

# Voting System Examination

## Hart Verity 2.0

Prepared for the  
Secretary of State of Texas

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This report conveys the findings of the Attorney General's technical designee from an examination of the equipment listed, pursuant to Title 9, Chapter 122 of the Texas Election Code, section 122.036(b).

**Examination Date:** June 29-30, 2016  
**Report Date:** July 30, 2016

<b>Component</b>	<b>Version</b>
Verity Data	2.0.2
Verity Build	2.0.2
Verity Central	2.0.2
Verity Count	2.0.2
Verity User Management	2.0.2
Verity Election Management	2.0.2
Verity Desktop	2.0.2
Verity Scan	2.0.3
Verity TouchWriter w Access	2.0.3
Verity Controller	2.0.3
Verity Touch	2.0.3
Verity Touch with Access	2.0.3

The version numbers of the equipment examined matched those above.

### System Summary

**Overview.** The Verity system comprises equipment for the polling place (Verity Scan, TouchWriter with Access, Controller, Touch, and Touch with Access), software components that run under Windows (the remaining components listed above), and commercial-off-the-shelf (COTS) components (such as computers, high-speed scanners, and utility software).

## **New Since the Last Exam (on Dec. 13, 2015)**

- The “Invalid vDrive” bug (which was discovered in the last examination) has been fixed.
- The Verity Verify system now has a DRE (a *direct-recording electronic* voting machine), the Verity Touch and Touch with Access.
- The Verity Touch has support for provisional electronic voting.
- The new Verity Data provides a graphical user interface for creating and managing election definitions.
- There is full support for cumulative voting.
- Reporting has been improved.

## **Security**

**Image Verification.** To verify that the Build, Central, Count, User Management, Election Management, and Desktop software we tested is exactly the same as that certified by the Election Assistance Commission (EAC), the Secretary of State obtained the software images directly from the EAC. The software was then decompressed, loaded, and configured by Hart personnel under the supervision of the technical examiners, thus maintaining the chain of custody. This software is normally delivered to customers on hard drives that are pre-installed in the machines.

There is also a procedure that allows the county to verify that the software has not been tampered with. This is done by creating a manifest containing hashes of the files that the system comprises. The hashes are then compared with those on a manifest downloaded from the National Software Reference Library. If the hashes are the same, the files are also.

**Verity Keys** are USB drives used to control access to various parts of the Verity system. They contain no election data, and are used solely to restrict access to only those people who have the appropriate Verity Key. To gain access, the authorized person must insert the Verity Key and also enter a password. Verity Keys are not used in polling places, where only a user id and password are needed.

## **Election Setup**

**Election Definition.** An election definition (containing races, candidates, etc.) is normally created with Verity Data. This is different from Verity 1, where the election definition was imported from a text file in XML format.

**Verity Build.** The election definition is then read by the Verity Build program, which allows the county to (a) proof the election, (b) proof the

layout of ballots, (c) print ballots or create PDF files to send to a printer, (d) create Verity Keys, and (e) create vDrives (see next paragraph).

The election definition is carried from Verity Build to other components on *vDrives*, which are USB drives that are easily distinguishable from Verity Keys by color. All vDrives contain the entire election definition and any vDrive for the election can be used to convey the election definition to any Verity device. For example, vDrives are used in polling places to initialize devices such as Verity Touch or TouchWriter.

When voting is over, the vDrives convey any cast-vote records and logs to the location where they will be counted.

**Verity User Management** manages users – their passwords and the parts of the Verity system they have access to. For the more sensitive parts of the system, a Verity Key is required in addition to a username and password.

**Verity Desktop** has three functions that it performs on central computers, such as the one that runs Verity Build or Verity Count. It sets the system clock, exports file hashes to a removable drive for verification that the files have not been tampered with. It also allows Hart personnel to have access to the operating system using a pass code. This is for maintenance, such as installing device drivers. (For security, Verity computers used in the central-count office are run in *kiosk mode*, denying access to the operating system to anyone who does not have the pass code.)

## Voting

There are three ways of voting:

- By hand-marking a paper ballot,
- On a Verity TouchWriter, or
- On a Verity Touch DRE.

**Verity Touch/Controller.** Verity Touch is a DRE, or direct-recording electronic machine. Up to 12 of these can be connected to a single Verity Controller. The Verity Controller allows pollworkers to enter a voter's precinct and split, and generate a five-digit code that the voter can then use to vote on any connected Verity Touch.

**TouchWriter.** The TouchWriter allows the voter to make selections and then prints a marked ballot. The TouchWriter does not record the votes, except (of course) on the marked ballot that it prints.

Voting on the TouchWriter can be done using the touch screen, but there is also support for disabled voters, such as audio, paddles, and sip-and-puff. Support for disabled voters was tested by the Secretary of State, and is not covered by this report.

The TouchWriter seemed well-designed and easy to use. It presents one electoral race at a time to the voter, which in my opinion is the best method. It does, however, have one behavior which I found confusing. See item 1 under 'Concerns.'

Each voter who wants to vote on a TouchWriter must be authorized by a poll worker who physically walks to the TouchWriter, enters a password to gain access, and then selects the voter's precinct. In my opinion, this awkward procedure makes it impractical to have many TouchWriters in use at the polls. When several voting stations are required, the Verity Touch DRE is preferable. Where voting is primarily on paper ballots, TouchWriters allow private voting for those who are unable to mark a paper ballot, although they are not limited to that use.

Each TouchWriter is paired with an OKI model B431d printer. This is a duplex (two-sided) printer that prints the user's ballot along with his choices. As with most duplex printers, the paper comes almost all the way out of the printer during the printing of the first side. Then it is pulled back in for printing of the second side. We observed that every examiner who tested the TouchWriter would instinctively reach to receive the half-printed ballot from the printer, so we tested forcibly pulling the half-printed ballot completely out. The TouchWriter responded to this event exactly as it should. It (1) showed the voter an error message, (2) waited for a poll worker to retrieve the spoiled ballot and clear the error, and finally (3) automatically re-printed the ballot. It responded equally well to other unusual events, such as the printer's losing power or running out of paper.

**Verity Touch** is the DRE of the Verity family. It behaves just like the TouchWriter, with the following exceptions:

- It directly records the voter's choices, instead of printing a paper ballot.
- Pollworkers authorize voting using a connected Verity Controller, where the voter's precinct and split are entered. The Verity Controller then prints a five-digit code that the voter can use to vote on any connected Verity Touch.

Concern number 1 below applies to the Verity Touch as well as the TouchWriter.

**Verity Scan.** Hart also offers Verity Scan, which can be used to scan ballots in the polling place and store cast-vote records for later tabulation.

**Components.** Verity Scan, Touch, and TouchWriter share many common components. For example, they can be collapsed into almost identical units that look like small suitcases. Although they are identical in size they are easily distinguishable from each other. They also fit on identical stands. Most importantly, they share identical *tablets*, which is what Hart calls the component that contains the touch screens. Any tablet can be mated with either a TouchWriter or a Verity Scan.

Access to these components is controlled with user names and passwords created and maintained by Verity User Management.

## **Tabulation, Reporting, and other Central Activities**

**Verity Central** does ballot scanning, resolving ballot issues, processing write-in and provisional votes, producing reports, and auditing data. It can resolve issues and process write-ins, both for ballots it scanned and for those scanned in the precinct and then transported on a vDrive. Verity Central does not tabulate votes.

**Verity Count** actually tabulates the votes (stored in cast-vote records on a vDrive) and produces reports. It can also resolve issues and process write-ins.

## **Concerns**

**1. Multi-select Overvote (Hart is planning to fix).** The TouchWriter and Touch have one behavior which I found confusing. Consider a race where one can vote for multiple candidates – say the voter can choose three of seven. If the voter has selected three candidates and tries to select a fourth, the TouchWriter will automatically deselect the first candidate selected. There is no message or warning, and no reason to think the deselected candidate is the one the voter would have deselected. I found this confusing and unexpected. I believe many voters will have a similar experience, and the TouchWriter should instead give a message to the effect that the voter must deselect a candidate before selecting another.

I understand from Hart that they plan to address this issue. Their plan is to give the voter a message explaining which candidate was deselected. This is acceptable, but I believe my solution is significantly better, because it is easier for the voter to understand. With the Hart solution, it is very likely that the candidate Hart chose to automatically deselect is not the right one. In this case the voter must still figure out how to deselect that candidate and select the right one.

**2. Paper audit log is very difficult to read.** In order to save paper, Hart decided not to start each log entry on a new line. In my opinion, this significantly reduces the usability and therefore the value of the paper log.

## **Conclusion**

The Hart Verity system is a solid, well-designed, reliable voting system -- one of the best we have examined. It's unfortunate that is marred by Concern 1, Multi-select Overvote, and I highly recommend to Hart that they fix this. However, it is acceptable for now.

I recommend certification of this system.