

Variable Frequency Drive (VFD)

## HV600 Redundant Package Specification Submittal

# GENERAL

The HV600 drive is a high performance PWM (pulse-width-modulated) The Redundant drive package that contains two (2) equally sized HV600 drives. Three-phase input line power is converted to a sinusoidal, 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 12.5 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 of the printed circuit assemblies. The microprocessor delivers the computing power necessary for complete three phase motor control in building automation systems.

Operating Principle: Input three-phase AC line voltage is first rectified to a fixed DC voltage. Using pulse width modulation (PWM) inverter technology, the DC voltage is processed, to produce 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.

# STANDARDS

UL 508A (Industrial Control Panels)

BTL Listed

UL, cUL listed

**ENVIRONMENTAL & SERVICE CONDITIONS**

Ambient service temperature:

 -10°C to 40°C (14°F to 104°F)

Ambient storage temperature:

-20°C to 70°C (-4°F to 158°F)

Humidity: 0 % to 95 %, non-condensing

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

Service factor: 1.0

Vibration: 9.81m/s2 (1 G) maximum at 10 to 20 Hz, 2.0 m/s2 (0.2 G) at 20 Hz to 55 Hz.

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

Input Section of the VFD - VFD 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 5% DC bus reactor reduces harmonics for cleaner power.

Intermediate Section of the VFD - DC bus maintains a fixed DC voltage, with filtering and short circuit protection, as a DC supply to the VFD output section. It is interfaced with the VFD diagnostic logic circuit, to continuously monitor and protect the power components.

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

**CONSTRUCTION (continued)**

Power and control electronics housings:

UL Type 1 or UL Type 12 wall-mounted enclosure:

480 V, 1 thru 100 HP

UL Type 1 or UL Type 12 floor-mounted enclosure:

 480 V, 125 thru 250 HP

Microprocessor based control circuit

Simple PC Connection

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

Digital operator keypad and display 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

# PROTECTION

Output current overload rating of 110% for 60 seconds, 140% for 2 seconds, 175% instantaneous

Output short circuit protection

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

Optically isolated operator controls

Fault display

“Hunting” prevention logic

Electronic ground fault protection

Electronic motor overload relay protects the motor while operating.

Motor current is displayed on each of the drives keypad

Proof of flow or loss of flow detection can be displayed on both drives

DC bus charge indication

Heat sink over temperature protection

Cooling fan operating hours recorded

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 can be enabled or disabled

Short circuit withstand rating of 100KAIC RMS with customer provided branch circuit protection.

Two smoke purge/fireman’s override modes (Across the line or speed selectable via the drive)

# OPERATION

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

Power loss ride-thru (2 seconds capable)

Time delay on start, peak avoidance

VFD accepts either a direct acting or a reverse acting 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.

Eight 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

# PRODUCT FEATURES

Displacement power factor of .98 throughout the motor speed range

Internal EMI/RFI filter complies with IEC 61800-3 restricted distribution for first environment

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 transmitter 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

Controlled speed range of 40:1

Critical frequency rejection capability: 3 selectable, adjustable bandwidths

100% starting torque capability, available from 3 Hz to 60 Hz

Remote speed reference (speed command) signal:

 0 to 10 VDC (20 kΩ)

 4 to 20 mA DC (250 Ω)

Adjustable carrier frequency, from 1 kHz to 12.5 kHz

Dynamic noise control for quiet motor operation

Programmable security code

Eight Programmable digital inputs (24Vdc, 8mA) shall be provided for Remote Transfer from drive to drive, Safety Interlock, BAS Interlock.

Four Programmable form C relays (24Vdc/120 VAC, 2 Amp) for: “Motor Run”, “Damper Actuator”, “Auto Transfer”, “Drive Run”, “Hand Mode”, “Auto Mode”, “System Fault”,”Serial Com Run” and numerous other options.

Seven preset speeds

Stationary motor auto-tuning

“Kinetic Energy Braking” (KEB) function stops the motor in up to half the time it would take without this function.

LCD keypad with Hand/Off/Auto functions.

Motor preheat function

Flash upgradeable firmware

Heat sink over temperature speed fold-back feature

“Bumpless” transfer between Hand and Auto modes

Emergency override can be used as “smoke purge” function

Fan failure detection and selectable drive action

Input disconnect switch with a lockable, through-the-door operating mechanism

Redundant drive package are factory assembled, and electrically interlocked, utilizing fuses for drive isolation.

VFD’s can be serviced or removed, with other drive left in place.

UL Type 1 or UL Type 12 enclosure

Input disconnect with a lockable, through-the-door operating mechanism

2 Output contactors

120 VAC fused control power transformer

Control and safety circuit terminal strip

22 mm LED pilot lights; “Drive Fault A”, “Drive Fault B”, “External Fault”, “Drive Run A” and “Drive Run B”

“Fault XFR Man/Auto” selector switch

“Hand/Off/Auto” selector switch

“Auto DRV A / DRV B” selector switch

“Drive A Fault”, “Drive B Fault” and “External Fault” annunciation contacts

Switch selectable auto transfer to alt drive on drive fault

Switch selectable remote transfer to alt drive via contact closure

Switch selectable smoke purge function

100 VA of 120-volt power available for customer use at terminal strip

Includes Two HV600 drives in single enclosure

Semiconductor fuses for each drive

Single input/output wiring points

Single control wiring point

Two door mounted keypads

Selectable Manual or Auto Transfer

Test A / Normal / Test B switch

Integral damper control circuit

BACnet, Siemens Apogee, Metasys N2, and Modbus communication protocols as standard with the ability to configure controller parameters, view controller monitors, control I/O, clear faults and view controller status.


### ENCLOSURE TYPE

[1] UL Type 1 Enclosure

[2] UL Type 1 Enclosure

### VOLTAGE

 [B] 480 volt model for nominal, 380, 400, 415, 440, 460 or 480 VAC (+10/-15 %); 60 or 50 Hz (+/-5%) systems

### [P] POWER OPTIONS

[M] Circuit Breaker Option is a 100 kAIC rated circuit breaker with fuses. When option (M) is specified, the configured drive package will be rated at 100 kAIC.

*(Replaces default input disconnect)*

### [T] CONTROL & COMMUNICATION OPTIONS

[W] Engraved nameplate

[3] Multi-Protocol Ethernet (Default BACnetIP)

[D] Ethernet/IP

[L] LonWorks