat sink cooling fan with programmable on/off control

USB Type B port for quick and easy PC Connection

# PRODUCT FEATURES

Displacement power factor of .98 throughout the motor speed range

Input phase insensitive; sequencing of the three phase input is unnecessary

Built-In real time clock for time and date stamping events along with timer functions for starting, stopping and speed changes without the need for external controls

Volt meter, ammeter, kilowatt meter elapsed run time meter and heat sink temperature monitoring functions

Two internal (PI) Controls

1. Drive internal PI closed loop control with selectable engineering units
2. Independent PI control for use with external device

Differential PI feedback feature

Sleep function in both closed loop and open loop control

Feedback signal low pass filter

Feedback signal loss detection and selectable response strategy

Feedback signal inverse and square root capability

24 Vdc, 150ma transducer power supply

Input and output terminal status indication

Diagnostic fault indication

VFD efficiency: 96% at half-speed; 98% at full-speed

“S-curve” soft start / soft stop capability

Run/Fault output contacts

Serial communication loss detection and selectable response strategy

“Up/Down” floating point control capability (digital MOP)

Controlled speed range of 40:1

Critical frequency rejection capability: 3 selectable, adjustable bandwidths

150% starting torque capability, available from 3 Hz to 60 Hz

Remote speed reference (speed command) signal:

 0 to10 VDC / -10 to +10 VDC (20 kΩ)

 4 to 20 mA / 0 to 20mA DC (250 Ω)

Adjustable carrier frequency, from 4 kHz to 10 kHz

Dynamic noise control for quiet motor operation

Programmable security code

8 programmable multi-function input terminals (24Vdc) providing 60+ programmable features, including:

 Customer Safeties

 BAS / Damper Interlock

 Emergency Override

 Preset Speed

 PI control enable / disable

3 programmable multi-function output relays (2 Form A and 1 Form C) rated 1 amps @ 250Vac & 30Vdc), providing 50+ functions, including:

 Damper control

 Hand / Auto Status

 Contactor Control for External Bypass

 Overtorque/undertorque detection

 Serial communication status

 No load detection (broken belt alert)

One fixed “Fault” form C output relay (Rated 1 amps @ 250Vac & 30Vdc)

6 preset speeds

Built-in BACnet (BTL listed), Siemens APOGEE FLN, Johnson Controls Metasys N2, and Modbus/Memobus communication

Protocols are accessible via RS-422/485 communication, which is standard

Stationary motor auto-tuning

LCD keypad: Hand/Off/Auto functions with a built-in copy feature,

Motor preheat function

Flash upgradeable firmware

Customizable monitor display

Heat sink over temperature speed fold-back feature

# PRODUCT FEATURES (continued)

Bumpless” transfer between Hand and Auto modes

Emergency override can be used as “smoke purge” function

Fan failure detection and selectable drive action

# OPERATION

Output frequency and speed display can be programmed for other speed-related and control indications, including: RPM, CFM, GPM, PSI, inch Water, % of maximum RPM or custom

Power loss ride-thru (2 seconds capable)

Time delay on start, peak avoidance

VFD accepts a bi-polar speed command signal

Bi-directional “Speed Search” capability, in order to start into a rotating load. Two types: current detection and residual voltage detection

DC injection braking, to prevent fan “wind milling”

Remote Run/Stop command input

Two programmable 0 to +/-10 VDC or 4-20ma analog outputs, proportional to drive monitor functions including: output frequency, output current, output power, PI feedback, output voltage and more…..

5-Line 16 Character LCD display provides readout functions that include: output frequency, output voltage, output current, output power, DC bus voltage, interface terminal status, PI feedback and fault status.

Programmable HVAC specific application macros

Over 100 programmable functions, resettable to factory HVAC presets

User parameter initialization, re-establish project specific parameters

Ramp-to-stop or coast-to-stop selection

Auto restart capability: 0 to 10 attempts with adjustable delay time between attempts

One custom selectable Volts/Hertz pattern and multiple preset Volts/Hertz patterns

Auto speed reference input signal, adjustable for bias and gain

While the VFD is running, operational changes in control and display functions are possible, including:

 Acceleration time (0 to 6000 seconds)

 Deceleration time (0 to 6000 seconds)

 Frequency reference command

 Hand/Off/Auto commands

 Monitor display

 Removable digital operator

Automatic energy saving, reduced voltage operation

# PROTECTION

Output current overload rating of 120 % of drive’s continuous current rating for 60 seconds

Output short circuit protection

Current limited stall prevention (overload trip prevention) during acceleration, deceleration, and run conditions

Optically isolated operator controls

Fault display and last 10 faults storage

“Hunting” prevention logic

Electronic ground fault protection

Electronic thermal motor overload protection (UL approved)

Power supply charge indication

Heat sink over temperature protection

Cooling fan operating hours recorded

Input/Output phase loss protection

Reverse prohibit selectable

Short circuit withstand rating of 100K amps RMS

OPTIONS

LonWorks Interface

 EtherNet/IP

Tag:

Model Number:

HP:

Amps:

Volts: