Election Systems & Software
Ballot Production Guide

Document Version 1.0
Software Version N/A
Published: June 25, 2015
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Chapter 1: Introduction

The ES&S Ballot Production Guide contains specific guidelines for printing Election Systems & Software (ES&S) ballots. Printers use the specifications contained in this manual to set up, print, and proof Election ballots. If a customer chooses to print their ballots with someone other than ES&S, they will need to direct any questions or concerns to that particular printer as ES&S cannot provide support for non-ES&S associated printers. The non-ES&S associated ballot printer (and the jurisdiction requesting the ballots) should maintain a database of the ballot printing laws and regulations for the state where the ballots are being printed. By maintaining such a database, the ballot design and order specifics can be checked against it to ensure compliance prior to the printing of ballots, thus ensuring the legality of ballots.

**Note:** The ES&S Ballot Production Guide is an internal document that includes ballot specifications for all ES&S products and software; including under development and supported legacy products that are no longer available for purchase. This document may reference software and hardware that is not included in the current system configuration.

Contact for ES&S Technical Support

This guide will help you in the printing of most ES&S ballots: however, if additional assistance is needed, or if a processing problem is encountered or system error, ES&S’ technical support staff can provide advice and help resolve the situation.

When contacting ES&S for technical support, select Option 3 for Ballot Printing on the Call Tree, and be near the equipment. In addition, be prepared to provide the following information to the support representative:

- The version number of the product being used (for example, Election Reporting Manager version 5.5.0.0).
- The exact wording of any messages that appeared.
- A description of what happened when the problem occurred.

Use the following methods to contact Technical Support:

- **Phone** – A live-person Technical Support team member can be reached Monday through Friday, 7:00 A.M. to 7:00 P.M. (Central Time) at the following numbers:
  - 877-377-8683 (Toll-free USA/Canada)
  - 402-593-0101 (International)
  For either phone number, select the following options:
• Option 4 - for Hardware/Software Support
• Option 2 - for Software Support

◆ Email – Trained and knowledgeable experts provide prompt answers during normal support hours of Monday through Friday, 7:00 A.M. to 7:00 P.M. (Central Time). Send your messages to one of the following addresses:
  • Firmware@essvote.com
  • Hardware@essvote.com
◆ Fax – 402-967-1267
◆ Address – 11208 John Galt Blvd., Omaha, NE 68137 USA

ES&S’ support services are subject to ES&S’ prices, terms and conditions in place at the time the service is used.

For more information about ES&S Technical Support, click the Contact ES&S tab on the ES&S secure website and then click Technical Support (Hardware & Support) or scroll to the section.
Chapter 2: Scanners and Ballots

Optical Ballot Scanners

ES&S optical scanners recognize marks in the read area of the ballot and record voter selections. As a ballot passes through the scanner, light reflects from the ballot surface, filters through several lenses and is recorded by various photo-transistor channels in the ballot scanner. The photo-transistors convert the optical image of the ballot into an electronic signal. The scanner interprets the signal as votes according to an election definition created by an election programmer. The scanner then adds the election results from the ballot to the count for the entire jurisdiction.

ES&S supports central count voting systems and precinct count systems.

Central Count Voting Systems

Jurisdictions with central count systems generally collect ballots at multiple polling places and transport them back to election headquarters for scanning after the polls close. During the voting process, the scanners record votes from each ballot and add results to an internal results total. The results are then loaded into Election Reporting Manager (ERM). ERM consolidates the voting totals into final election reports.

Precinct Count Voting Systems

Jurisdictions that use precinct count systems record election results at individual polling places as voters cast ballots. Voters place their ballots directly into precinct scanners such as the Model DS200. The scanners record votes from each ballot and add the data to an internal results total. At the end of the day, election workers load ballot data from the precinct scanners into ERM from memory devices such as pc cards, smart packs and memory packs or over the Internet. ERM combines results from all of the precinct scanners in a jurisdiction to produce final election reports.

Image Manager Ballots

Scanners will reject ballots that are printed incorrectly. A jam can occur if the ballots are damaged or cut too wide. Ballots produced out of specification may cause scanners to reject, jam, or incorrectly tabulate ballots. Check the ballots against the specifications in this guide to ensure correct functionality.

ES&S has two different ballot image managers to produce two types of ballot artwork.

♦ ES&S Image Manager (ESSIM) produces the 3-column ballot.
♦ ElectionWare Paper Ballot produces the 24-column ballot which provides greater layout efficiencies for the newest ES&S tabulators.

The following examples show that the ESSIM and ElectionWare ballots have the content and ballot information arranged slightly differently, but all ES&S ballots are printed and finished in the same manner.
FIGURE 1. ESSIM Ballot

This specification is valid on any ballot length or style. This specification is valid for any ES&S tabulator. This specification is valid for any version of firmware.

Data channel extends .20” from right side of ovals or .32” right of oval center.

CONTEST
Candidate 1
Candidate 2
Candidate 3
Candidate 4

Data channel can be breached only if all printed information and tint is at least .20” above or below all active oval positions.

Tint cannot be printed outside of the inner column borders, or within .1” of the Black Check Marks.

Tint cannot be printed outside of the inner column borders, or within .2” of the Black Check Marks.

Text cannot be printed outside of the timing band with a font size that should not exceed 3/4 of the height of the timing band. Text cannot be bold.

Tint shade cannot exceed 10%.

Oval width .24”
Oval height .10”

Oval outlines are .05” wide.

Text Zone
All text or stamps must remain in this zone. It is .1” below the bottom edge of the ballot, and .2” below the Black Check Marks.
Machine-readable components are areas of the ballot that scanners recognize and record marks (such as voting targets and code boxes). Each ballot has four machine-readable components as shown in the preceding figure.

- **Code Channel**: The scanner reads the code channel to identify the precinct, split, type and style of the ballot. It is a bar code that differentiates one ballot from another.

- **Orientation Boxes (Black Check Marks)**: Black checks appear above and below each ballot column, timing track, and code channel. The locations of black check marks correspond to sensor locations on ES&S ballot scanners (sensor “A” on your scanner reads the black check mark above and below column “A” on the ballot). Ballot scanners read black checks to calibrate sensors. Where the timing track intersects the vertical column, a potential voting mark can be programmed. Tracks A, B, and C are on the front of the ballot while D, E, and F are on the back.

- **Timing Track**: The left-most column of boxes on the edge of the ballot. The boxes correspond to the vertical positions of the voter response areas and inform the scanner where to look for votes.

- **Voting Marks (Voting Targets)**: A voting mark or target is the selection area next to a ballot response that voters mark to indicate ballot choices. Properly printed voting targets are invisible to optical sensors. Depending on the type of election equipment, the targets appear as ovals, incomplete arrows, touch screen boxes or punch areas. Place ballot text, tint, or ruling lines no closer than 0.20 inches (0.508 cm) from the oval voting mark and 0.06 inches (.152 cm) from the arrow voting mark. Make sure the oval pixel setting is set at 0.003 in ESSIM and that the printed oval is not thicker than 0.005.”
ElectionWare Paper Ballot

ElectionWare ballots are one or two-sided and contain 24 columns on each side, and up to 91 rows. A voting target appears next to each candidate name (or referendum response). Voting targets are ovals that voters mark to indicate selection.

FIGURE 3. ElectionWare Paper Ballot
Machine-readable components are areas of the ballot that scanners recognize and record marks (such as voting targets and code boxes). Each ballot has four machine-readable components:

- **Timing Track**: The timing tracks are the vertical columns of black boxes on the far-left and right edges of the ballot, front and back.

- **Voter Marks (Voting Targets)**: A voting target is the selection area next to a ballot response that voters mark to indicate ballot choices. Properly printed voting targets are invisible to optical sensors. Place ballot text, tint or ruling lines no closer than 0.20 inches (0.508 cm) from the oval voting mark. Make sure the oval pixel setting is set at 0.003 in Paper Ballot and that the printed oval is not thicker than 0.005.”
Chapter 3: Ballot Paper

ES&S CountRight Ballot Stock

ES&S CountRight™ Ballot Stock has been specially engineered to run on ES&S tabulators and meets all ES&S specifications for the ES&S tabulators.

**Important:** CountRight Ballot Stock **MUST** be used when printing for ES&S equipment.

As the manufacturer of the scanning equipment, ES&S understands the critical synergy required between the ballot paper, the ink on the paper, and the tabulator logic. As a result, CountRight Ballot Stock was designed with specific consideration regarding the following measurements:

- Caliper – Thickness of the paper.
- Opacity – Amount of light absorbed vs. reflected by the paper.
- Brightness – Reflectance of the paper when measured under a calibrated wave of light.
- Smoothness – Measurement of surface “roughness” of the paper.
- Basis Weight – Mass (expressed as weight) per number of sheets.

ES&S tabulators are designed to use digital CountRight Ballot Stock, which is blank with no pre-printing for the DS200 and DS850.

The following figure is an example of generic ballot stock:
Generic Ballot Stock

Counterfeit Detection Boxes
- Printed in MRC ink.
- Cannot be seen by M100/650.
- If the official ballot is photocopied, MRC boxes will be reproduced with xerographic toner that will be detected by the M100/650. The following message appears:
  "SUSPECT BALLOT FOUND"
- Fraud detection, not prevention.

Registration Boxes
- Four boxes on front of ballot.
- Four boxes on back of ballot.
- BM creates cross-hairs, and when placed over boxes, register the BM ballot face to the D-code stock.

Registration Box
Cross-Hairs and Circle on Ballot Artwork

Registration Box, Cross-Hairs, and Circle for Good Registration

Ensures customers will process ballots that are printed on
eS&G GoxxeRight Stock, which meets eS&G OHM tabulation devices' specifications regarding ballot sheet properties for
the following properties:
- Thickness
- Smoothness
- Opacity
- Brightness
Ordering CountRight Ballot Stock

When ordering stock, it is imperative that the tabulator(s) in use be known and communicated to ES&S in order to ensure the correct stock is ordered. CountRight is available two ways:

- As the only authorized distributor of CountRight, Xpedx offers parent sheets and rolls in several sizes and formats.
- ES&S stocks and markets CountRight Ballot Stock and CountRight Digital Ballot Stock in several sizes and formats. CountRight is only be available from ES&S. Any production of any ES&S Ballot stock without written authorization from ES&S will be considered a copyright violation.

TABLE 1. Ballot Specifications

<table>
<thead>
<tr>
<th>Specification</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grain Direction on Finished Ballot</td>
<td>Long</td>
</tr>
<tr>
<td>Basis Weight</td>
<td>80# text weight (36.2874 kg)</td>
</tr>
<tr>
<td>Thickness</td>
<td>0.0061 in. (0.015494 cm)</td>
</tr>
<tr>
<td>Smoothness</td>
<td>130 Sheffields</td>
</tr>
<tr>
<td>Moisture</td>
<td>5.5 percent</td>
</tr>
<tr>
<td>Opacity</td>
<td>97.0</td>
</tr>
<tr>
<td>Brightness</td>
<td>92 to 94</td>
</tr>
<tr>
<td>PPI</td>
<td>338</td>
</tr>
</tbody>
</table>

TABLE 2. Tolerances

<table>
<thead>
<tr>
<th>Specification</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Band Width</td>
<td>8.5 in. (+.027, -.02)</td>
</tr>
<tr>
<td>Ballot Length</td>
<td>11, 14, 17, 19 in. (+/- 0.03)</td>
</tr>
<tr>
<td>Ink Density</td>
<td>1.15 to 1.25 wet ink density; 1.10 to 1.15 dry ink density</td>
</tr>
<tr>
<td>Oval Thickness</td>
<td>Target thickness is 0.003 (maximum oval thickness is 0.005)</td>
</tr>
</tbody>
</table>

Important: The AutoMark, DS200, and DS850 can accommodate narrower ballots.

Important: The DS200 and DS850 cannot read colored ballot stock.

Important: Avoid using adhesive stickers or labels and avoid embossing or embellishing when you print ballots. Any technique that changes the caliper of the ballot stock will cause read errors during scanning.
Chapter 4: Color Stripe Specifications

ES&S ballots use a color stripe instead of full color tinting that further protects the anonymity of a voter’s ballot. The strip can be any color and darkness as it is placed on a part of the ballot that the scanner does not read. See the following example for exact specifications.

This specification is valid on any ballot length or style for the ES&S AutoMARK.

FIGURE 4. Color Stripe
Chapter 5: Offset Production

Ballot Ink for Offset Production

Print all of the machine-readable components with high quality, commercially available black ink (extra or double black) and note the following guidelines:

- Use inks with high tack.
- Only use readable black ink to print ballot components.
- Make sure that all offset is solid and dense without voids, breakthroughs, dirt, foreign particles, white hickies in the timing track, or gray lines.
- Print with a minimum density of 0.95 and a maximum density of 1.5.
  - For best results, use a density of 1.15.
- Do not use powder or varnish.
- Do not smear, smudge or spray the ink when you handle the ballots.
- Test the ballot ink on the press with a densitometer.
- Do not print text in the active voting tracks.

Offset Pre-Press Preparation

Before Going to Press

Use the following instructions to prepare the ballot layout for mass printing:

1. Image the PDF file to film negatives or direct to plate at 100%. A PDF file can vary as much as ½ of 1% depending upon how the software is handled by the output devices. Overlays are required because of the potential for variation.

2. Use the Mylar® overlay provided by ES&S to verify that the .pdf is sized correctly, that all machine-readable components are aligned and that all cut-marks and score marks appear on the ballot.

3. Inspect the ballot for accuracy with Mylar master overlays, hard copy laser prints (if one is sent) and a visual inspection of the document image. Check the ballot for wrapping, overprinting, dropping lines, text outside the text areas or other signs of a corrupt file.

Note: Call ES&S Printing Services at 1-877-377-8683 if you have any questions.
Prepare the Printing Plate

In offset printing, use diazo-coated aluminum or high quality vinyl plates to preserve the integrity of the film image. Paper plates do not maintain the side-to-side dimensions of the ballot image.

Prepare Ballot Stock

Only use ES&S CountRight Ballot Stock and ballot ink that adheres to the specifications in this manual.

Reference: Refer to Chapter 3: Ballot Paper for specifications for paper stock.

Refer to Ballot Ink for Offset Production for ballot ink specifications.

Square the stock before sending it to the press.

Offset Preparation, Printing, and Proofing

1. Print 150 make-ready sheets and cut to the final size. Check the following:
   - Ballots are square.
   - Front-to-Back registration is accurate by holding ballot to the light.
   - Width is accurate by a using Go/No-Go Gauge.
   - Any visible spots or scratches on the ballot or printing plate.

2. Turn the ballot over and do the tests again on the back of the ballot. If all three tests on each side fall within tolerances, the scanner will be able to read the ballot.
3. After you have performed your registration checks, run your job and inspect the ballots. Allow the ballots to dry.

4. For every 500 sheets printed on the main production run, check the following and initial accordingly:
   - Ink density with a densitometer.
   - Overall print quality – visible flaws, spots, or marks on the ballot or printing plate.
   - Make any corrections/adjustments necessary to the printer. Reprint, and replace ballots as needed.

**Note:** The large frame on the ballot does not align front to back. They must be off by 0.030 inch (.076 cm.).

**Warning:** In elections where most ballots are printed on a single side, if a single precinct has a ballot that is duplex printed, all precincts must be printed duplex. ES&S code stock is already printed duplex.

### Offset Cutting, Scoring and Folding

#### Cutting

To ensure ballots are the proper width, ES&S has created a Go/No-Go Gauge that will easily measure whether a ballot is the right width, too narrow, or too wide.

ES&S CountRight Ballot stock is already cut to size but you will want to check your ballot stock with a Go/No-Go Gauge to ensure that it is properly cut.

If you are printing from a roll-fed machine, you will want to utilize the Go-No-Go Gauge to make sure that your ballots are being cut the correct width.

#### Scoring and Folding Ballots

It is not recommended that you score these ballots before folding them. A folding machine should be used to expedite the process. In addition, roller pressures should be reduced to about 2 – 3 thickness of ballot stock.

**Warning:** Do not fold across timing marks, ovals, or arrows as this may cause tabulation errors. Scoring followed by folding may result in the ballot separating at the score/fold line.
Perforating and Numbering Ballot Stubs

A ballot stub is a non-readable portion of the ballot that election workers remove at the polling place for auditing purposes. Stubs usually contain at least one identification number (such as a precinct identification number or sequence code number) and a sequentially printed number that matches the number on the ballot used to audit ballots that have been cast. Ballots should be perforated for easy separation. Use a micro-perfing wheel to place perforations on the ballot for one 3-inch (7.62-cm) stub or two 1.5-inch (3.81-cm) stubs.

Note: Stubs should always be at the bottom of the ballot.

Squaring

The first few sheets should be taken to the cutter immediately to determine if all is square. Stack ballots in lift sizes of 3 inches to 5 inches (7.62 to 12.7 cm). The weight of the ballot stock may cause offset during the drying process if you stack ballots in quantities greater than 5 inches (12.7 cm).

Note: Keep your ballot stock clean before, during, and after printing. Avoid grease, water, ink splatter or spray and dirt. Always clean your hands before handling ballot stock.

Binding and Shipping

- Bind, number and box the ballots for shipping. If the ballots are to be glued or stitched, do so at the bottom of the ballot stub.
- Do not bind ballots at the top.
- Ship the exact number of ballots that have been requested in shrink-wrapped packaging.
- Package ballots with a backer to provide support and prevent damage to ballots.
- Ship ballots in containers large enough to hold the ballots and strong enough to withstand damage that may occur during normal shipping and handling.
- Label the outside of the cartons “ELECTION MATERIALS” and include a shipping manifest unless directed to do otherwise.

Verify: Call ES&S or the client for labels or with shipping questions.
◆ Protect the edges from damage or curling. Damaged edges or curling leads to ballot jamming in the scanners.

◆ Ballot count must be exact. Election officials are audited to account for all ballots issued to them. Inaccurate counts will cause recounting of assigned ballots.

◆ Boxes must be strong enough to withstand normal handling in shipping and should be neutral.

◆ Labels on boxes should indicate the content and quantities. They should also have an ES&S sticker as well as a label indicating that the box contains “election materials” (supplied by ES&S).

**Verify:** Contact ES&S Customer Support at 1-800-247-8683 if you have any questions.
Chapter 6: Digital Printing

After receiving the files, all ballot sequences need to be proofed to ensure information on the ballot is correct.

Preparation, Printing, and Proofing

Overlays and Registration

A PDF can change depending upon the software that is used and although the change may not be visible (about ½ of 1 percent) it could be enough to cause read errors or ballot rejection on ES&S equipment. Using the provided Mylar overlays and the registration boxes, which are preprinted on the ballot stock, will ensure that the ballots being produced are within ES&S specifications.

Registration Boxes

Inspect the ballots using the registration marks as a guideline. Registration targets must appear entirely within the registration boxes. If one mark is out of position, the entire ballot is out of registration. Make adjustments to the machine and reprint any misaligned ballots.

Using Registration Overlays

- Make sure that you have a “front” and a “back” overlay.
- Align the top and right edges of the ballot with the “edge of paper” lines on the overlay and inspect the printed ovals. The ovals must be printed entirely inside the boxes. If any part of the oval is outside the box, the ballot is not in registration and the PDF or printer must be adjusted and the ballots reprinted until the sizing and registration is correct.
- Verify that the black check boxes at the top and bottom of the ballot and the timing tracks and code channels along the left side of the ballot are within the boxes that are printed on the overlay. The left and bottom edges of the ballot must fall between the Min. and Max. lines when the top and right edges are on the “edge of paper” line. If any part of the boxes are outside the box, the ballot is not in registration and the PDF or printer must be adjusted and the ballots reprinted until the sizing and registration is correct.

Warning: Check front-to-back registration on the ballot by holding it up to a light source. The timing track should line up evenly.

Printing

1. When printing, use the following tools to check the following:
• Mylar Overlay:
• Registration
• Ballot width
• Ballot length
• Go/No-Go Gauge:
• Ballot width
• Densitometer:
• Ink/toner density
• Micro-ruler:
• Oval thickness

2. On every ballot inspected, make sure to check the following:
• Overall print quality – any visible flaws, spots or marks.
• Front-to-back registration.
• Proper toner/ink adhesion.

**Important:** If any of the above measurements are out of ES&S specifications, make any corrections/adjustments necessary to the printer, reprint, and replace ballots as needed.

### Packaging

Before shrink-wrapping and shipping the ballots, perform these last steps:

◆ Fan through the pages (both front and back) to identify any visible errors or marks through the naked eye. Reprint and replace ballots as necessary.
◆ Use chipboard when shrink-wrapping quantities of less than 50 ballots.
◆ Do not shrink-wrap in quantities of more than 250.
◆ Include a packing list or label each ballot box that clearly shows what ballots are in each specific box for easy customer recognition.
Chapter 7: Warnings

- Some printers use offset powder to prevent ink from offsetting as finished documents fast dry. ES&S recommends not using offset powder.
- Some printers use cornstarch to thicken ink and add to the grain of documents. Do not use cornstarch to print election ballots.
- Toner processing, heat transfer or other pressure fusing techniques to print ballots must have prior approval from ES&S.
- Do not spray wax onto printed documents to prevent offsets during drying. Wax adds to the caliper (thickness) of the ballot stock and interferes with the application of a second color or additional ink to the ballot. Allow sufficient printing time to dry ballots without the use of wax or offset powder.
- Do not shift the voting tracks or change the orientation of the tracks with improperly produced ballot art or incorrectly cut ballots.
Chapter 8: ExpressVote Paper Stock

The ExpressVote™ unit uses specially configured thermal paper to record printed images such as bar codes and contest selections. The unit's thermal printer selectively heats the paper on one side to activate the dye(s) in the paper. The paper stock is formulated to prevent moisture from causing the paper to curl.

The following figure shows the corner-cut specifications for the paper stock.

**FIGURE 5. Thermal Paper Stock**

The following table describes the characteristics of the paper.

<table>
<thead>
<tr>
<th>Attributes</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type</td>
<td>Thermal heat-sensitive paper</td>
</tr>
<tr>
<td>Color</td>
<td>White</td>
</tr>
<tr>
<td>Thickness</td>
<td>134 Microns + / - 6 Microns (0.005275” +/- 0.000236”)</td>
</tr>
<tr>
<td>Lengths Available</td>
<td>11, 14, 17, and 19-inches +/- 0.008” tolerance for all paper lengths</td>
</tr>
<tr>
<td>Width Available</td>
<td>4.25 +/- 0.008” tolerance for all paper lengths</td>
</tr>
<tr>
<td>Die-cut Corner</td>
<td>.750 +/- 0.008” tolerance on two sides (see Figure 5)</td>
</tr>
</tbody>
</table>

The following figure shows an example of the paper stock.
### Chapter 9: Revision History

**ES&S Ballot Production Guide**

**June 25, 2015**  
**Document Version 1.0**

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<th>Chapter</th>
<th>Version</th>
<th>Description</th>
<th>Project</th>
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<tbody>
<tr>
<td>All</td>
<td>1.0</td>
<td>Initial document based on EVS 5.2.0.0</td>
<td>5203</td>
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