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

## P1000 Mechanical Specification Submittal

## (For NEMA 1 / UL Type 1 Rated Bypass Drives)

# GENERAL

The P1000 bypass package provides a P1000 Drive in a NEMA 1 (UL Type 1) enclosure, with a 3-contactor style bypass, allowing motor operation from either the drive or across the line. The P1000 features pump- and fan-specific application macros, an easy-to-read LCD keypad that provides Hand-Off-Auto interface, and a real time clock. These features make the P1000 perfect for most pump and fan applications that require reliable motor control.

The P1000 Bypass also features embedded communications for Modbus/Memobus, BACnet, Siemens APOGEE, and Johnson Controls Metasys. DeviceNet, PROFIBUS, Modbus TCP/IP, LonWorks and EtherNet/IP cards are also available as separate options.

The P1000 Drive 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 IGBTs (Insulated Gate Bipolar Transistors), with a carrier frequency range of 1 kHz to 15 kHz, permits quiet motor operation.

This drive has one control logic board and keypad for all horsepower ratings. Printed circuit boards employ surface mount technology, providing both high reliability, and small physical size of the printed circuit assemblies.

# P1000 DRIVE STANDARDS

UL 508C (Power Conversion)

CSA 22.2 No. 14-10 (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

IEC 60529

IEEE C62.41

BTL certified (BACnet)

UL, cUL listed; CE marked

RoHS Compliant

# BYPASS PANEL STANDARDS

UL 508A (Industrial Control Panels)

UL, cUL listed

BTL certified (BACnet)

# ENVIRONMENTAL & SERVICE CONDITIONS

Ambient service temperature: -10°C to 40°C (14°F to 104°F)

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

Humidity: 95% RH or less, non-condensing

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

Service factor: 1.0

Vibration: 0.33 mm displacement (10 to 20 Hz)
 0.22 G (20 to 55 Hz)

# 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 tested with induction motor loads to assure unit specifications are met

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

# DRIVE CONSTRUCTION

Input Section- The drive power input stage converts three-phase AC line power into a fixed DC voltage via a solid-state full wave diode rectifier with MOV (Metal Oxide Varistor) surge protection. An internal 3% DC bus reactor at ratings of greater than 30HP reduces harmonics (optional at smaller ratings).

Intermediate Section- The DC bus maintains a fixed, filtered DC voltage with short circuit protection as a DC supply for the drive output section. The DC bus is monitored by drive diagnostic logic circuits to continuously protect and monitor the power components.

Output Section- Insulated Gate Bipolar Transistors (IGBTs) convert DC bus voltage to a variable frequency, variable voltage PWM sine-coded AC output to the motor. Use of IGBT devices allow motor noise at 60 Hz to measure less than 2 dB (@ 1 meter) above that resulting from across the line operation.

Available horsepower ratings:

 208VAC: 1 thru 150 HP
 480VAC: 1 thru 500 HP

Microprocessor based control circuit uses non-volatile memory (NVRAM) so all programming data is saved when the drive is disconnected from power

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

Multi-language 5-line 16-character LCD Hand-Off-Auto keypad with real time clock. Provides local programming, run/stop control, monitoring, speed reference and reset commands

Customizable display of readouts including output frequency, output voltage, output current, output power, DC bus voltage, PI feedback and fault status. Includes parameter settings copy backup function

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

Removable I/O terminal board has backup memory. All parameter changes are automatically saved to both the main control board and the I/O board. Leave I/O wiring connected when replacing a drive

Easy to remove DC voltage heat sink cooling fans with programmable on/off control

USB Type B port for quick and easy PC Connection

# PROTECTION

Output current overload rating: 110% 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 keypad controls

Fault display with time stamp storage of last 10 faults

Motor hunting prevention function

Electronic ground fault protection

Electronic thermal motor overload (UL approved) protects the motor while operating in drive and bypass mode

Motor current displays in both drive and bypass modes of operation as well as verification that the motor is running

Proof of flow/loss of flow detection in both drive and bypass modes

DC bus charge indication

Heat sink over temperature protection

Cooling fan operation hours monitor

Input/output phase loss protection

Line voltage sensors to monitor for brownout and blackout conditions with adjustable fault levels to ensure the proper settings pursuant to each application.

Reverse prohibit function

Short circuit withstand rating of 65kAIC RMS, 100kAIC RMS with optional breaker

# OPERATION

Over 100 programmable functions with resettable factory fan and pump presets

User parameter settings initialization for re-establishing project specific parameter settings

Output frequency and speed display can be programmed for speed-related and control indications including: Hz, RPM, % or custom units

Power loss ride-thru (2 seconds capable)

Time delay on start, peak avoidance

Drive accepts either a direct acting or a reverse acting speed command signal

Bi-directional speed search capability allows starting into a rotating load. Two types: current detection and residual voltage detection

DC injection braking prevents fan wind milling at motor start

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

Analog speed reference signals have adjustable bias and gain

Automatic energy savings, reduced voltage operation

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

Hand/Off/Auto commands
 Start/stop commands
 Frequency reference command
 Acceleration time (0 to 6000 seconds)
 Deceleration time (0 to 6000 seconds)
 Monitor displays
 Remove the operator keypad

# DRIVE FEATURES

Displacement power factor: 0.98 throughout the motor speed range

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

Starting torque capability: 150% from 3 Hz

Speed control range: 40:1

Carrier frequency: adjustable from 1 kHz to 15 kHz

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

Voltmeter, ammeter, kilowatt meter, elapsed run time meter and heatsink temperature monitoring functions

Two internal (PI) Controls

1. Drive internal PI closed loop control with selectable engineering units
2. Independent PI control of external devices

Differential PI feedback feature

Sleep function in both closed loop and open loop control

Feedback signal low pass filter

Feedback signal loss detection with selectable response

Feedback signal inverse and square root capability

Feedback transmitter power supply: 24 VDC, 150 mA

Input and output terminal status monitors

Diagnostic fault/alarm indicators with dedicated contacts

 S-curve soft start / soft stop capability

Network communication loss detection with selectable response

Up/down motor operated pot (MOP) floating point control

17 preset speeds

Critical frequency rejection capability: 3 selectable, adjustable bandwidths

Dynamic noise control function for quiet motor operation

Programmable security code for operator keypad lockout

Run/stop command methods:

 Terminal strip (2-wire or 3-wire)
 Network communication
 Operator keypad

Speed reference (speed command) methods:

 0 to 10 VDC or -10 to 10 VDC (20 kΩ)
 4 to 20 mA or 0 to 20 mA (250 Ω)
 0 to 32 kHz pulse train
 Network communication
 Operator keypad

8 programmable multi-function digital input terminals providing 60+ functions (24 VDC, sinking or sourcing, internal/external power supply)

3 programmable multi-function digital output terminals providing 50+ functions (2 Form-A and 1 Form-C relays, 1 A @ 250 VAC / 30 VDC)

3 programmable multi-function analog input terminals providing 15+ functions (individually selectable for 0 to 10 VDC, -10 to 10 VDC, 4 to 20 mA, or 0 to 20 mA)

2 programmable multi-function analog output terminals providing 20+ functions (individually selectable for 0 to 10 VDC, -10 to 10 VDC, or 4 to 20 mA)

1 programmable multi-function pulse train input terminal providing several functions (0 to 32 kHz)

1 fixed fault output relay (Form-C, 1 A @ 250 VAC / 30 VDC)

1 built-in RS-422/485 115.2 kbps Modbus/Memobus network communication port

Stationary and rotational motor auto-tuning

Overexcitation braking function stops the motor in up to half the normal time

Motor preheat function

Upgradeable drive firmware via PC program

Heat sink over temperature speed fold-back feature

Bumpless transfer between local and remote modes

Fan failure detection and selectable response

# BYPASS FEATURES

Bypass and drive are factory assembled

Bypass and Drive input/output contactors

Lockable Main Input circuit breaker (65kAIC panel rating)

Thermal motor overload relay, class 20

115 VAC control transformer, fused

Drive H/O/A keypad used for bypass control

Damper control circuit with end of travel feedback with two adjustable wait time functions

Input fuses

Selectable energy savings and harmonic reduction mode.

No load detection (loss of load) fully monitored in drive and bypass modes

Door mounted control keypad with LCD display for “Control Power”, “Drive Ready”, “Drive Run”, “Drive Selected”, “Drive Fault”, “Drive Test”, “Bypass Selected”, “Bypass Run”, “Motor OL”, ”Safety Open” “BAS Interlock”, “Auto Run”, Auto Transfer”, “Emergency Override”, “Hand Mode”, “Off Mode”, and “Auto Mode”

7 programmable multi-function digital input terminals (24 VDC, 8 mA) providing 60+ programmable functions including:

 Customer Safeties
 BAS / Damper Interlock
 Emergency Override
 Preset Speed
 PI control enable / disable

4 programmable multi-function digital output terminals (Form-C relays, 2 A @ 120 VAC / 24 VDC) providing 50+ functions including:

 Damper control
 Hand / Auto Status
 Contactor Control for External Bypass
 Overtorque/undertorque detection

Auto speed reference (speed command) methods:

 0 to 10 VDC (20 kΩ)
 4 to 20 mA (250 Ω)

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|  GR ***P1000 Bypass Options*****Variable Frequency Drive (VFD) P1000 Mechanical SpecificationProducts and Options Submitted** |
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ENCLOSURE TYPE

[1] NEMA 1 (UL Type 1) Enclosure

VOLTAGE

[D] 208 volt models, 200 to 208 VAC (+10/-15 %); 50/60 Hz (+/-5%)

[B] 480 volt models, 380 to 480 VAC (+10/-15 %); 50/60 Hz (+/-5%)

[P] POWER OPTIONS

MAIN INPUT DISCONNECT (Choose None or One)

Tag:

Model Number:

HP:

Amps:

Volts:

[M] Circuit Breaker Disconnect with a UL508A panel SCCR of 100k RMS Symmetrical, 480VAC maximum (Replaces Standard Input Disconnect)

REACTOR (Choose None or One)

 [A] Two Motor “AND”
 [Y] Two Motor “OR”
 [R] 3% Line Reactor
 [X] 3% Bus Reactor (1)
 [H] 3% Load Reactor

FILTER (Choose None or One)

 [N] Cap Filter

[T] CONTROL OPTIONS

NAMEPLATE (Choose None or One)

 [W] Custom Nameplate

NETWORK COMMUNICATION (Choose None or One)

 [D] EtherNet/IP
 [G] DeviceNet
 [H] PROFIBUS
 [Q] Modbus TCP/IP

(1) 3% bus reactors are only available as an option on small ratings; large drives have a bus reactor as standard. See the price book for details.