

# Voting System Examination of Hart InterCivic Verity Voting 2.7

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Exam Dates: March 1-2 & July 6, 2023  
Report Date: July 17, 2023

## 1 Background

An examination of Hart InterCivic Verity Voting 2.7 was conducted at the Texas Secretary of State Elections Division offices on March 1-2, 2023 with a follow-up exam conducted at the Hart InterCivic offices in Austin, TX on July 6, 2023.

Verity Voting 2.7 is a comprehensive voting system which can consist of a subset of the following components [1]:

- Verity Data - Data management software application
- Verity Build - Election definition software application
- Verity Count - Tabulation and reporting software application
- Verity Central - Central scanning software application
- Verity User Management - User management software application
- Verity Election Management - Election management software application
- Verity Desktop - Application for authorized users to manage a very limited set of operating system functions
- Verity Scan - Digital scanning device for the polling place
- Verity Touch Writer with Access - Ballot marking device (BMD), with audio tactile interface (ATI) and external commercial off-the-shelf (COTS) ballot printer
- Verity Controller – Polling place management device for Touch Writer Duo
- Verity Touch Writer Duo – a BMD with internal thermal printed vote record (PVR) printer and optional ATI
- Verity Touch Writer Duo Standalone – a version of the Touch Writer Duo that does not require connection to a Controller
- Verity Transmit - a device for the remote transfer of unofficial results to a central site
- Verity Transmit Receiving Station – a workstation and application for receiving data transmitted by the Verity Transmit device

The Election Assistance Commission (EAC) Certificate of Conformance includes configuration options and tables that describe the voting system software components, voting system platforms, hardware components, and system limits [2].

Through a secure chain of custody, the Texas Secretary of State Elections Division obtained the software and drive images used in the EAC certification. Hart personnel used those same files to perform installation under the supervision of the examiners. In [3-4], Hart provides instructions for the identification and verification of the certified products included in Verity Voting 2.7.

The examination consisted of a vendor presentation, accessibility tests, a mock election, and a free-form session where examiners could ask follow-up questions and perform ad-hoc testing of the voting system. I did not participate in the accessibility tests, see the legal examiners reports for more details on compliance with accessibility requirements.

This report will focus on the changes between Verity Voting 2.5 and Verity Voting 2.7. Examiners' reports on Verity 2.5 can be found in [5], and previous certification exam reports of Hart systems can be found in [6].

Changes between Verity Voting 2.5 and 2.7 that are common to all devices and workstations include [7-9]:

- “Support for contests where no candidates have filed”
- “When using the System Validation Tool on devices or workstations, the system exports hashes for all Verity-related system files, as well as the files themselves”
- “Supports adding new languages to devices and workstations via the Language Pack functionality”
- Added support for Gujarati, Hmong, Lao, Hawaiian, Cantonese, Punjabi, and Bengali languages
- Added the Brother HL-L6400DWVS laser printer which “replaces the OKI Data B432 printer for use on Verity Touch Writer, Verity Printer, Verity Build, and for report printing on all Verity workstation software”
- Added Duracell DR660PSS UPS as battery backup for the Brother HL-L6400DWVS when used with the Verity Touch Writer
- “Added support for the IntoPrint SP1360 laser printer”
- “Added additional CFast card vendor”
- “Added magnifying devices for use with ballots in the polling place”
- Disallowed use of hotkey combination that can result in reboot of devices

## 2 Verity Workstations

Verity workstations run the Data, Build, Central, Count, User Management, Election Management, Desktop, and Transmit Receiving Station applications. The workstations available for use with Verity Voting 2.7 are the HP Z4 G4 and the Z240 (only supported for existing customers). The workstations run Windows 10 Enterprise 2019 LTSC as their OS.

Workstations can be stand-alone or setup in a client-server configuration. With the exception of the Transmit Receiving Station, workstations are only intended to operate within their own local network (i.e. air-gapped from public and other private networks). The network traffic is encrypted and digitally signed. All wireless capabilities are disabled.

Workstations will only boot up into the Verity desktop environment. Users are not able to access the Windows desktop without intervention from Hart's technical support team.

General Workstation changes from Verity Voting 2.5 to 2.7 include [7-9]

- Enabled Secure Boot on workstations
- "Full Disk Encryption now required for all deployments"
- Eliminated support for workstation models with less than 64GB of memory

### 2.1 Observations

The configuration demonstrated at the exam had one workstation running Data, Build, and Count and another stand-alone workstation running Central. Client-server configurations were not demonstrated. Observations about Verity Transmit and the Transmit Receiving Station will be covered in Section 10.

There were no major concerns with the Verity workstation hardware or configuration. Installation and configuration is always performed by Hart; thus, there is no added burden or opportunity for misconfiguration by the jurisdictions. The COTS components performed adequately during the observed tasks.

The hash validation process is user-friendly.

Restricting access to the Windows OS and enforcing a strict applications allowlist are good security measures. It is recommended that administrators follow the best practices provided by Hart to ensure the security of the workstations.

## 3 Verity Data

Verity Data is the application used to import and manage election and jurisdiction data. This includes the ability to enter translations, record audio, choose ballot templates, preview ballots, and export the election data to Verity Build [2][10].

Changes to Verity Data between 2.5 and 2.7 include [7-9]:

- Added ability to wrap proposition text to adjacent columns
- Added “ballot validation for propositions that do not fit on a single page”, and removed “validation for propositions that do not fit in a single column”
- “Allows users to apply column and page forces to contest by precinct-split”
- “Paper ballots support a maximum paper size of 8.5”x22””
- “Supports 80lb Text paper weight for ballots”
- “Added targeting landmarks to ballot corners for option box triangulation”
- “The Contest Title field limit is increased to 250 characters”
- “Verity Data now supports entering separate contest instructions for devices and paper ballots. Verity Data proofing reports containing contest instructions display both electronic instructions and paper instructions.”
- “Added additional rich-text formatting options for Ballot Additional Text”
- “The Ballot Additional Text field limit increased to 3000 characters”
- “Verity Data validates that fold lines do not intersect ballot landmarks, in addition to barcodes and option boxes”
- “The default PVR [printed voted record] paper size changed to 8.5” x 11””

### **3.1 Observations**

Use of Verity Data was not directly observed as the data, layout, and audio for the mock election were created prior to the start of the exam. However, no problems were observed during the export to Verity Build or during the mock election.

## **4 Verity Build**

Verity Build is the application where election definitions, election media (known as vDrives), and two-factor authentication dongles (known as Verity Keys) are created. Build also allows the user to proof data, view reports, print ballots, and configure scanners and voting devices [2][11].

Changes to Verity Build between 2.5 and 2.7 include [7-9]:

- “Verity Build includes a new setting to print single language ballots on Touch Writer”
- “New options to control second-chance voting behavior for unmarked write-ins on Scan devices”
- “New option to control the default counting behavior for unmarked write-ins on Scan devices”

## 4.1 Observations

Examiners observed the import of a signed election export from Verity Build as well as the creation of vDrives and Verity Keys. No issues were observed with the use of the Build application, vDrives, or Verity Keys.

## 5 Verity Central

Verity Central is a ballot scanning system intended for high volume processing of ballots at the jurisdiction's central office. Verity Central utilizes COTS scanning hardware in addition to Hart's ballot processing software. Central also has ballot review and resolution functionality. Cast vote records are written to vDrives by Central for tabulation in the Verity Count application [2][12].

Changes to Verity Central between 2.5 and 2.7 include [7-9]:

- Corrected a defect where, "a user was unable to import a Certified Write-in Candidates list that had just been exported"
- Added support and additional features for a new adjudication condition called "Unmarked Write-in"
- "Prevent querying for unresolved contests in PVR batches during navigation and disable the Next Unresolved and Previous Unresolved buttons when viewing a PVR batch"

### 5.1 Observations

Examiners observed the use of Verity Central to scan batches of ballots and PVRs during the mock election. No issues were found with respect to accuracy, speed, paper jams, or interpretation of ballot marks. The quality of the scanned images was good and suitable for the adjudication of ballots.

## 6 Verity Count

Verity Count is the application that is used to read and tabulate vDrives, perform adjudication, export data, and print reports. It also manages storage of election logs collected from Verity components and devices used during the election [2][13].

Changes to Verity Count between 2.5 and 2.7 include [7-9]:

- Added support for "the simultaneous adjudication of write-ins within a single task on multiple Count client workstations"
- User Interface (UI) updates including a new "Refresh" button, a "Last Updated" time indicator, a contest selection drop-down menu, and a "Post" button to capture "the entire write-in resolution state of the task and move it to become available for reporting"
- Display up to 10 voting types in the Results by Category, Cumulative, Precinct, District, Canvass, HTML Cumulative, HTML Precinct, HTML Canvass, and Detailed Vote Total reports and exports.

- Support for “batch subtraction of records during a Manual Vote Recording session” in which “use cases may include changing election data source or other error corrections”
- Corrected defect so that voting types now follow sequential ordering in the Reporting Options Screen
- “Now allows users to set a custom order for contests on results reports”
- New reports and exports: Three-Column Summary Results Report, Three-Column Precinct Results Report (export only), Statement of Vote Report, Precinct Detail Export, and Summary Export
- Support for adding a Run ID to the report header in the Three-Column Summary Results Report and Three-Column Precinct Results Report
- Support for identifying the Three-Column Summary Results and Three-Column Precinct Results reports as “zero reports”
- “Support for calculating ballots cast in a multi-sheet election using the highest recorded sheet count” in the Three-Column Summary Results, Three-Column Precinct Results, Statement of Vote Report, Precincts Reporting, Summary Export, and Precinct Detail Export reports
- “Manual vote recording now allows users to enter sheet counts for each sheet that exists in the ballot for the precinct-split/party being adjusted”
- “Count results reports containing contest instructions display electronic instructions only”
- Any exported collection of CVRs includes a digital signature which is user-verifiable using a separate utility
- Updates to Aliases Groups and Sets (collections of Alias Groups):
  - “Can be exported or imported to/from removable media.”
  - “Can be imported into any elections containing the same strings”
  - “Can only be imported into the election with the same Election ID from which they were generated”
  - “Can be used for reports and results exports, including the Detailed Vote Total export.”
- Corrected a defect where a blank page could be included in the PDF export of the Canvass Results Report

## 6.1 Observations

During the mock election examiners adjudicated ballots, observed the tabulation of votes from vDrives, and observed the generation of reports. The results matched the expected outcome. During ad hoc testing, examiners attempted to process vDrives that had already been tabulated, and the Count application appropriately flagged the media as having already been read.

## 7 Verity User Management

Verity User Management is a tool for administrators to manage user accounts and assign specific roles to users along with the associated permissions. User Management provides a default set of user roles, but administrators are able to create customized roles for users [2][3].

### 7.1 Observations

Use of User Management was not directly observed during this exam. It is strongly recommended that users only be granted the narrow set of roles and permissions necessary to perform their given tasks.

## 8 Verity Election Management

In Verity Election Management, administrator-level users can import, delete, archive, and manage election definitions.

Changes to Verity Election Management between 2.5 and 2.7 include [7-9]:

- Added “Configuration Control” feature “which supports limiting election variations based on what equipment and ballot types are used by a jurisdiction”

### 8.1 Observations

Though the Election Management application is used throughout the election process, its full set of features was not demonstrated during the examination and mock election. Nevertheless, no issues with this application were observed.

## 9 Verity Devices

Verity Devices include a custom touch screen tablet docked in a base. The tablet, base, and associated cables can be folded into a rugged carrying case. Depending on the configuration, Verity Devices are standalone, paired with a COTS printer, or daisy-chained together to a Verity Controller. The Verity Touch DRE which was certified in previous versions of Verity is not included in the scope of Verity 2.7 in Texas [1].

The device firmware is loaded with a CFast card. Logs and, if applicable, cast vote records (CVRs) are stored redundantly on the CFast cards and vDrives. All files are digitally signed. A software daemon ensures that the records are kept in sync. Should the two storage devices get out of sync, the vDrive is considered the official record.

Similar to Verity Workstations, Verity Devices enforce a strict applications allowlist. USB ports for vDrives and other peripherals are secured underneath locked covers. The CFast slot is also sealed underneath a locked cover which includes a hasp for additional tamper prevention during long term storage. USB cables used to connect the daisy-chain are keyed and custom wired to prevent malicious access to those ports which are not physically secured. Data that flows across the daisy-chain network is digitally signed as an additional security measure.

General changes related to Verity Devices between 2.5 and 2.7 include [7-9]:

- “A single standardized circuit board replaces baseboard and I/O board combinations found in all Verity devices...Electronic components from the existing Tally Tape Thermal Printer are added directly to the baseboard”
- “Tally Tape thermal printer for report printing now uses Hart built plastics and firmware”
- “Rear panel connectors now recessed to...reduce cable strain if a device is handled while cables are installed”
- “Tamper evident seal now serialized”
- “All Verity devices now show the first three sections (XX.XX.XX) of the system version number in the user interface, without needing to reboot the device”
- “If an unrecoverable error occurs on a polling place device, the device suspends voting operations and presents a clear indication to the user of the malfunction”
- “Warnings and alerts issued to a voter on a device shall state the nature of the problem”
- “When color is used to indicate status in the system, the user interface uses green, white, or blue for normal status; amber or yellow for marginal status; and red for an error status”
- “When color is used to indicate the type of information displayed, the user interface uses green, white, or blue for general information; amber or yellow for warnings; and red to indicate problems that require immediate attention”
- “Added retry strategy to account for Ballot Layout Services timing issue” which previously could occur when “instructional text to the voter may be missing from ballot”

## 9.1 Verity Touch Writer with Access

Verity Touch Writer with Access is a standalone Ballot Marking Device (BMD) that is paired with a COTS printer. The Touch Writer with Access is not daisy-chained with other devices or a Verity Controller. Instead, a poll worker must be in-the-loop to initiate each voting session for voters. The Touch Writer with Access is designed to act an accessibility device in a jurisdiction where voters would normally fill out paper ballots by hand at the polling place.

## 9.2 Verity Touch Writer Duo

The Touch Writer Duo is a BMD with an integrated thermal printer that creates a printed vote record (PVR) that is both human- and machine-readable. It is configured for use in a daisy-chained network with Verity Controller. Voters are issued an access code from the Controller and use the touchscreen to mark and review their choices. The Touch Writer Duo can include an ATI which provides accessibility features.

### **9.3 Verity Touch Writer Duo Standalone**

The Duo Standalone is a standalone version of the Touch Writer Duo that is not integrated with a Verity Controller. A poll worker must be in-the-loop to initiate each voting session for voters.

### **9.4 Verity Controller**

Verity Controller is used by the poll worker to create access codes for the Touch Writer Duo. Access codes are used by the voter to initiate their voting session. The Verity Controller can manage up to 12 devices connected via a daisy-chain network. The Verity Controller touchscreen gives the poll worker the current status of each device in the daisy-chain. The Verity Controller base also has an integrated on-board thermal printer for printing reports.

### **9.5 Verity Scan**

Verity Scan is a digital scanning device used in the polling place in conjunction with an attached ballot box. Verity Scan can be configured to accept both marked ballots (by hand or from the Touch Writer) and PVRs (from Duo devices).

Changes to Verity Scan between 2.5 and 2.7 include [7-9]:

- “Added support for Write-in Mark Detection, where Scan can return the ballot for second-chance voting...if a mark is detected in the write-in area but the option box is not marked. If the ballot is accepted as-is, unmarked write-ins will count only if the Build setting for default counting behavior is enabled.”
- “Performance improvements that reduce ballot processing time”
- Corrected defect where “scanner multi-feed calibration can get stuck on a spinner and not show the results screen, requiring a lock and unlock of the tablet to exit the screen.”
- Corrected defect so that “scanner contrast calibration interface no longer hangs when calibration fails and instead presents a message to clean the scanner and retry calibration.”

### **9.6 Observations**

The ballot box provided with Verity Scan provided sufficient security measures.

The Touch Writer with Access and Touch Writer Duo Standalone require poll worker intervention to initiate sessions for voters. This may place a burden on larger polling sites if these are the only voting methods available.

The Touch Writer Duo’s PVR still has readability issues; the font is small and the whitespace between the contests and the selected choices is too wide.

If an election requires a two-page PVR, voters may experience some confusion with the Touch Writer Duo since they have to insert and print each page one-at-a-time. In the event of such an election, poll workers and the public would require extra training.

The exported audit logs were sufficiently detailed.

The hash export and validation process was user-friendly and no issues were observed. The system verification exports now include the Verity-related system files themselves so jurisdictions have the ability to independently compute hashes of the exported files.

There was some potentially confusing and inconsistent terminology used among the voting devices where on some screens the ballot is referred to as the record. The Duo Standalone does not instruct the voter to take their ballot to the scanner when finished.

Verity Scan can be configured to automatically print a results tape when polls are closed, but not on-demand. Jurisdictions may need to update early voting procedures so that early voting results tapes are not printed prematurely. One solution is to suspend rather than close polls on the Verity Scan at the end of early voting, then perform the close polls operation and the printing of results tapes at the jurisdiction's central site as soon as results tapes are allowed to be printed by law.

## 10 Verity Transmit

Verity Transmit is a system for remotely transmitting unofficial results on election night. The intent is to mitigate the challenge of providing timely reporting of unofficial results. The system consists of Verity Transmit devices which are placed at regional transmit sites, the Verity Receiving Station which is at the jurisdiction's central site, and an additional Verity Count workstation which would also be at the jurisdiction's central site air-gapped from the official election equipment and workstations [14].

Scan devices can be configured to store voting data on redundant vDrives so one can be used as the "dirty" media providing unofficial results ("dirty" because it will touch an outside network), while the "clean" media is retained for official results reporting and canvassing.

Verity Transmit has been used in the State of Texas with prior versions of Verity, but it was not evaluated as part of the state's voting system certification process. Due to increased interest in these types of systems, the Texas Secretary of State has since required that systems for the remote transmission of unofficial results should be examined under the state certification program.

Changes between 2.5 and 2.7 include [7-9]:

- "Transmit supports transmitting/receiving vDrives written by Verity Central [and] Verity Scan"
- "For Central vDrives, Transmit now displays 'Central vDrive' in lieu of the vDrive polling place"

## 10.1 Verity Transmit Device

The Verity Transmit Device maintains the same form factor as other Verity devices. Transmit can be configured with one of three options: a cellular modem, WiFi, or Ethernet. Voting data sent by the Transmit device is encrypted and digitally signed. As an additional security measure, when the Transmit device is ready to start sending voting data, a user of the Verity Transmit Receiving Station must generate a one-time authorization code which is communicated out-of-band to the user of the Verity Transmit device (typically over a voice call).

## 10.2 Verity Transmit Receiving Station

The Verity Transmit Receiving Station is a workstation that would be located at the jurisdiction's central site, but air-gapped from the official election equipment and workstations. It receives voting data sent by authorized Transmit devices and writes it to vDrives. An unofficial Count workstation (also air-gapped from the official election equipment and workstations) is used to tabulate votes and report unofficial results.

Changes between 2.5 and 2.7 include [7-9]:

- “vDrives written from Verity Transmit Receiving Station support at least the same number of ballots as vDrives written from Verity Central [or] Scan”
- “The Receiving Dashboard displays the status of Central vDrive data separately from the status of device vDrive data”

## 10.3 Observations

Examiners ran a set of ballots through Verity Scan and Verity Central, both configured to create redundant media (“clean”/official and “dirty”/unofficial). They tabulated votes on the official Count workstation simulating the typical hand delivery of official voting media to the central office. Voting data from the unofficial media was sent via the Verity Transmit device. Using vDrives written by the Transmit Receiving Station, results were tabulated and reports were generated on the unofficial Count workstation. Reports from both the official and unofficial Count workstations contained the same results.

Examiners attempted to re-transmit voting data, both from the same Transmit device and from a different one. The Receiving Station prevented redundant voting data from being written to its vDrive.

Write-ins would have to be adjudicated twice using this type of system, creating an opportunity for human error and inconsistency in reporting unofficial results.

Ideally jurisdictions would want to compare results reports generated from official media to those generated from unofficial media as soon as they are able. Count allows for custom reports at the device level; however setting up these custom reports for a county with many polling places is currently cumbersome. Hart should improve reporting capabilities in the next release of Verity with this use-case in mind.

Examiners also evaluated the EAC approved ECO-01605 which “allows for the streaming of backup (recovery) vDrives” on the Verity Transmit Receiving Station [15][16]. Streaming in this context means that the voting data is written to the Receiving Station vDrive as soon as it is received from the Transmit device.

The benefits and drawbacks of systems like Verity Transmit mostly relate to public perception and trust of the administration of elections. Voters, journalists, and candidates have come to expect the timely reporting of results on election night. Even though election night reporting provides unofficial results (with the official results usually confirmed much later after careful canvassing), misrepresentation of these unofficial results can erode public trust in elections. Care must be taken to ensure that the benefits of these systems outweigh the risks of reporting errors.

Another major risk of systems like Verity Transmit is that official media may be considered contaminated if introduced into the Transmit system. Ultimately the ballots themselves are available as the official record in this event, but this scenario would still put a black eye on the overall process.

The Transmit system complies with Section 7.5 of the Texas Secretary of State’s Electronic Voting System Procedures Advisory [17]. However, the Texas Secretary of State should use their authority under Section 122.001(c) of the Texas Election Code to prescribe additional procedures related to the transmission of unofficial results for election night reporting and the acquisition of systems for this purpose. Purchases of systems like Verity Transmit should only be approved if a county can demonstrate a compelling need and has developed a robust plan for secure transmission, counting, and media handling.

Secure transmission would include the use of the jurisdiction’s dedicated wide-area network (WAN) or virtual private network (VPN) to prevent the results from being transmitted over a public network. For consistency, the Texas Secretary of State should only certify the Transmit device that employs the Ethernet port hardware configuration. Jurisdictions should follow Hart’s best practices at a minimum as part of their security plans.

## **11 Conclusions**

While some concerns arose during the examination, none were disqualifying. Overall, Verity Voting 2.7 is a comprehensive voting system that is secure, accurate, and user-friendly. The system reported results accurately during the mock election portion of the exam. Hart personnel provided clear and knowledgeable answers to the examiners’ questions.

I recommend certification of Verity Voting 2.7 under the following conditions:

- Only counties that can demonstrate a compelling need and have developed a plan approved by the Texas Secretary of State for secure transmission, counting, and media handling should be able to purchase Verity Transmit
- The Verity Transmit device may only be configured with the Ethernet port hardware option

Additionally, I approve of ECO-01605. The changes are de minimis and no further examination is required.

## 12 References

- [1] Application for Texas Certification of Voting System – Form 100, Verity Voting 2.7
- [2] United States Election Assistance Commission Certificate of Conformance, Hart Verity Voting 2.7, EAC Certification Number HRT-Verity-2.7, Jun-07 2022,  
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- [3] Verity System Administrator’s Guide, Version 2.7, Document Number 6641-061 A02
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- [5] URL: <https://www.sos.state.tx.us/elections/laws/jan2021-hart-intercivic.shtml>
- [6] URL: <https://www.sos.state.tx.us/elections/laws/hart.shtml>
- [7] Verity Voting 2.6 Change Notes, Revision A.00, Document Number 4005686
- [8] Verity Voting 2.7 Change Notes, Revision A.02, Document Number 4005722
- [9] Verity Voting 2.7 Change Notes: Update from 2.7.0 to 2.7.1, Revision A.00, Document Number 4005724
- [10] Verity Administrator’s Guide: Data, Version 2.7, Document Number 6641-056 A02
- [11] Verity Administrator’s Guide: Build, Version 2.7, Document Number 6641-057 A01
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- [13] Verity Administrator’s Guide: Count, Version 2.7, Document Number 6641-059 A01
- [14] Verity Remote Transmission Administrator’s Guide, Version 2.7,  
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- [15] ECO-01605 Change Summary Verity Transmit Streaming of Backup vDrives Correction,  
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- [16] HART Engineering Change Order 01605, EAC Approval Letter, Sean Pumphrey, Jun-30 2023
- [17] Electronic Voting System Procedures Advisory, Election Advisory No. 2019-23, Section 7.5  
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