Clean Power VFD

Technical Support Troubleshooting Guide

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The user must exercise caution and follow all safety protocols when working with VFDs. This includes, but is not limited to, wearing appropriate personal protective equipment (PPE), disconnecting power before working on equipment, and adhering to all applicable local and national electrical codes.

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Overview

The guide proposes basic steps to troubleshoot a customer issue. It is not an exhaustive list of all the possible steps, and it should be used as information to help you to gather relevant information to understand the customer's issue and propose a solution to solve it.

Gather the information

Gather information from the customer, make sure to get the following information:
- VFD model and S/N (About / Hardware / Controller) – **Photo of HMI and mobile app**
- Software version (About / Software information) – **Photo of the HMI or mobile app**
- Motor specifications: nominal voltage, nominal current, nominal power (kW/HP), service factor (SFA) – **Photo of the motor's nameplate**
- VFD installation and commissioning date
- Application and motor load information if possible
- Environmental information: location, wall mount/in panel, temperature, humidity, dust level – **Photo**
- Network connectivity (Ethernet)
- Control mode: I/O, Modbus TCP, BACnet IP or local
- Full description of the issue
- When the issue started and any recent changes (electrical, mechanical, or control system)
- Any prior troubleshooting done

Assess the current conditions

- What does the HMI show? **Ask the customer to send a photo of the current HMI screen**.
- What is the HMI banner color?
- What is the color of the HMI LED?
- Does the HMI report any alarm?
- If there are alarms, **ask the customer to open the alarms screen on the HMI and send a photo of the alarms screen**.

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HMI banner color
Refer to the table below to translate the HMI banner color into VFD state

Color	State	Description
GREY	Unconfigured, need auto-tuning, updating, shutdown, factory reset	The VFD is not ready to run. Look into the HMI notification window for what is required
BLUE	Ready to run	The VFD is configured, no fault detected, it is ready to run
GREEN	Running	The VFD is controlling the motor normally
LIGHT ORANGE	Running degraded	The VFD is controlling the motor but in a degraded mode
DARK ORANGE	Running in fire emergency mode	The VFD is controlling the motor in fire emergency mode
RED	Fault, lockout	There is a fault on the VFD or it is lockout
GOLD	Maintenance mode (OOS)	The VFD was put in maintenance mode

HMI LED color definition
Refer to the table below to translate the HMI LED color into VFD state.

Color	Definition
BLINKING RED	There is at least one unresolved critical alarm that is not acknowledged by the user
SOLID RED	There is at least one unresolved critical alarm already acknowledged, and it is in lockout mode
BLINKING ORANGE	There is at least one unresolved major alarm that is not acknowledged by the user
SOLID ORANGE	There is at least one unresolved major alarm already acknowledged
BLINKING YELLOW	There is at least one unresolved medium alarm that is not acknowledged by the user
SOLID YELLOW	There is at least one unresolved medium alarm already acknowledged
BLINKING GREEN	There is at least one unresolved minor alarm (minor alarm does not required acknowledgement)
SOLID GREEN	The VFD is running normally
SOLID WHITE	The VFD is booting
BLINKING WHITE	The HMI firmware is updating
BLINKING BLUE	Bluetooth is waiting to pair

Understand the fault and alarm
In case of alarms, the VFD uses the HMI LED to indicate the severity of the alarm.

Alarm severity
The Clean Power VFD has defined 4 severity levels depending on the impacts of safety for personnel and equipment.

Severity	Purpose	Default Action
Critical	Immediate danger to people and damage to equipment	The fault cannot be reset automatically. The user must identify and fix the issue. The drive restarts if the fault is cleared and after a reset (power off / power on cycle is the default reset operation for a critical fault).
Major	Imminent danger risk to people and damage to equipment	The user must analyze and fix the issue. When fixed the VFD goes into the ready-to-run state, and the motor can be re-started.
Medium	The application can generate the fault or from a non-destructive electrical fault. These are faults that may disappear without the need for human intervention.	The motor stops when the fault occurs and lasts longer than the filter timer if one is configured. The user configures restart behavior during setup: - Automatic re-start, or - Manual Restart with acknowledgment.
Minor (warning)	A transitory fault with little impact on the drive and the process	The motor does not stop. The fault is reset automatically when the cause disappears and does not need any acknowledgment.

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List of alarms, Possible causes and suggested remedies
The items are sorted by ascending code number.

Check the online version for the latest version: Alarms and troubleshooting suggestions

DC Undervoltage (Code: 4)

The DC bus voltage drops below the required level for normal operation.

Possible causes and suggested remedies:

1. The input voltage is too low or unstable.
   - Check if the input voltage is below the Clean Power VFD specifications. To protect against such events, install additional power conditioning equipment, such as voltage stabilizers, uninterruptible power supplies (UPS), or line conditioners.
2. Input phase loss or open circuit.
   - If there's a contactor upstream of the Clean Power VFD, it may be defective. Check the operation and connection of the upstream contactor. If defective, replace it. Inspect input terminals and circuit breakers.
3. Sudden disconnection of motor/load.
   - Verify for sudden load drop and ensure stable load connection.

DC Overvoltage (Code: 5)

The DC bus voltage is way above the line-nominal-voltage side, and the DC overvoltage stall prevention function did not succeed in limiting the rise of the DC bus voltage.

Possible causes and suggested remedies:

1. Deceleration time is too short compared to load inertia.
   - Increase deceleration time.
2. The input voltage is too high.
   - Check if the input voltage is above the Clean Power VFD specifications.

Line voltage sag (Code: 6)

A temporary drop in input voltage may disrupt VFD operation or cause faults like undervoltage or AFE ride-through failure.

Possible causes and suggested remedies.

1. Utility power disturbance (grid fluctuation or switching)..
   a. Install voltage monitoring equipment; work with the utility provider to identify the root cause
2. Large motor or equipment starting on the same power line.
   a. Use soft starters or VFDs for large loads; stagger startup sequences.

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3. Undersized transformer or excessive impedance upstream.
    a. Upgrade transformer or cabling; reduce length or improve conductor sizing.
4. A fault or short circuit elsewhere in the facility is drawing current.
    a. Inspect the facility's power distribution for abnormal loads or faults.
5. Shared power source with high inrush loads.
    a. Separate sensitive loads or use dedicated circuits.
6. Loose or poor supply terminals or breakers.
    a. Inspect and tighten all line-side connections.

Line voltage balance (Code: 7)

One or more phases of the incoming supply voltage deviate significantly from the average of the line input voltage.

Possible causes and suggested remedies:

1. Upstream voltage imbalance (utility or transformer)
    a. Check phase-to-phase voltages with a power analyzer. Contact the utility provider or adjust transformer tap settings to balance voltages within ±2%.
2. Asymmetric source impedance (unequal cable lengths or impedance)
    a. Use identical cable lengths and cross-sections for all three phases. Match upstream fuses or circuit breakers phase by phase.
3. Nearby large single-phase loads
    a. Redistribute single-phase loads across phases. Consider adding load-balancing transformers or power conditioners if redistribution isn't possible.
4. Harmonics from other nonlinear loads (welders, other drives, etc.)
    a. Remedy: Install line reactors or active harmonic filters upstream.
5. Improper grounding or bonding (e.g., high impedance in return paths)
    a. Verify TN-S or HRG grounding is correctly implemented. Ensure clean bonding at the drive cabinet and the upstream panel. Follow SmartD grounding best practices.
6. Internal AFE fault or hardware asymmetry
    a. Run diagnostics from the SmartD HMI or app. Measure per-phase current draw. Contact SmartD for test procedures or replacement.
7. Loose or corroded terminal connections
    a. Inspect and retighten all power connections. Clean terminals and apply an antioxidant compound if required. Follow torque specs.
8. Damaged transformer windings or taps
    a. Perform transformer testing (e.g., TTR, insulation resistance). Replace or service the faulty transformer.
9. Shared neutral or undersized grounding conductor (in rare cases)
    a. Use a separate, properly sized PE conductor per IEC 60364 and UL 508A. Avoid shared neutrals in three-phase systems.

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HMI communication loss (Code: 9)

Communication problem between the control board and the HMI

Possible causes and suggested remedies:

1. Communication cable or connector failure (e.g., loose or broken cable).
   ○ Inspect and replace any damaged cables or connectors; ensure a secure connection.
2. Grounding or electrical noise issues are causing communication interference.
   ○ Improve grounding; use only SmartD HMI cable. Do not use a standard Ethernet RJ-45 cable
3. Hardware failure.

Please escalate this issue to the SmartD support team

Line Overcurrent (Code: 11)

The VFD has triggered its self-hardware protection for grid overcurrent

Possible causes and suggested remedies:

1. Ground fault or short circuit on the input wiring.
   ○ Power off the system and visually inspect the input wiring for damage, loose connections, or signs of insulation breakdown.
2. Sudden grid voltage swell due to unstable power supply or switching events.
   ○ Check for ground faults using an insulation tester (megohmmeter) between each input phase and ground.
3. Connection to a high-impedance or weak grid that cannot sustain regenerative or fluctuating loads.
   ○ If connected to a generator or weak grid, verify the voltage stability and consider enabling specific VFD settings for generator compatibility (if available).
4. Confirm proper input fuse or circuit breaker sizing per the drive's installation guide.

Preventive Recommendations:

● Ensure correct grounding and shielding of the power cables.

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Motor currents unbalanced (Code: 12)

The current on any phase deviated above a certain threshold from the maximum mean of the three phases' nominal value.

Possible causes and suggested remedies

- Winding Problems: Shorted or open windings can cause unbalanced currents. This could be due to insulation failure, aging, or physical damage to the motor.
    - Check Motor Connections:
        - Inspect and tighten all motor and VFD terminal connections.
        - Ensure that all connections are clean and free from corrosion
- Uneven Air Gap: A non-uniform air gap between the rotor and stator can cause magnetic field distortion, leading to current imbalance.
    - Measure and Compare Phase Currents: Use a clamp meter or other suitable instruments to measure the current in each motor phase. Compare the readings to determine the level of imbalance.
- Bearing Issues: Worn or damaged bearings can lead to rotor misalignment, resulting in uneven magnetic pull and current unbalance.
    - Inspect Motor Windings:
        - Perform a resistance test on the motor windings to check for open or short circuits.
        - Consider performing an insulation resistance test to check for potential insulation failures.
- Rotor Bar Issues: Broken or cracked rotor bars can cause unequal current distribution within the rotor, leading to unbalanced currents in the stator.
    - Examine the Motor Mechanically:
        - Inspect the motor for mechanical issues such as bearing wear, rotor misalignment, or physical damage.
        - Check for even air gaps and rotor conditions, particularly the rotor bars.
- Poor Connections: Loose or corroded connections in the motor terminals or VFD output terminals can cause an imbalance.
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- Inspect and tighten all motor and VFD terminal connections.
- Ensure that all connections are clean and free from corrosion
- Incorrect Cable Sizing: Cables that are undersized or of different lengths can cause unequal voltage drops, leading to current imbalance.
    - Check Cabling and Grounding:
        - Inspect motor cables for damage, proper sizing, and ensure they are of equal length.

Verify proper grounding and shielding to minimize the effect of electrical noise.

Motor overtemperature (Code: 14)

The VFD, connected to the PTC sensors of the motor to achieve thermal protection, has detected that the motor exceeds its maximum operating temperature.

Possible causes and suggested remedies

1. The motor has overheated due to mechanical issues or improper selection.
    - Reduce the load or operating frequency.
2. The PTC sensors are defective.

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- ○ Disconnect the sensors from the Clean Power VFD and check their resistance. If defective, replace them.
3. At low speeds, the motor's fan does not provide sufficient airflow.
    - ○ Check the motor, and avoid prolonged low-speed operation.
4. Improper acceleration or deceleration settings.
5. Adjust acceleration/deceleration times.
    - ○ Voltage drop or high capacitive charging current can lead to heat (inadequate cable sizing).
6. Verify the cable with the proper size.
7. Incorrect motor information.
    - ○ Ensure all motor parameters (voltage, current, frequency, RPM) are correctly configured.
8. The ambient temperature is too high, the motor is operating in an environment that exceeds its thermal rating.
    - ○ Improve ventilation or air conditioning in the motor room, and consider a motor with a higher insulation class.

Application Overload Prevention (Code: 15)

The Clean Power VFD monitors the motor current to detect an application overload.

If the current drawn by the motor exceeds the threshold value, which lasts longer than the inhibition delay, then the fault is triggered.

Possible causes and suggested remedies:

1. The motor is drawing current above the set overload threshold for longer than the set inhibition delay.
2. The overload threshold may be set too low for the application, causing nuisance tripping.
3. The inhibition delay may be set too short, not allowing for normal load fluctuations.
4. Actual application overload due to mechanical binding, increased load, or a process issue.
5. The motor FLA (Full Load Amp) value is programmed incorrectly in the VFD.
6. A faulty current sensor or wiring in the VFD can lead to incorrect readings.
1. Check Application Load:
    - ○ Inspect the mechanical system for any signs of binding, excessive load, or process issues causing the motor to draw excess current.
    - ○ Resolve any mechanical or process problems as necessary.
2. Verify VFD Settings:
    - ○ Ensure that the motor's FLA (Full Load Amps) is programmed correctly in the VFD.
    - ○ Adjust the overload threshold according to your application:
        - ○ For normal/light duty: set threshold to 110–120% of FLA, inhibition delay at 60s.
        - ○ For heavy-duty loads: set threshold to 150–160% of FLA, inhibition delay at 60s.
    - ○ Avoid setting the threshold too low or the inhibition delay too short, as this may cause nuisance tripping.
3. Check Fault Reset and Restart Settings:
    - ○ Confirm that the fault reset time is suitable for your application (the default is 60 seconds).
    - ○ After a fault, ensure that the motor current falls below 10% of the overload threshold before attempting a restart.

VFD over temperature (Code: 16), or VFD high temperature (Code: 20), or High ambient temperature (Code: 59)

Embedded temperature sensors monitor the level of heat applied to the electronic components of the VFD.

3 levels of temperature allow for maximizing the availability of the VFD.

The VFD detected that the pre-warning, the warning level, or the overtemperature level has been exceeded

Possible causes and suggested remedies

1. Blocked or dirty ventilation.
   - Check if a foreign object is obstructing the air inlet or outlet.
2. A cooling fan is defective.
   - Inspect and replace defective internal cooling fans.
3. The ambient temperature is too high.
   - Keep the ambient temperature below the specified maximum operating temperature of the Clean Power VFD.
4. VFD is continuously running at or beyond its rated output current
   - Check the motor load and reduce the load if necessary. Consider using a higher-rated drive.
5. Inadequate ventilation or airflow around the drive.
   - Ensure minimum clearance around the VFD; install in a temperature-controlled and ventilated enclosure.
6. Excessive load on the VFD.
   - Reduce motor load or check application demands vs drive rating

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Unknown boot state (Code: 17)

Something goes wrong during boot.

Possible causes and suggested remedies

1. Corrupted firmware or software.
   - Reinstall the VFD software and reboot the VFD. If the alarm is still activated, please escalate to the SmartD support team.
2. Incomplete or interrupted boot process due to unstable power.
   - Ensure stable input voltage during boot-up; install a line conditioner if needed

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Booted backup software (Code: 18)

Booted on the backup version, which is compatible with the current configuration of the VFD.

Possible cause and suggested remedy:

- The VFD fails to boot with the active version, it boots from the backup version (the configuration is compatible). Possibly due to a corrupted active partition
- Verify the software version, and upgrade to the latest or desired version.

Booted backup software with factory default configuration (Code: 19)

The VFD fails to boot with the active version; it boots from the backup version, but the active configuration is incompatible, so it uses the factory default configuration.

Possible cause and suggested remedy:

- Corrupted active partition.
- Verify the software version, and upgrade to the latest or desired version.

Line voltage swell (Code: 21)

One or more line voltages momentarily rise significantly above nominal for a brief period.

Possible causes and suggested remedies.

1. Utility capacitor bank switching, sudden energizing of capacitor banks by the utility, can cause brief voltage surges.
   - Request switching coordination or delay from the utility.
   - Use surge protection devices (SPDs) on the VFD input panel.
2. Sudden disconnection of large inductive loads. When large motors or transformers are disconnected, stored magnetic energy may spike the voltage upstream.
   - Use controlled shutdown procedures.
   - Add snubber circuits or damping devices if switching is frequent.
   - Coordinate start/stop sequences of large equipment.
3. Generator overshoot or AVR malfunction, poor voltage regulation, or sudden load shedding may cause a voltage swell.
   - Calibrate or upgrade the generator's AVR.
4. fault clearing or reclosure events on the utility side, when a utility breaker recloses after a fault, a temporary voltage swell may occur.
   - Use input surge arresters (MOVs or TVSS).
   - Enable "overvoltage delay".
5. Poorly tuned or oversized power factor correction banks can cause overcorrection or resonance with inductive loads can raise voltage levels.
   - Use detuned or passive filter PFC systems.
   - Recalculate and retune the capacitor bank size and switching steps.
   - Coordinate with the utility or facility power quality team.

6. Lightning or nearby surge events
   - Install SPD (surge protective device) compliant with IEC 61643-11.
   - Ensure proper bonding and grounding system integrity.
   - Use shielded input cables with proper termination to ground

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Software update failed (Code: 22)

The software or firmware upgrade process was unsuccessful, which could lead to system instability, outdated features, or malfunctioning of control functions.

Possible causes and suggested remedies

1. Power loss during the upgrade process.
   - Use a stable power supply during the upgrade process.
2. Upgrade process interrupted by external factors.
   - Avoid interrupting the upgrade process; if an interruption occurs, restart the process after fixing the issue.

Cooling fan (1-4) fault (Code: 24 to 27)

Cooling fan (1-4) is defective.

Possible causes and suggested remedies:

1. Blocked or dirty fan. Ensure no debris or obstruction is in the fan mechanism.
   - Verify if the cooling fan is not obstructed.
2. Fan motor failure or mechanical.
   - Inspect and replace the faulty fan.
3. Fan electrical connection issue.
   - Verify and tighten all electrical connections to the fan.

Cooling fan capacity fault (Code: 28)

The VFD has detected that the cooling fan is either not working properly or is providing inadequate airflow.

Possible causes and remedies:

1. Fan speed is too low or zero.
   - Inspect fan operation and replace any faulty fan(s).
2. Fan obstructed by dust, debris, or a foreign object.
   - Clean the fan blades and airflow path; remove any obstructions or buildup.

3. Fan wiring is loose or disconnected.
   ○ Check and secure all electrical connections to the fan terminals.

Line unexpected voltage (Code: 29)

Possible causes and suggested remedies:

1. Incoming line voltage is outside the specified range (either too high or too low).
   ○ Verify the input voltage and ensure it is within the VFD's rated voltage range.
2. Voltage spikes or surges from the utility grid.
   ○ Install surge protection devices or voltage suppressors on the incoming supply line.
3. Power supply instability (e.g., fluctuating voltage from generator or transformer).
   ○ Use voltage stabilizers or ensure a stable power supply from the generator or transformer.
4. Loose or poor connections at the incoming power supply terminals.
   ○ Inspect and tighten all power supply connections, clean and secure connections.
5. High line impedance causes a voltage drop under load.
   ○ Ensure proper wire size and reduce the distance between the VFD and power source if possible

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Internal Error (Code: 30)

The firmware or the FPGA watchdog raises this alarm to indicate an issue with the Interrupt Service Routine (ISR).

Possible causes and suggested remedies:

- Hardware failures, corrupted firmware, or software.
- Reinstall the VFD software and reboot the VFD if the alarm is still activated. Please escalate to the SmartD support team.

DC unbalanced (Code: 31)

The DC bus voltage on one side of the drive's floating neutral point is too high compared to the other.

Possible causes and suggested remedies:

1. Motor control is unstable, for example, at low speeds.
   ○ Adjust Motor Control Settings: Reduce the start/stop ramp times to prevent rapid changes in current.
2. The DC bus voltage is not measured correctly.
   ○ Lower the torque boost percentage, especially at low speeds, to avoid unbalanced currents.

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3. A hardware issue.
   ○ Restart and Retest: If the issue persists, consult SmartD technical support for further troubleshooting.

Drive Output Overcurrent (Code 32) / Acceleration overcurrent prevention

To prevent the Clean Power VFD from going into an overcurrent alarm during acceleration, at the starting phase, or the speed change phase, the acceleration is automatically paused if the output current reaches a trigger threshold.

Possible causes and suggested remedies:

1. Drive acceleration/deceleration is too aggressive.
   ○ Increase acceleration/deceleration times to reduce inrush current and prevent torque spikes.
2. Sudden mechanical load spike or locked rotor.
   ○ Inspect the driven load for jamming, mechanical seizure, or sudden torque spikes.
3. Motor too large for VFD rating.
   ○ Verify the motor FLA vs. VFD rated output. Resize the drive or motor for proper capacity.
4. Loose output terminals.
   ○ Inspect and tighten motor terminals at both the VFD and motor ends.
5. Incorrect VFD control mode (e.g., sensorless vector vs. V/f).
   ○ Select an appropriate control method for motor/load type. Use sensorless/vector for torque-sensitive loads.

Simultaneous forward and reverse command (Code: 33)

The alarm is generated because a user activated forward and reverse run signals simultaneously, while the VFD has been configured to generate an alarm when receiving both forward and reverse run signals simultaneously via digital inputs.

Possible causes and suggested remedies

1. Both forward and reverse digital inputs are active at the same time
   ○ Review wiring and PLC logic to ensure only one direction signal is active at a time
2. Incorrect control logic in the PLC or relay contact bouncing
   ○ Add interlocking logic in the PLC or relay circuit to prevent both signals from being active simultaneously
3. A faulty switch or relay contacts closing both inputs
   ○ Inspect and replace faulty mechanical switches, contactors, or relays
4. Misconfigured input function mapping and/or priority of spinning direction in VFD parameters
   ○ Verify the VFD digital input assignments and priority of spinning direction to ensure correct forward/reverse mapping
5. Short circuit or wiring error connecting both direction signals.
   ○ Inspect wiring for shorts, miswiring, or incorrect terminal connections
6. A floating or noisy signal on digital inputs
   ○ Use pull-up/pull-down resistors or shielding to eliminate noise; verify clean control signals

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System boot time exceeded (Code: 34)

The system remained in booting state for too long.

Possible causes and suggested remedies:

1. Corrupted firmware or software.
   - Reinstall the VFD software and reboot the VFD. If the alarm is still activated, please escalate to the SmartD support team.
2. Incomplete or interrupted boot process due to unstable power.
   - Ensure stable input voltage during boot-up; install a line conditioner if needed.

Abnormal CPU usage (Code: 36)

The CPU usage is abnormally high.

Possible causes and suggested remedies:

- Firmware bugs or memory leaks
- Please escalate this issue to the SmartD support team if it is frequent

Abnormal memory usage (Code: 37)

The internal memory usage of the VFD is unusually high or behaves erratically.

Possible causes and suggested remedies:

- Firmware bugs or memory leaks
- Please escalate this issue to the SmartD support team if it is frequent

DC overvoltage stall prevention (Code: 38)

the motor is decelerating and the voltage on the DC bus is too high, the "DC Overvoltage stall prevention" alarm is raised and an automatic action is executed to prevent the VFD from going into a DC overvoltage alarm.

Possible causes and suggested remedies:

1. The deceleration rate is too fast, causing regenerative energy to be fed into the DC bus.
   - Increase deceleration time.
2. Load has high inertia (e.g., fan, centrifuge).

- ○ Tune deceleration to match mechanical characteristics.

Motor overcurrent stall prevention (Code: 39)

The VFD detected that the motor current is approaching or exceeding the overcurrent threshold during acceleration, deceleration, or constant speed, and it engaged a protective function to reduce torque or slow acceleration to prevent a trip

Possible causes and suggested remedies.

1. The acceleration rate is too fast, causing high current draw
   - ○ Increase acceleration time
2. Motor starting under heavy mechanical load
   - ○ Reduce initial load where possible; use torque boost features
3. Load requires more torque than the motor can supply (e.g., jam, too heavy)
   - ○ Check for mechanical obstructions or size mismatch; consider upsizing motor/VFD
4. Incorrect motor parameters configuration
   - ○ Verify motor nameplate data; ensure proper tuning and autotuning if available
5. Motor wiring issue or partial phase loss
   - ○ Inspect motor leads and terminal connections; check for phase imbalance
6. High inertia load causing excessive current during rapid speed change
   - ○ Lengthen acceleration/deceleration ramps; apply torque limits
7. Improper torque or current limit settings in the VFD
   - ○ Review and adjust torque and current limit parameters in the drive configuration

Line unexpected frequency (Code: 40)

The line configuration does not match the actual line values.

Possible causes and suggested remedies:

1. Misconfigured VFD settings for the expected input frequency.
   - ○ Ensure VFD is correctly set to expect the proper input frequency (50 Hz or 60 Hz, as applicable).
2. The input power source is providing incorrect frequency (e.g., generator instability).
   - ○ Verify and stabilize the generator or alternate power source to ensure proper output frequency.
3. Utility power grid frequency fluctuation or fault.
   - ○ Verify grid stability; install power monitoring equipment if needed.

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DC unexpected voltage (Code: 41)

The line configuration does not match the line values.

Possible causes and suggested remedies:

1. An incorrect or unstable AC supply voltage causes the bus voltage to deviate.
   ○ Verify stable input voltage; use voltage stabilizers or correct upstream power issues.
2. Sudden load drops during braking cause bus voltage spikes.
   ○ Verify the application load requirements.

AFE fault (Code: 42)

Active Front-End detected line voltage sag or line voltage unbalance.

Possible causes and suggested remedies:

1. Incorrect line configuration.
   ○ Verify and change the input line configuration.
2. Line dips or unstable supply prevent proper AFE operation.
   ○ Verify the input line voltage and install line conditioners or voltage stabilizers.
3. High line impedance destabilizes the AFE
   ○ Analyze the grid impedance with a power quality meter and consider using isolation transformers if the impedance is too high
4. AFE hardware failure
   ○ Please escalate this issue to the SmartD support team

AFE low voltage ride-through (Code: 43)

Active Front-End detected line voltage sag or line voltage unbalance.

Possible causes and suggested remedies:

1. Utility grid voltage sag or temporary drop.
   ○ Install line voltage monitoring; consult the utility provider if sags are frequent.
2. Excessive load during a voltage dip.
   ○ Reduce momentary load demand or use load shedding strategies.
3. Weak or unstable grid source.
   ○ Add voltage stabilizers; reinforce grid connection.
4. Poor grounding or interference affecting LVRT detection.
   ● Verify and improve grounding/shielding to ensure accurate voltage sensing

Remote to local override (Code: 44)

A user has forced the VFD to go back to local mode while the VFD is remotely controlled

Possible cause and suggested remedy

The user uses the HMI or mobile app to switch back to local control mode.

Reset the lockout to resume local control

Analog output sensor loss (Code: 45)

The VFD detects a failure or disconnection in the analog output signal path to a connected actuator.

Possible causes and suggested remedies:

1. The actuator is disconnected from the analog output circuit.
   - Verify and resecure actuator wiring at both the VFD and actuator terminals.
2. Broken or loose wiring in the analog output circuit.
   - Inspect and repair any damaged cables or loose connectors.
3. Analog output misconfigured (e.g., wrong mode or range).
   - Verify analog output configuration (e.g., 0–10 V, 4–20 mA); adjust settings if needed.
4.
5. Analog output is short-circuited or overloaded.
   - Disconnect load and test output; ensure connected device is within output capacity.
6.
7. Signal interference or grounding issues.
   - Improve grounding and isolation; check for noise sources.
8.
9. Incorrect wiring polarity (e.g., reversed 4–20 mA loop wiring).
   - Recheck the polarity of analog connections, especially in current loop systems.

PID process value alarms (Code: 46 and 47)

The VFD detected that the process value has crossed the minimum or the maximum user-defined alarm thresholds.

Possible causes and suggested remedies

1. Process sensor (e.g., pressure, flow, temperature) giving incorrect readings
   - Calibrate or replace the sensor; verify signal range (e.g., 4–20 mA, 0–10 V)
2. Sensor disconnected, failed, wiring open or short-circuited.
   - Inspect wiring; resecure or replace the failed sensor.
3. PID loop tuning is too aggressive or poorly set.
   - Re-tune PID gains (P, I, D); use trial-and-error method.
4. The setpoint is configured too high or too low for the current process conditions.
   - Adjust the setpoint to a realistic target for the current operating state.
5. The motor is not responding or is undersized.
   - Verify the motor's status; confirm it can deliver the required output for control.
6. Analog input is misconfigured (wrong scaling or mode).
   - Verify analog input range and signal type; correct scaling parameters.
7. Actuator (e.g., valve, motor) not responding or stuck open.
   - Inspect and service the actuator; ensure it is functioning and controllable.
8. Incorrect PID tuning is causing overshoot or instability.
   - Re-tune the PID gains to prevent excessive overshoot; reduce proportional/integral gains.
9. Control direction set incorrectly (direct vs. reverse action mismatch).
   - Verify control direction matches the process behavior.
10. Process disturbance or load decrease causes the output to exceed the target.
    - Identify and stabilize external conditions influencing the process.
11. Feedback signal delay or sensor location causing lag.
    - Improve sensor placement or adjust derivative time to compensate for response lag

---

Control board power loss (Code: 48)

The control board power supply has been lost.

Possible causes and suggested remedies:

1. Control power input (external 24 VDC) is missing or unstable
   - Verify the 24 VDC supply source; measure voltage and inspect wiring
2. Grounding issues are causing voltage reference instability
   - Ensure proper chassis and control ground connections
3. Hardware failure
   - Please escalate this issue to the SmartD support team

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Motor control instability (Code: 49)

The Clean Power VFD has detected conditions that could lead to motor control instability and has stopped operating to prevent any damage.

Possible causes and suggested remedies

1. The voltage command for U/V/W phases is changing too rapidly, causing instability.
   - Verify Motor and System Parameters:
     - Double-check that all motor nameplate data (voltage, current, frequency, speed) is entered correctly into the VFD.
     - Ensure that the motor is appropriately sized for the application and load.
2. Incorrect control mode selected for the application (e.g., V/Hz mode used instead of vector control).
   - Review and Adjust Control Mode:
     - Confirm that the selected control mode matches the application requirements (e.g., use vector control for dynamic loads).
     - Switch from V/Hz to iFOC mode if more precise control is needed.
3. Instability in the Flux, Id, and Iq controllers within the Indirect Field Oriented Control (iFOC) scheme.
   - Perform Autotuning: Run the VFD's autotuning procedure to accurately measure motor parameters.
4. Load inertia mismatch—motor is too small for the load, or control loop gains are set too aggressively.
   - Fine-Tune Advanced iFOC Parameters:
     - Check and adjust controller gains for Flux, Id, and Iq loops to achieve stable operation.
     - Reduce control loop aggressiveness if oscillations or instability are observed.
5. Presence of mechanical resonance or shaft torsional oscillations.
   - Address Mechanical Issues:
     - Inspect the system for mechanical resonance or torsional oscillations and take corrective actions (e.g., add dampers, change coupling).
     - Ensure the load inertia matches the motor capabilities, or adjust VFD parameters for high-inertia loads.
6. Encoder feedback signal noise, poor wiring, or encoder failure (in closed-loop systems).
   - Check Encoder Feedback (for closed-loop systems):
     - Inspect encoder wiring and connections for noise or intermittent contact.
     - Replace or repair faulty encoders as needed.
   - Use shielded cables and proper grounding to reduce signal noise.

Motor overspeed (Code: 50)

The motor speed is higher than the Overspeed set value, for a longer time than the Overspeed detection delay time.

Possible causes and suggested remedies:

1. Incorrect maximum speed setting in VFD parameters.
   - Verify and correct the maximum frequency or RPM limit in the VFD configuration.
2. External control signal (e.g., analog input) commanding speed above limit.
   - Scale and clamp analog input limits in VFD configuration.
3. Mechanical load disconnected (no load condition).
   - Check for coupling or load failure; confirm the motor is connected to the driven system.
4. Motor inertia is too low to resist acceleration during regenerative events.

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○ Use ramp-down profiles or add mechanical damping.
5. Incorrect motor parameters in the configuration.
    ○ Verify the motor nameplate and the information entered in the VFD.
6. Sudden drop in load torque (e.g., belt snap, valve opens).
    ○ Inspect the mechanical load for inconsistencies or failures.
7. Improper deceleration settings (too aggressive stop leads to overshoot).
    ○ Adjust the deceleration ramp time or enable deceleration control features.

Motor underspeed (Code: 51)

The motor speed is lower than the Underspeed set value, for a longer time than the Underspeed detection delay time

Possible causes and suggested remedies

1. Insufficient torque available from the VFD.
    ○ Increase motor drive capacity or check for VFD undersizing. Verify that the VFD is suitable for the motor's torque demands.
2. The mechanical load is too heavy.
    ○ Reduce the load on the motor or adjust system parameters to reduce torque requirements. Ensure that the motor is not overloaded.
3. The motor is not receiving sufficient power.
    ○ Verify the motor and VFD wiring for issues like voltage drops, poor connections, or damaged cables.
4. VFD speed reference not set correctly.
    ○ Verify that the reference input (e.g., analog input, Modbus, or setpoint) is configured correctly.
5. Incorrect motor or VFD settings.
    ○ Verify the motor's rated speed and the VFD's speed settings (e.g., min/max frequency limits, ramp-up time, etc.).
6. Inadequate acceleration/deceleration ramp settings.
    ○ Increase the acceleration ramp time to allow the motor to reach speed gradually without overloading.
7. Loss of motor load (e.g., motor uncoupled from driven equipment).
    ○ Ensure the motor is properly coupled to the driven equipment. Check for mechanical disconnections or failures.
8. Power supply issues (voltage sag, imbalance, etc.).
    ○ Verify the power supply for voltage dips, imbalances, or other power quality issues that might be affecting motor speed.

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Motor wrong direction (Code: 52)

The detected motor rotation is opposite to the actual rotation direction (command + active output) for a longer time than the reverse rotation detection delay.

Possible causes and suggested remedies:

1. The incorrect motor rotation direction is set in the VFD.
   - Verify the VFD settings for motor rotation direction. Reverse the motor rotation direction in the VFD configuration if necessary.
2. Incorrect wiring of motor leads (phases swapped).
   - Inspect the motor connections. Swap any two of the three motor leads (phases) or reverse the motor rotation direction in the VFD configuration to reverse the direction of rotation.
3. Control signal error.
   - Verify the input control signals (e.g., digital inputs, Modbus, etc.). Check if the wrong direction command is being sent to the VFD.
4. Faulty or incorrect direction command (e.g., 2-wire or 3-wire control).
   - Verify the control logic wiring for proper configuration (e.g., ensure correct start/stop and direction control). Adjust wiring for 2-wire or 3-wire control as required.
5. Reversed connections at the control terminals.
   - Verify if any reversed connections at the control terminals might cause the motor to rotate in the opposite direction. Reverse the motor rotation direction in the VFD configuration if necessary.

Encoder speed error (Code: 53)

The discrepancy between the speed feedback by the encoder and the speed estimated by the VFD is high.

Possible causes and suggested remedies:

1. Incorrect encoder wiring (A/B/Z phases reversed or disconnected)
   - Verify all encoder connections. Ensure correct wiring of A, B, and Z (index) channels according to the user guide
2. Faulty encoder or signal degradation
   - Test the encoder for proper output signals using an oscilloscope or encoder tester. Replace the encoder if the signals are weak or erratic
3. Encoder not mounted securely or misaligned
   - Verify the mechanical alignment between the motor shaft and the encoder. Re-align or re-mount securely
4. Electrical noise or interference
   - Ensure proper shielding of encoder cables. Use twisted pair, grounded shielded cables, and route away from power lines
5. Incorrect encoder settings in the VFD
   - Confirm encoder PPR (pulses per revolution) and direction settings in the VFD parameters.
6. The encoder signal polarity is inverted
   - Reverse encoder signal phase wiring (e.g., swap A+ and A−) to correct direction mismatch
7. Broken encoder cable or loose connector
   - Inspect the encoder cable and connectors for signs of wear, damage, or loose connections. Replace if needed.

Encoder communication error (Code: 54)

The signal on phase A or B is missing while the motor is running. Or the pulse frequencies between channels A and B are different.

Possible causes and suggested remedies:

1. Disconnected or loose encoder cable.
    ○ Inspect all encoder cables and connectors. Reseat or replace any loose or damaged connectors.
2. Broken or damaged encoder cable
    ○ Check for cuts, pinches, or internal breaks in the encoder cable. Replace the cable if faulty.
3. Electrical noise or interference
    ○ Route encoder cables away from high-voltage or switching power cables. Add ferrite cores if needed.
4. Encoder power supply issue (voltage too low or unstable)
    ○ Measure the encoder supply voltage. Verify it's within tolerance and stable.
5. Faulty encoder hardware
    ○ Test or replace the encoder. Use a working encoder of the same type to confirm the issue.

Analog input loss (Code: 55, 56, 57)

This alarm arises if the analog input is configured for a 4..20 mA input signal and the current value falls under 3 mA for a duration longer than the triggering time delay.

Possible causes and suggested remedies:

1. Faulty wiring or loose connections: The wiring connecting the analog input to the VFD could be faulty, or there could be a loose connection.
    ○ Check the wiring and connections: Inspect the wiring and ensure all connections are secure.
2. Signal interference: There could be interference affecting the 4-20mA signal.
    ○ Check the 4-20mA signal: Use a multimeter to check the 4-20mA signal for any possible interference. Ensure proper grounding and shielding of analog cables. Avoid routing near high-voltage or switching circuits.
3. Faulty sensor or transmitter: The device providing the 4-20mA signal could be faulty.
    ○ Test the sensor independently or replace it with a known good unit to verify function.
4. Sensor power supply failure (24V DC or loop power).
    ○ Verify that the sensor's power supply is active and providing the correct voltage. Replace if needed.
5. Incorrect sensor type selected (voltage vs current)
    ○ Ensure the VFD analog input is configured for the correct signal type: 0–10 V, 4–20 mA, etc.
6. Short circuit or open circuit in the sensor loop
    ○ Measure resistance and continuity in the analog loop. Repair or replace faulty wiring.

Modbus Comm Loss (Code: 58)

The Modbus TCP communication has been interrupted for some time.

Possible causes and suggested remedies:

1. The most common cause is network connectivity issues, which could be caused by faulty Ethernet cables, switches, or routers.
   ○ Ensure all network equipment (cables, switches, routers) functions correctly. Replace any faulty equipment.
2. The Modbus TCP device could malfunction or be powered off.
   ○ Ensure that the Modbus TCP devices are powered on and functioning correctly. Restart the devices if necessary.
3. If the network is overloaded with traffic, it could cause delays or interruptions in communication.
   ○ If the network is overloaded, try to reduce the network traffic. This could involve moving some devices to a different network or increasing the network's capacity.
4. Incorrect or unsupported Modbus function codes.
   ○ Ensure the TCP client sends only supported function codes (e.g., 03, 06, 16). Consult the Modbus specifications.

Motor phase loss (Code: 61)

A disconnection of one phase between the drive and the motor happened.

Possible causes and suggested remedies

1. The output wiring is faulty (Loose or disconnected terminal at the VFD or motor).
   ○ Check the output wiring on the Clean Power VFD side and the motor side. Tighten all output terminal connections at both the VFD and motor ends.
2. If you use a contactor between the Clean Power VFD and the motor, it may be defective.
   ○ Check the contactor wiring. Replace the contactor.
3. Fuse blown, connectors untightened, cut cable.
   ○ Check the wiring and fuses, fix the issue, and then restart the VFD after the alarm is acknowledged and reset.
4. Faulty VFD output stage.
   ○ Look at the VFD's output waveforms, and if missing, please escalate this issue to the SmartD support team

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Motor Stalled (Code: 62)

The motor failed to reach or maintain the speed commanded by the VFD.

Possible causes and suggested remedies

1. Mechanical Issues:
   - Excessive Load: This could be due to the driven mechanism being overloaded or jammed, which impedes the motor's function.
     - The solution to this issue could be to reduce the load on the motor. This could involve adjusting the driven mechanism to ensure it is not overloaded or jammed. Regular maintenance and inspection can also help prevent this issue.
   - Seized Bearings: If the motor bearings are worn out or damaged, they can cause the motor to bind and stall.
     - If the motor bearings are worn out or damaged, they should be replaced. Regular lubrication and maintenance of the bearings can also help prevent them from seizing. Faulty bearings, misalignment, or excessive friction in the driven machine can reduce the load on the motor.
2. Electrical Issues:
   - Insufficient Power Supply: An inadequate power supply can prevent the motor from reaching the necessary speed.
     - This issue could be resolved by ensuring the VFD is delivering the proper power supply in voltage and current. It might also be worth checking the VFD settings for any issues that could be causing a drop in power
   - VFD Setting Errors: Incorrect configuration of VFD parameters can result in inadequate motor control.
     - If the VFD parameters are incorrectly configured, they will need to be adjusted. This might involve consulting the motor and VFD manuals or contacting a professional.
   - Wiring Faults: Poor electrical connections can disrupt the flow of power to the motor, leading to stalling.
     - Poor electrical connections should be repaired to ensure a consistent flow of power to the motor. Regular inspection of the wiring can help identify any potential issues before they lead to a stall.

Motor disconnected (Code: 63)

The VFD cannot detect the motor connected to its output terminals.

Possible causes and suggested remedies

1. The motor is physically disconnected from the VFD.
   - The connection between the motor and VFD is faulty (loose wires, damaged terminals).
   - Verify the motor connection, then the VFD can be restarted.
2. Motor internal open circuit (e.g., broken winding).
   - Perform motor winding resistance check; repair or replace motor.
3. There's an internal issue with the VFD's motor detection circuit.
   - Please escalate this issue to the SmartD support team

Motor application underload (Code: 64)

The current has fallen below the "Min Load Current" for the duration of the trigger delay.

Possible causes and suggested remedies

1. Broken or disconnected mechanical load (e.g., belt, coupling, gearbox).
   ○ Inspect the mechanical connection between the motor and load. Reattach or replace failed mechanical parts.
2. Loose or slipping coupling or belt.
   ○ Tighten or replace any worn or loose mechanical transmission components.
3. The motor is oversized for the application
   ○ If this is not a fault condition, consider adjusting trip thresholds or using a smaller motor.
4. Incorrect motor parameters were entered during tuning.
   ○ Verify and correct motor nameplate data in VFD settings; re-run auto-tuning if needed
5. For a pumping application, the pump runs dry (no fluid to move)
   ○ Check for fluid supply issues (valve closed, empty tank). Refill or fix the supply path.
6. Fan or blower obstruction removed (e.g., air damper opened unexpectedly).
   ○ Verify air path integrity. Inspect dampers, vents, and filters for correct positioning.
7. Process line interruption or no material present (e.g., conveyor empty).
   ○ Ensure the material feed is functioning correctly. Resume normal process input.

Motor auto-restart failure (Code: 65)

The VFD failed to restart the motor after the specified number of restarts.

Possible cause and suggested remedy:

- Auto-restart configuration issues: restart delay too short or maximum number of restart attempts too low
- Increase the restart delay or maximum number of restart attempts

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AFE low voltage ride through cannot recover (Code: 66)

The VFD was unable to recover from an AFE low-voltage ride-through condition due to a severe or prolonged voltage drop.

Possible causes and suggested remedies:

1. Prolonged voltage sag beyond ride-through capacity. The voltage drop was either too severe or lasted too long. The compensation on the VFD's motor control was insufficient, and the DC bus voltage became too low, leading to the inability to maintain normal operation.
   - Check the Power Supply: Inspect the incoming power supply for signs of instability, such as voltage fluctuations, sags, or outages. Verify if there were any recent power disturbances in the area.
   - Evaluate the Severity of the Voltage Dip: Determine the cause and duration of the low-voltage condition. If a transient event caused the dip, you may need to monitor the power supply more closely or consider additional protective measures.
2. Faulty grid or unstable power source. Frequent occurrences of this alarm may indicate a broader issue with the power quality or the VFD setup. It's essential to address the root cause to prevent future interruptions and potential damage to the VFD or motor.
   - Consult with Your Power Provider: If the low voltage event is related to the quality of the external power supply, you may need to contact your power provider for further investigation or mitigation.
   - Consider Power Conditioning Solutions: If low voltage events are frequent, you might want to consider installing additional power conditioning equipment, such as voltage stabilizers, uninterruptible power supplies (UPS), or line conditioners to protect against such events.

Drive overload (Code: 67)

the current drawn by the motor and load exceeds the maximum output current capability of the VFD for an extended period.

Possible causes and suggested remedies:

1. Sustained current on the load is above the VFD's capability.
   - Check Motor Load vs. VFD Capacity: Ensure the actual motor load does not exceed the VFD's rated output. If the load consistently exceeds the drive's capability, consider upgrading to a higher-capacity VFD.
2. Short acceleration time causes excessive current surge.
   - Adjust Acceleration Ramp Time: Increase the acceleration ramp time in the VFD settings to reduce current surges during startup.
3. The drive is improperly sized for the motor or application.
   - Verify Drive Sizing: Compare the VFD's output rating with the motor's full load amps (FLA) and the application's duty cycle.
4. Mechanical load torque spikes, intermittent jams, or binding.
   - Inspect Mechanical System: Check for any signs of mechanical binding, irregularities, or impact loading in the driven equipment. Address any issues causing torque spikes or intermittent jams.

PIN invalid (Code: 68)

An incorrect PIN has been entered, the HMI displays the message "Invalid PIN. Please try again."

Possible causes and suggested remedies

The user entered an invalid PIN

Verify the PIN entered by the user and try again; ensure no typos or incorrect digits (reset to default factory while disabled, and reset the PIN).

Damper feedback loss (Code: 69)

The controlled fan is running, and the damper limit switch indicates the damper is closed, or a damper feedback signal is lost.

Possible cause and suggested remedy:

- The digital input connected to the damper feedback sensor indicates that the damper is closed while the motor is still running. The damper feedback sensor connection issue.
- Verify the damper feedback sensor or its connection.

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External start-stop feedback timeout (Code: 70 and 71)

The damper limit switch does not indicate the expected position of the damper within the user-defined time.

Possible causes and suggested remedies:

1. The damper feedback signal was not received by the VFD when the motor was already magnetized.
   - Verify the damper feedback sensor or its connection
2. Verify the damper mechanism, the damper feedback sensor, and its connection.
   - Inspect the damper and actuator for mechanical obstruction or motor failure. Manually test the damper movement.
3. No power to the damper actuator.
   - Check the power supply and control signals to the actuator. Restore power or replace fuse/relay.
4. Faulty damper position switch (feedback device failed)
   - Test the feedback switch manually. Replace if not switching or giving the correct signal
5. Incorrect digital input assignment in VFD settings
   - Verify that the correct digital input is configured as the "Damper Closed" feedback in VFD parameters.
6. The timeout period is set too short.
   - Extend the damper feedback timeout delay to accommodate longer damper closing times

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Motor ground fault (Code: 72)

A ground fault happens when an energized conductor unintentionally contacts the ground, often due to insulation failure, moisture, or wiring issues. It can cause equipment damage, fire hazards, and electric shock, so prompt detection and correction are vital for safety and reliability.

Possible causes and suggested remedies

1. Damaged insulation: This is the most frequent culprit. Over time, insulation on motor windings or cables can degrade due to heat, vibration, exposure to chemicals, or simply age. When the insulation weakens, the current can "jump" to the ground.
2. Moisture ingress: Water or other liquids entering the motor can cause a path for current to leak to the ground. This can happen due to condensation, leaks, or improper installation in a humid environment.
3. Contamination: Dust, dirt, or metallic debris inside the motor can bridge the gap between the winding and the ground, causing a fault.
4. Manufacturing defects: In rare cases, the motor itself might have a manufacturing defect that leads to a weak spot in the insulation, predisposing it to ground faults.
5. Damaged cable sheath: The cable connecting the motor to the power source might have a damaged outer sheath, exposing the live wires and increasing the risk of a ground fault.

If the MOTOR GROUND FAULT alarm occurs:
1. **Power off the VFD completely.**
2. Disconnect the motor cables from the drive output terminals (U, V, W).
3. Perform an insulation resistance test on the motor and cables to ground using a megohmmeter.
4. Inspect for:
   - Damaged or degraded insulation
   - Moisture ingress or condensation inside the motor
   - Dirt, dust, or contamination
   - Visible damage to cables or connections

- o   Manufacturing defects in the motor
5.   Repair or replace damaged components as necessary:
    - o   Rewind or replace motors with compromised insulation.
    - o   Replace damaged cables.
    - o   Resolve environmental issues like moisture or excessive dust.
6.   Reconnect and retest before returning the drive to service.

Troubleshooting with the audit logs

For traceability, technical support troubleshooting, and legal reasons the VFD keeps a persistent log of auditable events on the systems. Administrators or qualified personnel can refer to these logs to diagnose any issues that may arise. These logs provide valuable information for troubleshooting and identifying potential problems.

Audit log event information:
- **Timestamp** – Used to understand what happen in chronological order
- Severity
- **Message** – Information of each event
- **Event** – Used for filter
- Origin
- UserId
- TransactionId

Recommendations: Import the audit-log.json into a CSV or Excel. If possible, filter out the UNSPECIFIED event type

Audit log event information

Each log event contains the following information:

Timestamp
When the event occurred and logged in UTC time.

Event
The captured operation, event or action.

Event	Description
UNSPECIFIED	Unknown event – To be ignored
SHUTDOWN	VFD system and a VFD service is shutting down
STARTUP	VFD system and a VFD service is starting up
NETWORK_CHANGE	Network configuration has changed **– VFD network connectivity**
NETWORK_FAILURE	Network connection failure **– VFD network connectivity**
CONFIG_CHANGE	VFD configuration has changed, the message includes new and previous configuration
SETPOINTS_CHANGE	VFD setpoint has changed (speed, frequency, direction, …), the message includes new and previous setpoint values
ALARM	All the VFD's alarm transitions: triggered, acknowledged and cleared
LOGIN_ATTEMPT	Login and logoff attempt – **Mobile app connectivity**
ACCEPT_CURRENT_VERSION	Accept and commit the new version
REJECT_CURRENT_VERSION	Reject current version and revert back to previous version
START_SOFTWARE_UPDATE	Start software update
CANCEL_SOFTWARE_UPDATE	Cancel a software update
FETCH_SOFTWARE_UPDATE	Fetch a software update
SOFTWARE_UPDATE_COMPLETE	Software update completed successfully
SOFTWARE_UPDATE_ERROR	Software update failed
FACTORY_RESET	Factory reset has been issued
USER_CREATION	An user account has been created **(not supported yet)**
USER_UPDATE	An user account has been updated **(not supported yet)**
BACKUP_START	Start a software backup
BACKUP_COMPLETE	Software backup completed successfully
BACKUP_ERROR	Software backup failed
REBOOT_SOFTWARE_UPDATE	Reboot with new software update
METRICS_RESET	Reset VFD metrics **– Informative event**
LOCKOUT_RESET	Reset VFD from lockout mode. After this reset, the VFD should go back to ready to run mode if there is no critical alarm

Message
The detailed information of each event log.

Fault analysis

- Filter only SETPOINTS_CHANGE events with filter on "to SystemStateFault" to see all events bringing the VFD to fault (alarm)
- Highlight these events or timestamp

- Add filter on alarm events and highlight the alarm causing the SystemStateFault

- Look for the alarm in the alarm lists above
- And investigate the possible causes for this alarm
- Try to resolve the issue with the recommendations for this alarm

Escalation to SmartD Support Team

If the analysis of audit logs and configuration files does not help to troubleshooting the customer's issue, then request the support package from the customer and escalate to SmartD support team.

Export support package from HMI

The Clean Power VFD keeps different logs for traceability, technical support and troubleshooting. When needed, the user can create and download a support package, which will be used for troubleshooting. This allows qualified personnel to consult these logs and to diagnose problems that can arise in the field.

Please follow the steps below to export the support package from Clean Power VFD's HMI. Make sure to insert an USB key into the USB port of the VFD before he export.

Step-by-step instructions on the HMI
1. Click on the "≡" (low-left corner) to access the menu
2. On the Menu window, click on About
3. On the About screen, click on Diagnostic
4. On the Diagnostic screen, scroll down and click on Export support package
5. Make sure that you have a USB key in the Clean Power VFD's USB port
6. On the Support Package screen, click on Export
7. Once the support package file is downloaded successfully, click on "OK"

Support package description

The support package is a compressed (zip) file, please unzip the support package in a folder specifically for this customer. Once unzipped, you should find the following files, the files highlighted in **green** are relevant for troubleshooting and explained in the different sections of this user guide.

Filename	Description
afe-copro-debug.log	*Only used by SmartD team*
audit-log.json	The last 24 hours of all events in the Clean Power VFD. **Please refer to the audit logs section below to get relevant information for troubleshooting**
debug-log.tar.xz	*Only used by SmartD team*
device-info.log	Information on the Clean Power VFD: model, hardware revision, serial number, 2 ethernet MAC addresses, controller board revision, hardware feature flags, HMI model, HMI serial number, HMI BLE MAC address, and sensor calibration parameters. **Used for product tracking and warranty**

device-status.log	*Only used by SmartD team*
dmesg-output.log	*Only used by SmartD team*
linux-debug.log	*Only used by SmartD team*
motor-copro-debug.log	*Only used by SmartD team*
nginx.tar.xz	*Only used by SmartD team*
redis.tar.xz	*Only used by SmartD team*
smartdrive-config.json	The current configuration of the Clean Power VFD. **Please refer to the configuration section below to get relevant information for troubleshooting**
system-alarms.log	*Only used by SmartD team*
version.log	Current software version, backup software version, Bluetooth (BLE) software version, motor controller firmware version and AFE firmware version. **Used for identifying the version of all the softwares running in the Clean Power VFD**

Identify the customer's VFD information (device-info.log):

The device-info log contains useful information on the Clean Power VFD's components.
Example:

```
***sd-device-info []***:
model              : SDB-1-2185-A
hw_revision        : 01
serial_number      : 0001-20231016-000001
eth0_addr          : 70:b3:d5:ab:62:56
eth1_addr          : 70:b3:d5:ab:62:57
ctrl_board         : pcb045-rev03
hw_feature_flags   : 0x0
hmi_model          : PCB013
hmi_serial_number  : 0001-20231017-000001
hmi_revision       : 4
hmi_mac_address    : 8C:1F:64:4F:72:29
sensor_calibration : {…calibration parameters…}
***sd-version [-a]***:
Current: v2024.05.00-46-g90d2ffb43000-20240418
Backup: v2024.03.00-41-g69081f25f84b-20240314
BLE-CoPro: v2023.15.0-1
Motor-CoPro: 2024.05.00-rc.17+g03919f6
AFE-CoPro: 2024.05.00-rc.8+g61fc4cc
```

Please note the following information:
● Clean Power VFD: *model, serial_number* and *ctrl_board*
● HMI: *hmi_model, hmi_serial_number, hmi_version*

Identify the software versions (version.log):

The version log contains useful information on the Clean Power VFD's software components.
Example:

```
***sd-version [-a]***:
Current: v2024.05.00-46-g90d2ffb43000-20240418
Backup: v2024.03.00-41-g69081f25f84b-20240314
BLE-CoPro: v2023.15.0-1
Motor-CoPro: 2024.05.00-rc.17+g03919f6
AFE-CoPro: 2024.05.00-rc.8+g61fc4cc
```

Please note all the versions for
Active VFD's software   : *Current*

Bluetooth: : *BLE-CoPro*
Motor control firmware   : *Motor-CoPro*
AFE firmware   : *AFE-CoPro*
Backup VFD's software : *Backup*

Conclusion

Using the audit logs with accurate timestamps, clear event categories, explicit system-state transitions, and a detailed alarm table turns troubleshooting from guesswork into a forensic, data-driven process—saving hours of plant downtime and ensuring the VFD always returns to a safe, productive state as quickly as possible for the customers.

Having a strategy, to order the events by timestamps, to filter event type and to lookup for specific event description, allows to :

● **Causal chains immediately**
Merging timestamps with event types and state changes forms an indisputable narrative: *"Login-OK → Enable command → Running normal → Overcurrent alarm → Fault."* That clarity cuts diagnosis time dramatically.

● **Proof for compliance & warranty**
Time-stamped evidences of CONFIG_CHANGE, METRICS_RESET, or LOCKOUT_RESET demonstrate that safety interlocks were never bypassed—useful for auditors and OEM warranty claims.

● **Early-warning analytics**
Aggregating alarm entries lets you spot patterns (e.g., temperature creeping higher every Tuesday afternoon). Predictive maintenance dashboards rely on this granular history.

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For further information, and detailed specifications, or to initiate an implementation in your operations, please visit our website: https://smartd.tech/ or contact us at +1-866-776-2783

Let SmartD help you achieve operational excellence and improve system reliability with cleaner, more efficient power solutions.

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