



Voting System Anomaly Root Cause Analysis Template v2.0

Root Cause Analysis for:

**VV40ECT-101: VxSCAN INTERNAL CONNECTION PROBLEM PRINTER IS DISCONNECTED
VxSUITE, VERSION 4.0 AND EAC CERTIFICATION #VXS4**

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Introduction

This RCA documents an instance of the VxScan precinct scanner failing to scan and displaying an error indicating, “Internal Connection Problem: Printer is disconnected,” during the standard 104 hour test of continuous operation with Element and SLI Compliance, according to test requirements VVSG 2.7-B and 2.7-C. This is a programmed error message, and it occurred after 6,100 scans, 61 hours into the test.

Anomaly Description

Complete all sections. Descriptions must be as detailed as possible, while being clear and concise since the anomaly is the source of the entire RCA. This detail should include a complete list and/or description of the “symptoms” of the anomaly and the conditions present which the symptoms occurred.

<u>Date of Anomaly:</u> April 9, 2025	<u>Time of Anomaly:</u> 10:13pm
<u>Place of Anomaly:</u> Element, Longmont, CO	<u>Person identifying Anomaly:</u> Tabitha Lehman, VotingWorks
<u>Expected Results of actions leading up to anomaly:</u> The VxScan unit would allow scanning and printing as normal with no error messages. The 104 hour test was to continue without issue, with no errors expected to occur if following appropriate procedures for use and maintenance. No reboots were expected to be needed.	
<u>Detailed description of the event / anomaly:</u> After scanning 6,100 ballot sheets, the VxScan unit displayed the error message, “Internal Connection Problem” with subtitles of “Printer is disconnected. Please ask a poll worker for help.” The unit then functioned as expected when error messages are displayed, by not allowing scanning or printing until the error was resolved, but allowing access to settings and administrative actions. A reboot of the unit resolved the error and allowed normal function again.	

EAC (Election Assistance Commission) Root Cause Analysis

If the anomaly is repeatable, provide step by step instructions to recreate it:

This anomaly is not reliably repeatable in operational conditions. Printer disconnection errors that resolve on reboot occur because of transient data disconnections detected in software. These rare data disconnections could be due to unpredictable electrical or mechanical disturbances during operation.

Chronology of Events / Timeline

Provide a detailed chronology of the events leading up to, and following, the anomaly. Add additional events if necessary.

ID	Date/Time	Description	Entity Org/person	Result / Notes
1	4/7/25, 8am Mountain Time	104-hour continuous operation test begins, starting according to original plans.	Chris Pedersen, VotingWorks	No connection issues reported for VxScan unit. Test methodologies changed in the first hours due to VxMark ballots not scanning through VxScan. The new revised methodology would have VxScan only scan the regular pre-filled hand-marked paper ballots throughout this test.
2	4/9/25, 10:13pm	VxScan unit is reported to have displayed an "Internal Connection Problem" and "Printer is disconnected" message and would not scan.	Tabitha Lehman, Jessica Myers, Matt Roe VotingWorks	VotingWorks staff reviewed the known documented causes of this, as either: <ul style="list-style-type: none">• Wrong image installed on VxScan• Temporary software disconnection requiring reboot, with no hardware issues• Hardware disconnection of wiring internally requiring physical reconnection
3	4/9/25, 10:51pm	VxScan was rebooted, and the issue was resolved.	Tabitha Lehman, VotingWorks	Logs were collected from the test unit to analyze.
4	4/11/25, 12pm	VotingWorks staff analyzed logs from the anomaly and reviewed potential root causes. Hardware issues were ruled out.	Arsalan Sufi, Jesse DeWald, Jonah Kagan, VotingWorks	The symptoms seen ruled out various hardware causes, except rare transient ones. The software was analyzed to understand its behavior when reacting to disconnection.

Investigative Team and Method

This section shall describe how the investigative team is assembled by the voting system manufacturer, who it consists of, and how it gathers the data to be used in the analysis. Include the RCA method employed by the manufacturer in conducting the analysis and why this method was used.

Names and Positions of members of the investigation team:
Tabitha Lehman - Customer Success Manager
Jessica Myers - Head of Compliance
Matt Roe - Head of Product
Arsalan Sufi - Head of Software
Jesse DeWald - Head of Hardware
Jonah Kagan - Software Engineer
Describe the data gathering process:
<p>Tabitha Lehman and Jessica Myers coordinated the initial data collection and communications at Element with SLI Compliance, as they were present in-person during testing. Tabitha first learned of the issue and shared information with VotingWorks staff.</p> <p>Matt Roe, Arsalan Sufi, and Jesse DeWald joined the investigation from afar to find root causes. Matt shared the known procedural solutions of rebooting or physically reconnecting disconnected cables. Jesse presented more detailed potential hardware causes for the error, and Arsalan discussed the potential software causes. Jonah joined the investigation after it was known that a reboot resolved the issue, to plan out further software mitigations.</p>

EAC (Election Assistance Commission) Root Cause Analysis

Describe which methodology(s) is used to conduct the root cause analysis:

The investigative team used a fault tree analysis strategy to identify the root cause. It was known that the pre-programmed error only occurred from a limited number of causes, either:

1. wrong software was installed/imaged on the unit, or
2. a physical disconnection of the printer occurred, or
3. a transient USB data disconnection occurred.

It was known that the software was correctly installed, so fault branch #1 was ruled out.

Fault branch #2 discussed hardware causes. A printer disconnection error only would occur if:

1. the 10 pin connector to the printer came loose at the computer connection (but the card reader error should show instead, as they're on the same header and it takes precedence), or
2. the printer cable at the printer came loose (but a reboot would not fix this), or
3. the power supply to the printer had a fault or came loose (but a reboot would not fix this).

None of these hardware causes were consistent with the evidence (explained in parentheses above), and so more transient faults in the USB data connection were considered.

Fault branch #3 discussed a rare transient disconnection of the USB data stream while there is no physical disconnection. The software then follows the standard error recovery protocol to require a reboot before reconnecting. After rebooting, the system recovered without issue, and this confirmed the root cause.

Findings and Root Cause

Describe the findings of the investigation and explain the root cause(s) based on these findings. If the RCA results in findings that are not directly related to the root cause of the anomaly, these should also be captured as manufacturer product/process improvement steps in an effort to improve the voting system.

The investigative team received logs for the VxScan unit that presented this issue during the 104 hour continuous operation test. Analysis of the logs identified a printer disconnection error aligned with the reported anomaly.

Analysis of the logs also confirmed that the behavior found in testing aligns with rare behavior previously identified during internal testing of the thermal printer subcomponent where USB disconnections occur without a physical disconnection. Identification of these spurious disconnects previously informed VotingWorks' documented error recovery protocol in the user manual: if a disconnection occurs (as presented by the Internal Connection Error screen), users are instructed to first restart the device as previous internal testing identified that these rare disconnects are resolved upon device restarts.

Corrective Action(s)

The investigation identified that the issue identified is expected behavior in rare cases and the system recovered as expected after the documented restart procedure. Although this was confirmed to be expected behavior, VotingWorks plans to introduce a software change that includes more verbose logging of the thermal printer subcomponent to aid in future analysis of the underlying root cause of this issue when it occurs in the field in the future.

Solution Management

The purpose of this section is to manage the corrective action(s) moving forward. This should detail all process changes to manage those corrective actions, and steps taken to ensure the actions eliminate the anomaly over time.

More verbose logging of the thermal printer subcomponent will be incorporated in the next software version, to aid efficient identification of this issue in the future.