VFD in HAVC Technical Guide

1. Overview

In modern HVAC (Heating, Ventilation, and Air Conditioning) systems, Variable Frequency Drives (VFDs) are essential components for achieving energy efficiency, precise process control, and equipment longevity. This guide integrates technical specifications from OULU EV210, EV510A, and EV200 series to provide selection advice, parameter configuration, and application schemes for fans, pumps, cooling towers, and compressors.

Key Benefits:

- **Energy Efficiency:** VFDs reduce motor speed to match load demand. For variable torque loads like fans and pumps, power consumption is proportional to the cube of the speed, offering significant savings.
- **PID Control:** Built-in PID logic allows for constant pressure (water supply) or constant temperature (cooling tower) control without external PLCs.
- **Mechanical Protection:** Soft start/stop features reduce mechanical stress on belts, gears, and couplings.
- **System Reliability:** Comprehensive protection against overload, phase loss, over-voltage, and signal loss ensures continuous operation.

2. Selection Guide

Application	Recommended Model	Key Features & Selection Logic
Pumps / Constant Pressure Water Supply	EV210 Series	Specialized for Pumps: Features a dedicated water supply macro, multi-pump polling control, and advanced sleep/wake functions to prevent dry running and save energy.
Large Fans / Cooling Towers / Chillers	EV510A Series	High Performance & Power: Supports Dual Rating (G-type for heavy loads, P-type for fans/pumps). Wide power range (up to MW class) handles large industrial HVAC loads

		robustly.
Small Exhaust Fans / AHU / Cabinet Fans	EV200 Series	Compact Design: The narrow-body design saves up to 45% of cabinet space. Ideal for small motors (< 3.7kW) where installation space is limited.

3. Core Features & Configuration

3.1 PID Constant Pressure/Temperature Control The VFD adjusts motor speed based on feedback from sensors to maintain a setpoint.

- Target Application: Maintaining water pressure in high-rise buildings or return water temperature in cooling towers.
- Key Parameters (EV210/EV510A):
  - PA-00: PID Reference Source (Set to Digital or Comms).
  - PA-01: PID Setpoint Value (e.g., 50.0%).
  - PA-02: PID Feedback Source (e.g., AI1 for 0-10V pressure sensor, AI2 for 4-20mA temperature transmitter).
  - PA-03: PID Action Direction (Positive for Cooling, Negative for Heating/Pressure).

3.2 Sleep & Wake Mode (Energy Saving) Prevents pumps/fans from running inefficiently at very low speeds when demand is negligible.

- Key Parameters (EV210 Group A3):
  - A3-27 (Sleep Frequency): If frequency drops below this (e.g., 20Hz) for a set time, the VFD stops output.
  - A3-05 (Sleep Delay): Time delay before entering sleep mode.
  - A3-07 (Wake-up Threshold): VFD restarts when feedback pressure drops below this level (e.g., 80% of setpoint).

3.3 Load Lost Protection (Broken Belt Detection) Detects if a fan belt has broken by monitoring for abnormally low current while running at speed.

- Key Parameters (EV510A Group P9):

- P9-63: Enable Load Lost Protection.
- P9-64: Detection Level (Set to approx. 20% of rated current).
- P9-65: Detection Time (Time to trigger fault, e.g., 5.0s).

4. Typical Wiring Schemes

4.1 Constant Pressure Water Supply (EV210)

- Control Signals:
  - Start/Stop: Connect a selector switch or relay contact between terminals S1 and COM.
  - Feedback Sensor: Connect a 2-wire Pressure Transmitter (4-20mA) to terminals +24V and AI. Ensure the jumper is set to current (I) mode.

4.2 Cooling Tower Fan Control (EV510A)

- Control Signals:
  - Temperature Sensor: Connect PT100 transmitter (4-20mA) to AI2 and GND.
- Special Settings:
  - Flying Start: Set P6-01 = 1 (Catching a spinning motor). Large fans often rotate due to wind draft; this prevents over-current trips on startup.
  - Minimum Frequency: Set P0-14 = 20Hz. Gearbox-driven fans require a minimum speed to ensure proper oil lubrication.

5. Troubleshooting Common HVAC Faults

Fault Code	Description	Common HVAC Cause	Solution
FU01 / FU02	Overcurrent	Duct dampers closed (sudden load change), pump impeller seized.	Check dampers and valves. Check motor rotation and insulation. Increase acceleration time (P0-17).
FU05 / FU06	Overvoltage	Fan inertia is too high during deceleration.	Increase deceleration time (P0-18). Install a braking resistor if fast stopping is required.
FU10	Drive Overheat	Clogged heatsink, cabinet fan failure, high ambient temp (>40°C).	Clean VFD vents. Check control panel cooling fans. Ensure proper airflow.
FU16	Communication Error	Noise on RS485 line from BMS.	Use shielded twisted pair cable for BMS. Check grounding. Verify Baud Rate (Pd-00) matches BMS.

Disclaimer: This document is based on technical manuals for OULU EV series VFDs. Actual parameters should always be verified against the specific equipment nameplate and site conditions.