What Is KODAK Q-LAB Process Monitoring Service?

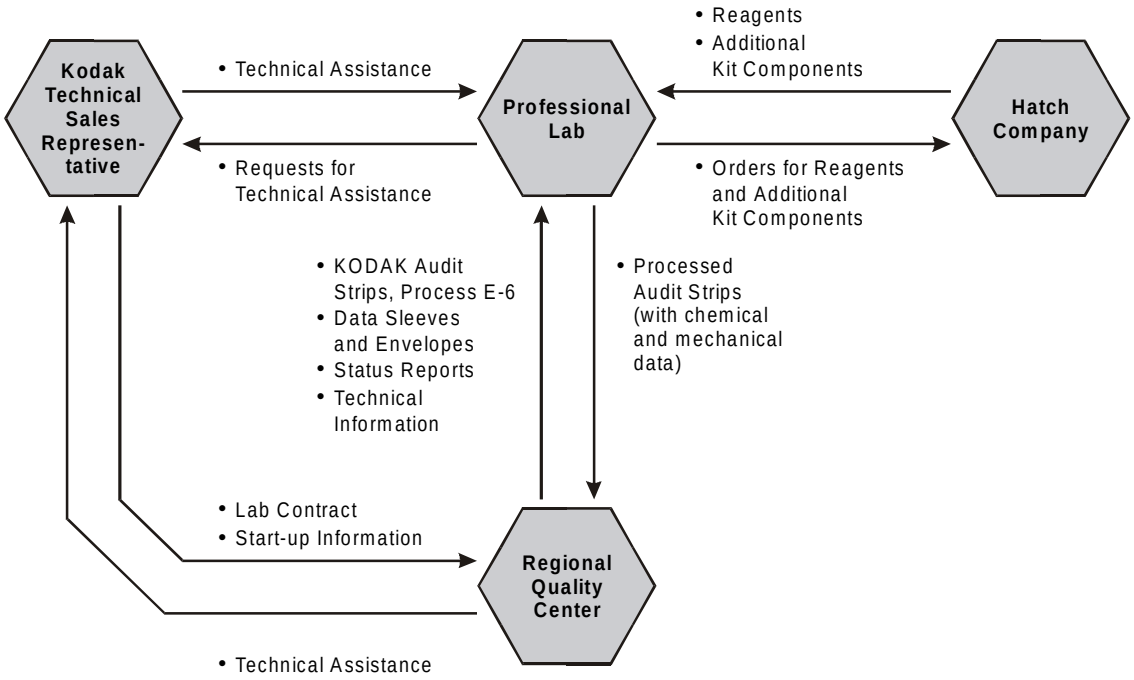
KODAK Q-LAB Process Monitoring Service is a program designed to help professional labs improve and maintain the consistency of Process E-6 in their processing equipment, and to obtain images of the highest quality from the KODAK PROFESSIONAL EKTACHROME Films that they process for their professional customers.

Because the requirements of professional photographers have become more sophisticated, new films of higher quality (e.g., with better color reproduction, finer grain, and increased sharpness) have been introduced. These new films are manufactured with the latest, state-of-the-art emulsions. Today, many films are made with varying emulsion technologies, and film sensitivities to process variations differ. To produce the best possible results when you process EKTACHROME Films, your process must operate within chemical, mechanical and sensitometric tolerances.

Q-LAB Service provides the tools, procedures, and technical assistance necessary for professional labs to monitor, control, and maintain the consistent performance of Process E-6 in their equipment.

HOW DOES *KODAK Q-LAB* SERVICE WORK?

The following diagram summarizes the interaction between the people involved in Q-LAB Service. It shows the key steps in obtaining the components or assistance that you need for monitoring, controlling, and maintaining the performance of your process.



WHAT ARE THE COMPONENTS OF *KODAK Q-LAB* SERVICE?

The components of Q-LAB Service are—

- Easy-to-use process-monitoring procedures
- KODAK Q-LAB Chemical Test Kit, Process E-6
- Plotting forms
- KODAK Audit Strips, Process E-6
- KODAK Q-LAB Densitometer Correlation Strip, Process E-6 (optional)
- Worldwide Regional Quality Centers (RQCs)
- Status reports

Easy-to-Use Process-Monitoring Procedures

These procedures help you to make chemical, mechanical, and sensitometric measurements. Monitoring chemical, mechanical and sensitometric conditions allows you to control and eliminate the variability that affects image quality. For more information on these procedures, see *Process Monitoring: Chemical and Mechanical Parameters,* Section 4, and *Process Monitoring: Sensitometric Parameters,* Section 5.

KODAK Q-LAB Chemical Test Kit, Process E-6

The KODAK Q-LAB Chemical Test Kit, Process E-6, contains the components (e.g., hardware, reagents, etc) required to test the concentration of 3 key chemical components of Process E-6: bromide in the first developer, reversal agent in the reversal bath, and sulfite in the color developer. Determining the concentration of these components will enable you to detect changes in your process—and find and eliminate the causes—*before* they affect the film you process. This kit is composed of 3 separate kits: KODAK Bromide Test Kit, Process E-6; KODAK Reversal Agent Test Kit, Process E-6; and KODAK Sulfite Test Kit, Process E-6.

For more information on this kit, see *Process Monitoring: Chemical and Mechanical Parameters*, Section 4; *First Developer,* Section 7; *Reversal Bath,* Section 9; and *Color Developer,* Section 10.

Plotting Forms

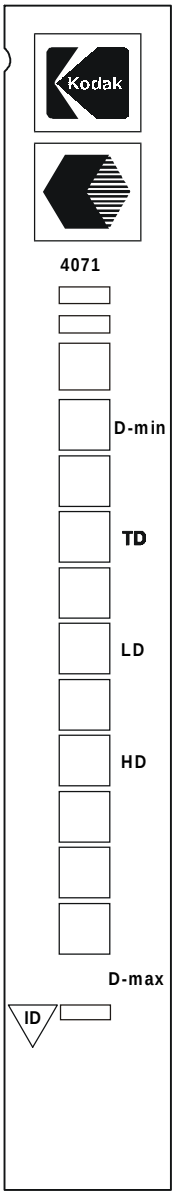
KODAK Publications No. Y-33, Y-34, Y-35, and Y-36 help you to track key parameters (i.e., time, temperature, specific gravity, replenishment rates, and chemical concentrations) and to plot control-strip densities. Tracking these parameters will allow you to monitor the performance of your process. For more information on these plotting forms, see *Process Monitoring: Chemical and Mechanical Parameters,* Section 4, and *Process Monitoring: Sensitometric Parameters,* Section 5.

KODAK Audit Strips, Process E-6

In addition to the KODAK Control Strips, Process E-6, that you use for daily process monitoring, you will process KODAK Audit Strips, Process E-6, on a regular schedule and send them to Kodak. Status report that incorporate data generated from density readings of these audit strips summarize the consistency of your process and provide a sensitometric comparison between the labs participating in Q-LAB Service.

The audit strips are manufactured on a limited basis for the primary purpose of determining the process levels of professional labs. You can compare the plots of your audit-strip data with the Process E-6 aim and the plots of the audit-strip data of other professional labs to determine your lab's performance. There is one performance aim for Process E-6. The aim values for control strips and audit strips are set to help you achieve and maintain this performance aim. (For information on establishing control-strip aims by using audit strips, see page 5-3.)

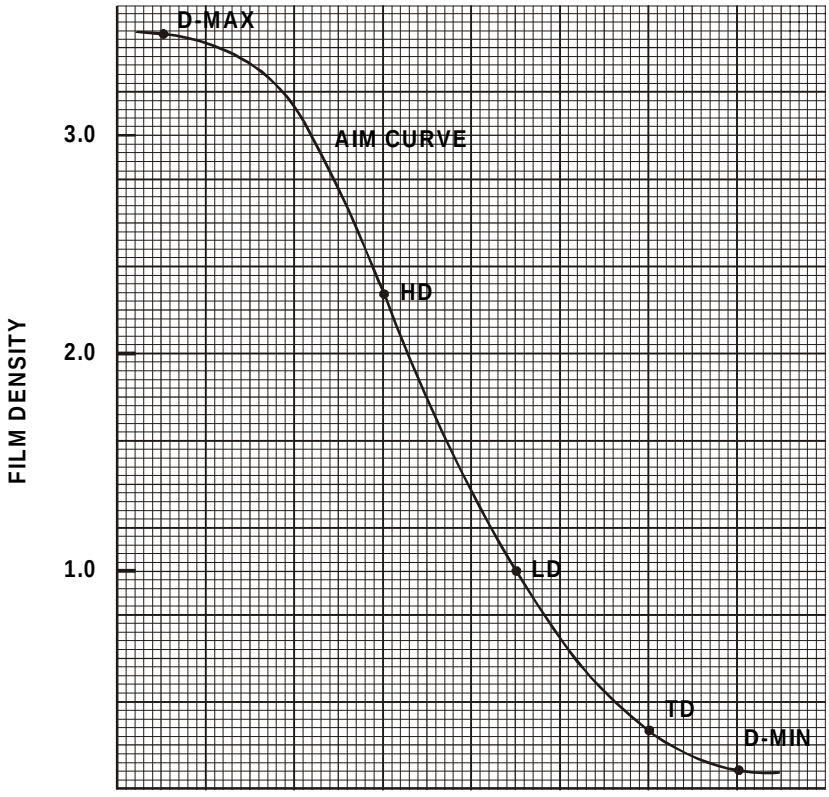
The audit strips are precisely exposed 11-step sensitometric scales on KODAK PROFESSIONAL EKTACHROME E100G Film. The 11 steps (or exposure levels) were carefully selected to provide a thorough audit of Process E-6 performance.



KODAK Audit Strip, Process E-6

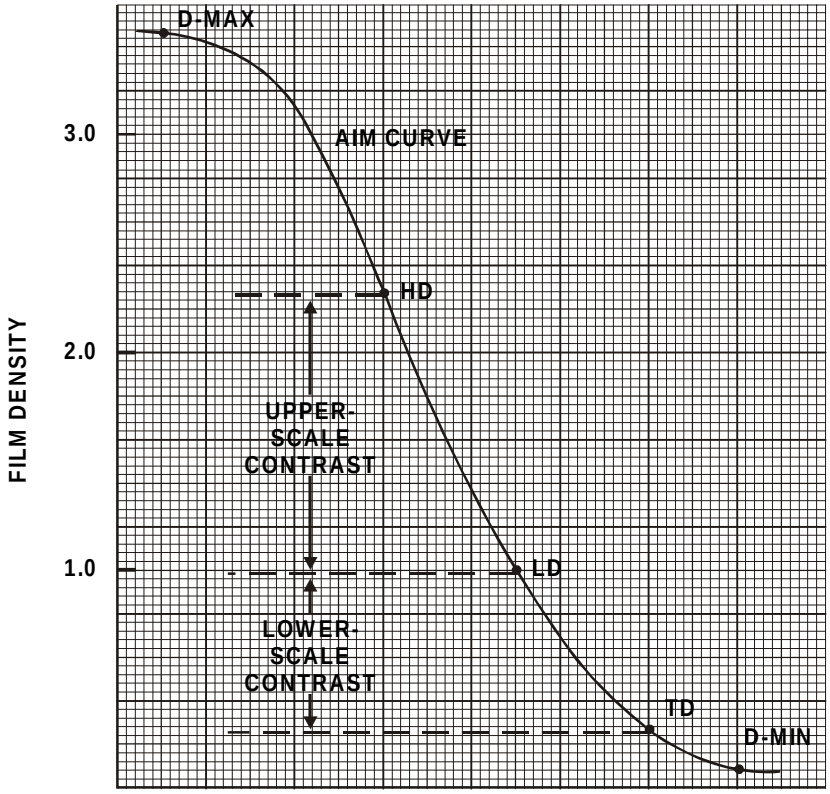
Five critical steps are labeled:

- ***D-min***—This step provides a measure of the minimum densities of processed film (areas in which the film received maximum exposure). It also provides a measure of highlight densities. Keeping densities in this step as low as possible is critical for clean, bright highlights in customer film.
- ***TD (toe density)***—This step, at a density of approximately 0.35, provides an important indicator of the color balance of the process; it is new to Process E-6 monitoring. Professional photographers are very aware of shifts in the toe density of their transparencies. If your process does not maintain neutral toe densities, the whites and highlights of customer images will show an objectionable color balance.
- ***LD (low density)***—This step, at a density of approximately 1.0, is traditionally known as the "speed point." It provides a measure of the overall density level of the process. The human eye is very sensitive to color shifts in mid-scale neutrals, so neutral color balance at this level is important.
- ***HD (high density)***—This step, at a density of approximately 2.3, is traditionally known as the "color step". The human eye is less sensitive to color shifts/casts at this density level than at lower densities; however, density readings of the HD step identify process shifts that affect color balance more readily than readings of the LD step. This step shows process effects on upper-scale densities and shadow areas.
- ***D-max***—This step provides a measure of the maximum densities of processed film (areas in which the film received no exposure).



Contrast is not plotted for Process E-6; however, you can evaluate the upper-scale contrast of your process by comparing the HD and LD densities, and you can evaluate the lower-scale contrast by comparing the LD and TD densities. Compare the color balances of HD and LD to determine if an upper-scale contrast mismatch exists; compare the color balances of LD and TD to determine if a lower-scale contrast mismatch exists; the description of the Color-Balance Summary on page 3-7 explains how to do this. A contrast mismatch exists if the color balances between density levels are different.

Professional photographers are very sensitive to contrast mismatches, so you should avoid color-balance differences between density levels.



Each box of audit strips contains 20 heat-sealed packets; ***each packet contains 2 strips.*** One box provides approximately a 6-month supply of audit strips for each processor—enough strips for you to process and submit 2 strips to your RQC every 2 weeks, as well as extra strips to use for establishing aims for at least l new batch of control strips (see page 5-3). Each batch of audit strips has a unique code number and color patch.

Distribution and Storage: KODAK Audit Strips, Process E-6, are distributed by Regional Quality Centers; a refrigerant keeps strips frozen during shipping. You will receive a new box of strips and a supply of data-collection/mailing sleeves and pre-addressed envelopes for each processor approximately every 6 months.

Note: Do not use the audit strips for daily process monitoring. Continue to use KODAK Control Strips, Process E-6, and plot the densities on KODAK Publication No. Y-33, *KODAK Plotting Form for Process E-6* (see *Process Monitoring: Sensitometric Parameters*, Section 5).

Store unprocessed audit strips at 0°F (–18°C) or lower. See the instructions packaged with the strips for other important handling information.

Processing and Mailing the Audit Strips: Process the audit strips according to the schedule provided by your Regional Quality Center. Make the required solution measurements just before you process the strips, and record the required information on the data-collection/mailing sleeve. Process the strips when your process is at a level acceptable for processing customer film.

Place both processed strips in the data sleeve, and place the sleeve in the pre-addressed mailing envelope. Mail the envelope ***promptly*** to your RQC.

KODAK Q-LAB Densitometer Correlation Strip, Process E-6

This strip is an optional component of Q-LAB Service. It helps you determine the differences (densitometer correlation factors) between your densitometer and the densitometer used to establish the aim values for KODAK Control Strips, Process E-6, and KODAK Audit Strips. We recommend that you use it when you establish control-trip aims (see page 5-2).

You can also use this strip to determine the accuracy of your densitometer. Measure the densities of the strip monthly and whenever you service your densitometer to check for satisfactory performance. Replace the strip after 2 years (or sooner if it becomes damaged).

Worldwide Regional Quality Centers (RQCs)

These centers, located around the world, administer Q-LAB Service. They distribute audit strips, analyze processed audit strips and mechanical and chemical data, and generate status reports. Each RQC uses standardized equipment (including calibrated densitometers) to produce status reports for all the labs that it serves. Your RQC will provide technical assistance if necessary, and information will be forwarded to you and your Kodak representative.

Process auditing is the primary service of your RQC. Your RQC compiles information on the performance of your process based on your audit strips and the chemical and mechanical data that ***you*** provide with the strips. Your lab will regularly receive reports that summarize this information.

Status Reports

As a participating lab, you will receive status report from your RQC on a regular schedule. Every month, you will receive a 2-part report based on the densities of your processed audit strips. Every 3 months, you will receive a 5-part report *in addition to the 2-part report*. Three parts of this report are based on the chemical and mechanical data ***you*** provide with your audit strips. The other 2 parts show the consistency of your audit-strip data during the quarter.

Status reports summarize the long-term performance of your process and confirm the chemical, mechanical, and sensitometric data that you've recorded on your daily plotting forms. Use the reports to judge long-term performance and consistency, and to make sure that your process aims are correct.

Color Zones on the Status Reports: The status reports include color zones that enable you to determine the status of your process quickly and easily. Most of the parts of the status reports use the following color zones:

- ***White*—**If your data plot within this zone, your process is in excellent control in relation to professional standards.
- ***Yellow*—**If your data plot within this zone, your process is in marginal control in relation to professional standards.
- ***Orange*—**If your data plot within this zone, your process is out of control in relation to professional standards.
- ***Red*—**If your data plot in this area or beyond the edges of the chart, your process is operating significantly and unacceptably outside professional standards.

Note: You may choose to bias your process from the performance aim for Process E-6 because of a unique customer base or specialized market applications. If your data plot ***consistently*** at approximately the same level within the yellow or orange zone, your process has a bias from professional standards. Biasing a process from professional standards is acceptable for members of Q-LAB Service only if the bias is intentional and is maintained consistently and it does not make data plot in the red zone.

The red zones on the consistency reports represent the consistency requirement for Q-LAB Service. For more information, see pages 3-8 and 3-9.

You will notice that the chart for LD spread on the audit-strip summary does not include color zones. This parameter includes no color zones because it indicates *changes* in the plots derived from the red, green, and blue densities of the LD step in relation to each other. This parameter provides a convenient means of monitoring color-balance changes at the LD level.

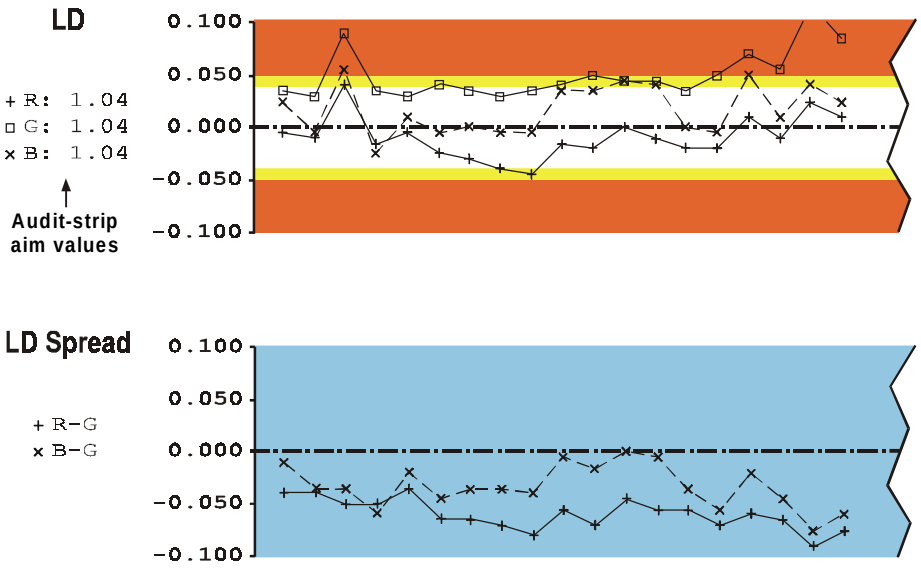
What the Status Reports Tell You: The ***Process Status*** tables on the page that includes your lab's address summarize the chemical and sensitometric data for each machine in your lab. The table at the top of the page lists the machine code, the chemical status, and the number of *completed* data sleeves received by the RQC for each machine in your lab. The table at the bottom of the page lists the audit-strip code, the machine code, the sensitometric status (based on audit-strip data), and the number of strips included in the monthly average for each machine.

The following terms are used in the tables to summarize the process status:

- ***OK***—Your data plot within the white zone; this parameter is in excellent control in relation to professional standards.
- ***Action***—Your data plot within the yellow zone; this parameter is in marginal control in relation to professional standards.
- ***Control***—Your data plot within the orange zone; this parameter is out of control in relation to professional standards.
- ***Critical***—Your data plot within the red zone or beyond the edges of the chart; this parameter is operating significantly and unacceptably outside professional standards.

The ***Audit-Strip Summary*** tells you how consistently your process has performed over a period of time; you will receive this summary once a month. The summary plots the differences between the Process E-6 audit-strip aims and the D-max, HD, LD, LD spread, TD (toe density), and D-min of your processed audit strips.

The colors on the grid for each parameter (except LD spread) indicate the status of your process; for more information, see page 3-5. The numbers below the parameter name at the left side* of each grid are the Process E-6 audit-strip aims for the parameter; these values are assigned to the aim (zero) line. The aim for LD spread is always zero (0). If the green density difference for any parameter exceeds the limits of the orange zone (i.e., data would plot in the critical [red] zone), a "Q" will be plotted at the edge of the orange zone. It is important to note any green density differences, because they indicate a speed difference between your process and the performance aim for Process E-6.



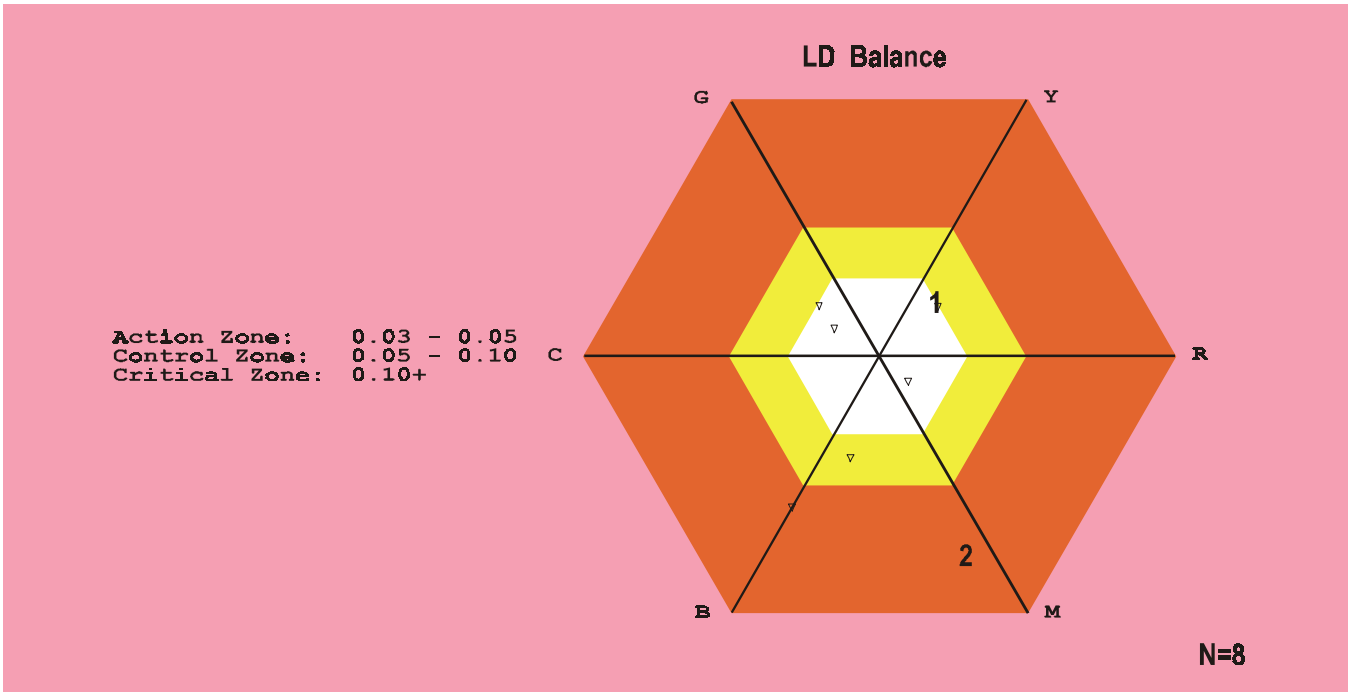
*Occasionally, very minor adjustments to the Process E-6 audit-strip aims may be necessary (e.g., if a new densitometer is used to establish the aims). If adjustments occur, the *most recent* aims will appear to the *right* of the grids on the Audit-Strip Summary.

The ***Color-Balance Summary*** shows the color balance of your process at three levels of neutral density—HD, LD, and TD—on trilinear grids; you will receive this summary once a month. This summary plots the monthly average HD, LD, and TD values of your processed audit strips and audit strips processed by other professional labs. The numbers within the grids represent *your* machine codes (e.g., in the example below, the lab has two machines, shown by numbers 1 and 2); the triangles represent the machines in other professional labs in your area that participate in Q-LAB Service. The values for the action (yellow), control (orange), and critical (red) zones are listed next to each grid. The N = # represents the number of machines included in the grid; if 2 or more machines have the same color balance, they are represented by a single triangle.

The trilinear grids are composed of six axes labeled C (cyan), G (green), Y (yellow), R (red), M (magenta), and B (blue). The intersection of the six axes represents the Process E-6 audit-strip aim (neutral density). The location of your average audit-strip density in relation to the center of the trilinear grid indicates the color balance of your process at HD, LD, and TD; the intensity of the color bias *increases* as the plot moves away from the center of the grid. For example, in the LD grid shown below, Machine 1 is *slightly* yellow-red (i.e., the data plots away from the center between the yellow axis and the red axis) and Machine 2 is *very* magenta (i.e., the data plots farther from the center than the data for Machine 1, and close to the magenta axis).

The HD balance, TD balance, and LD balance are plotted on one page so that you can easily determine if your process has a consistent color balance over a wide density range. If the color balance varies at different density levels, your process has a contrast mismatch. Professional photographers are very critical of a process with a contrast mismatch because they cannot compensate for it by using filters when they expose their film.

The colors on each trilinear grid indicate the status zones; for more information, see page 3-5.



Sample Status Report

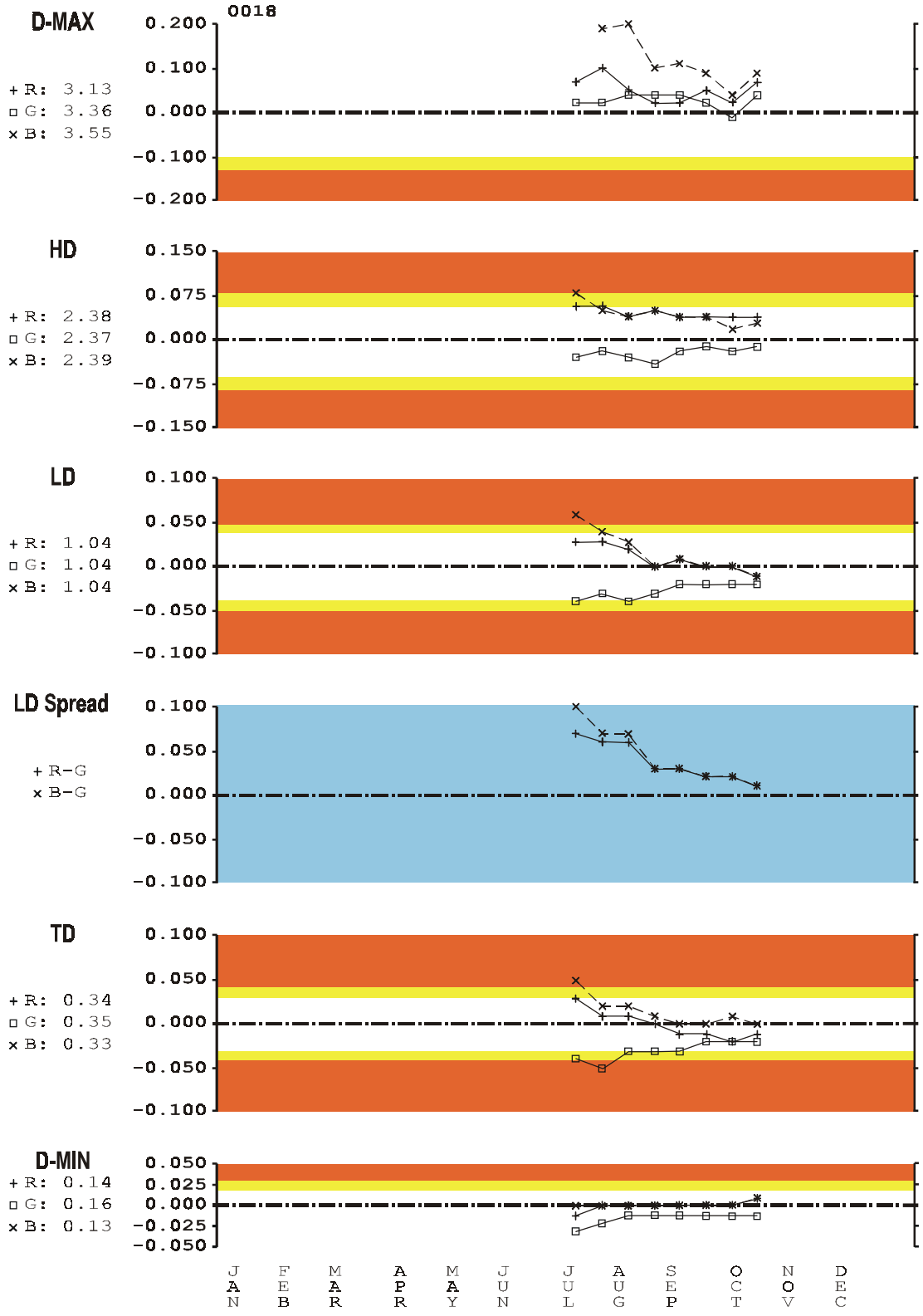
The following pages include sample status reports with descriptions of the control status of the processes and the results that photographers would see in their transparencies.

Example 1

The audit-strip summary for this process shows a gradual improvement. The LD spread for mid-August is considerably more neutral than the LD spread for mid-July. During this time, photographers have seen improvements in their transparencies, but have not detected any dramatic short-term differences in processing because the improvements have been gradual.

Note: The deviation from aim for the first blue D-max density was large—so large that it did not plot within the limits of the grid.

Audit Strip Summary -- Ending Date for Report: mm/dd/yr

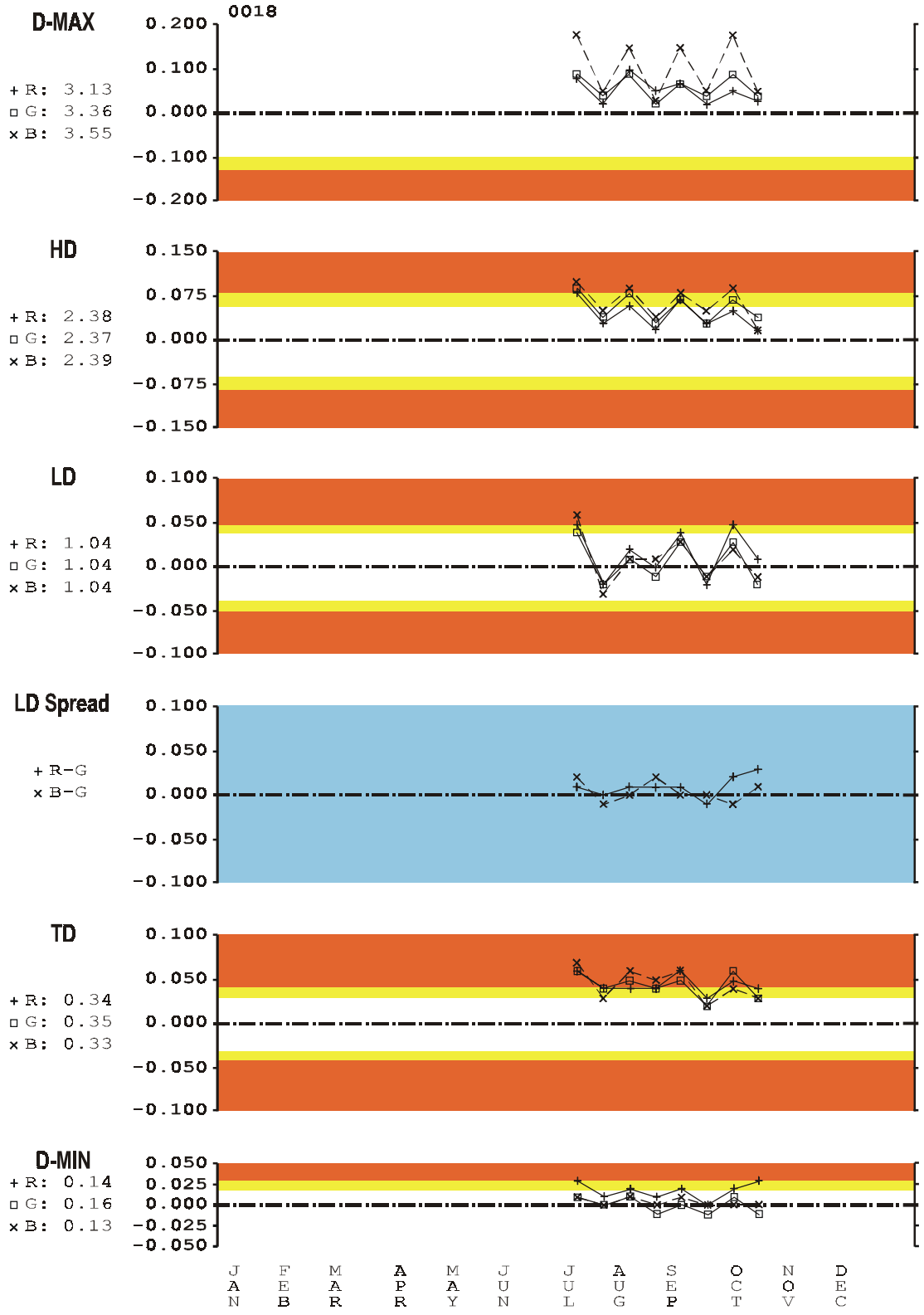


Example 2

The audit-strip summary for this process shows long-term cyclic variability. Problems of this nature may be difficult to detect from day to day or shift to shift. When the audit-strip summary indicates that cycling may be a problem, review your Form Y-33 data for the preceding month to determine the length of the cycle.

The LD spread is centered around the aim and is relatively consistent over time; however, the density of the LD step fluctuates every other week, which indicates fluctuations in density without variations in color balance. Possible causes of the density fluctuations are changes in the first-developer time, temperature, specific gravity, or replenishment rate. Data plots on Form Y- 34 should confirm the cause. The process operator should determine the cause of the fluctuations and correct it. The contrast mismatches (LD on aim and high HD [high-scale contrast mismatch]; LD on aim and high TD [low-scale contrast mismatch]) indicate a problem with more than one chemical or mechanical parameter. Some problems that may occur simultaneously (but with varying severity) and cause the audit-strip summary shown are underconcentrated first developer, underconcentrated color developer, too little color-developer Part A combined with sodium hydroxide additions, and first-developer time or temperature adjustments to control LD.

Audit Strip Summary -- Ending Date for Report mm/dd/yr



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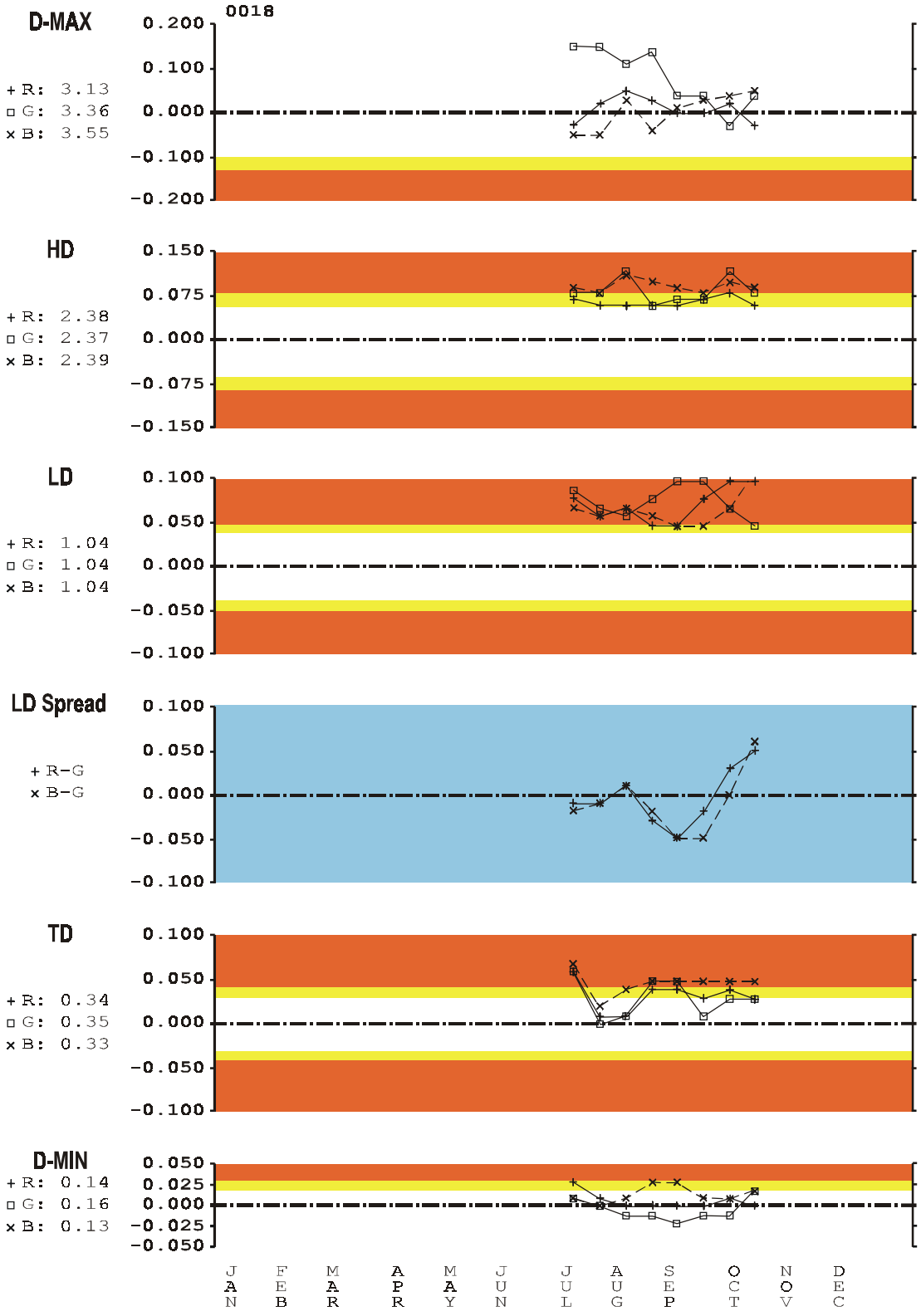
Example 3

The audit-strip summary for this process (Example 3A) shows high HD, LD, and TD, as well as color-balance shifts at D-max, LD, and D-min. Because HD, LD, and TD are consistently high, this lab may have an intentional bias. If the lab is biasing its process, it must continue to maintain the density level shown in the plot.

However, the color balance is inconsistent as shown by the plot of LD spread. These color-balance fluctuations are unacceptable, and the lab should investigate the cause and correct it.

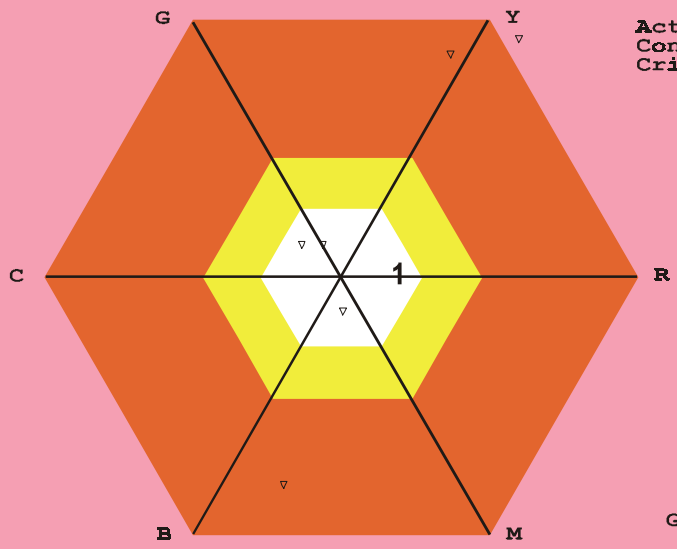
The color-balance summary for Machine 1 (Example 3B) shows acceptable color balance at HD, LD, and TD for the previous month. However, this process has a slight contrast mismatch (i.e., the color balance is slightly different at each of the 3 density levels). The lab should investigate the cause of the contrast mismatch and correct it.

Audit Strip Summary -- Ending Date for Report: mm/dd/yr



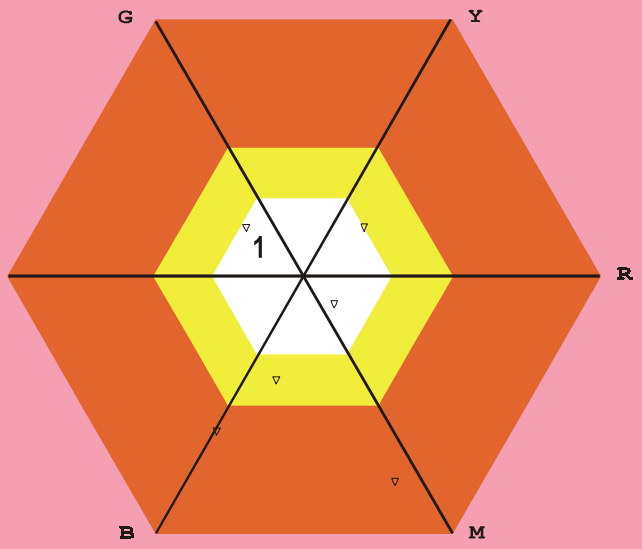
Color Balance Summary -- mm/dd/yr to mm/dd/yr

HD Balance



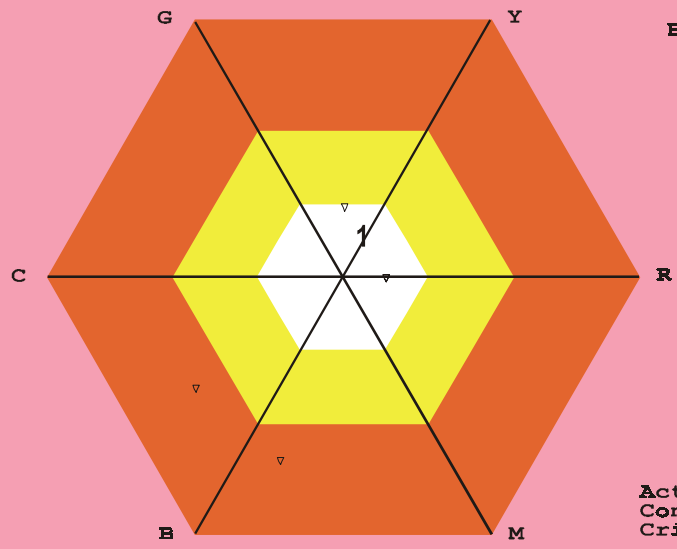
Action Zone: 0.04 - 0.07
Control Zone: 0.07 - 0.15
Critical Zone: 0.15+

LD Balance



Action Zone: 0.03 - 0.05
Control Zone: 0.05 - 0.10
Critical Zone: 0.10+

TD Balance



Action Zone: 0.02 - 0.04
Control Zone: 0.04 - 0.07
Critical Zone: 0.07+

N=8

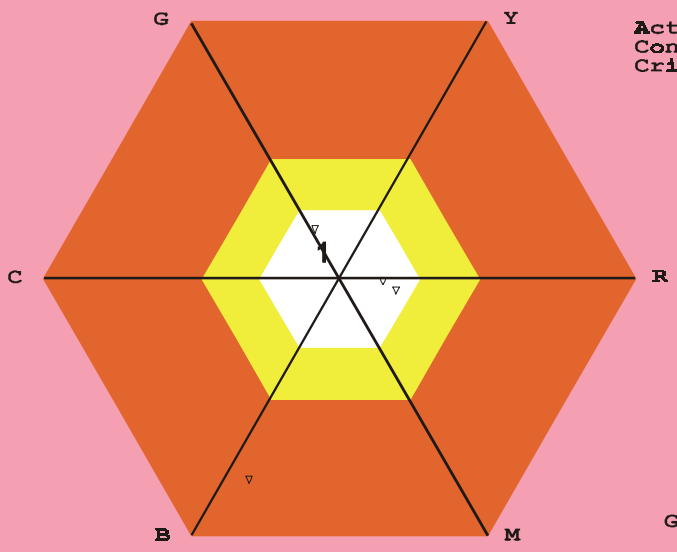
Example 4

The color-balance summary for Machine 1 indicates a process that is in excellent control in relation to professional standards. The plots show excellent color balance, even though there is a slight color-balance shift between density levels.

The process-status tables summarize the chemical and sensitometric data for this process. The table at the top was based on 2 completed data sleeves received by the RQC. The table at the bottom and the color-balance plots were based on the average densities of 4 audit strips.

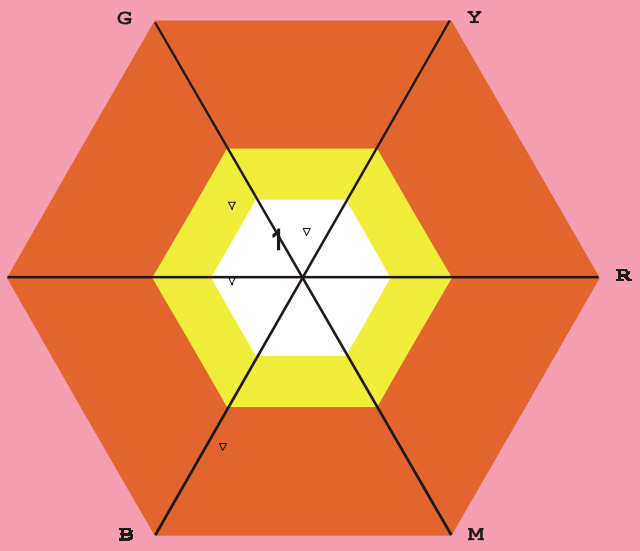
Color Balance Summary -- mm/dd/yr to mm/dd/yr

HD Balance



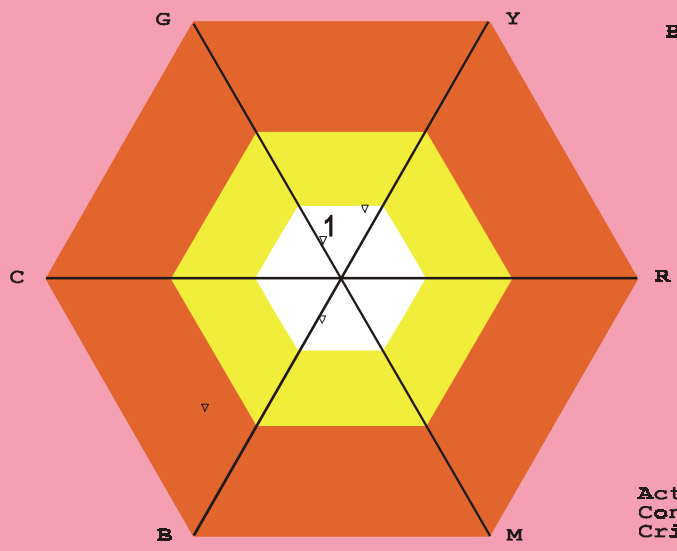
Action Zone: 0.04 - 0.07
Control Zone: 0.07 - 0.15
Critical Zone: 0.15+

LD Balance



Action Zone: 0.03 - 0.05
Control Zone: 0.05 - 0.10
Critical Zone: 0.10+

TD Balance



Action Zone: 0.02 - 0.04
Control Zone: 0.04 - 0.07
Critical Zone: 0.07+

N=5

Machine Code	Process Status -- mm/dd/yr to mm/dd/yr									Number of Runs
	First Developer			Reversal Bath			Color Developer			
	Specific Gravity	Repl. Rate	Bromide	Specific Gravity	Repl. Rate	Reversal Agent	Specific Gravity	Repl. Rate	Sulfite	
01	OK	OK	OK	OK	OK	OK	OK	OK	OK	2

Example Professional Laboratory
111 Example Park
City, State **11111**

Atten: Example, Owner

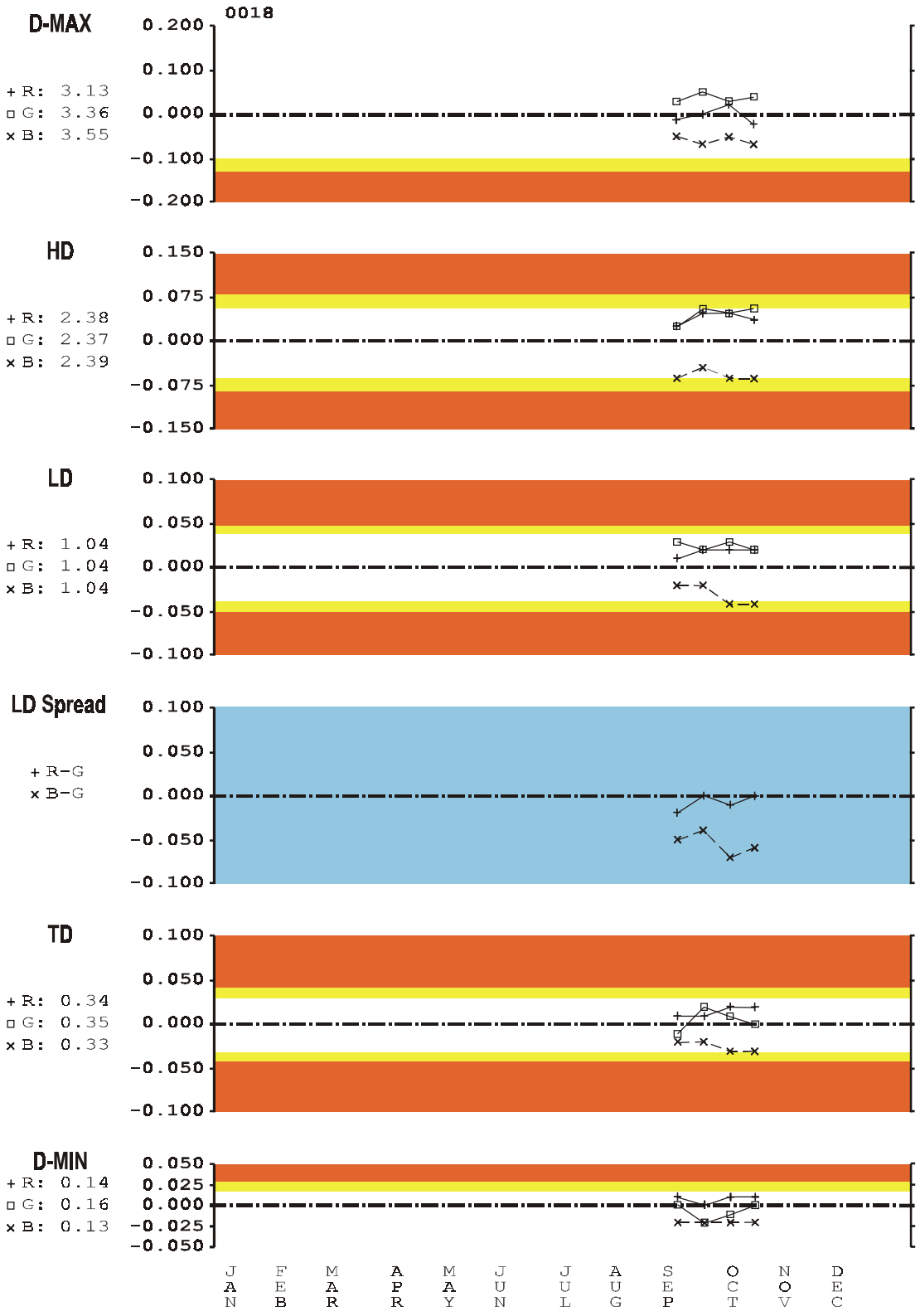
ID Code: PPP104 **Account: T4** **TSR: EXAMPLE, TSR**

Audit Strip Code	Machine Code	Process Status -- mm/dd/yr to mm/dd/yr								Number Strips Averaged
		D-MAX	HD	HD Balance	LD	LD Balance	TD	TD Balance	D-MIN	
0018	01	Control	OK	OK	OK	OK	OK	OK	OK	4

Example 5

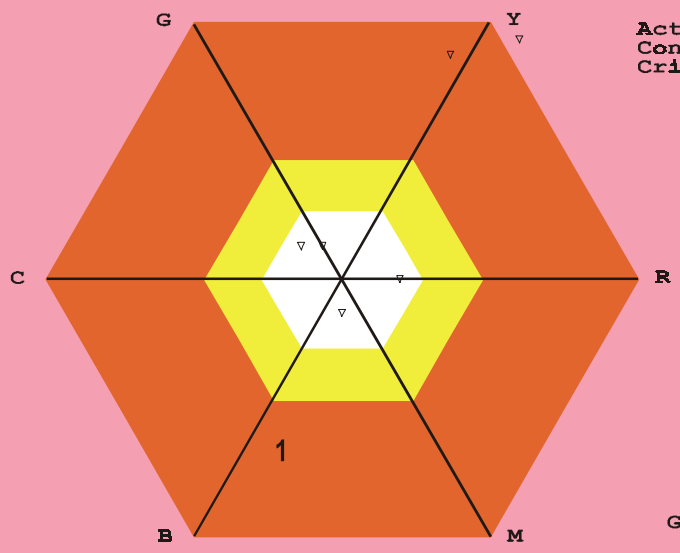
The audit-strips summary (Example 5A) indicates that the process is in good control. However, the color-balance summary for Machine 1 (Example 5B) shows that the process has a serious color-balance problem. Reevaluation of the audit-strip summary reveals color-balance shifts. You can detect the unacceptable blue color balance more easily from the color-balance summary because the plots of the 3 density levels are close to the B (blue) axis in the orange zone. To identify problems that cause color-balance shifts, the operator should check the plots on Forms Y-34, Y-35, and Y-36, and make any necessary adjustments.

Audit Strip Summary -- Ending Date for Report: mm/dd/yr



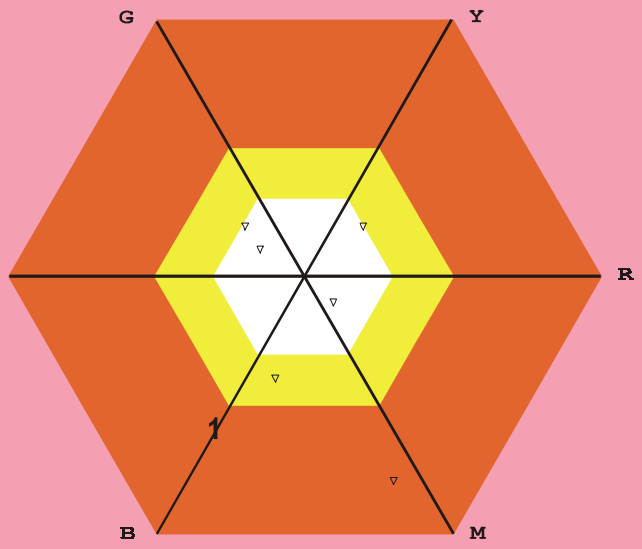
Color Balance Summary -- mm/dd/yr to mm/dd/yr

HD Balance



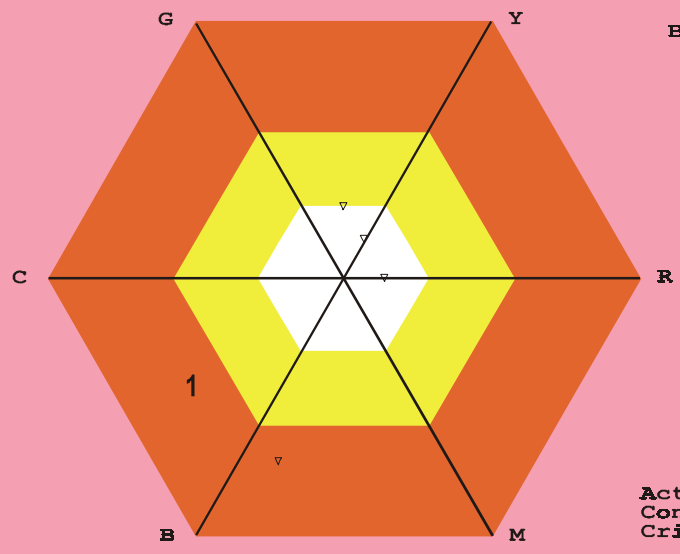
Action Zone: 0.04 - 0.07
Control Zone: 0.07 - 0.15
Critical Zone: 0.15+

LD Balance



Action Zone: 0.03 - 0.05
Control Zone: 0.05 - 0.10
Critical Zone: 0.10+

TD Balance



Action Zone: 0.02 - 0.04
Control Zone: 0.04 - 0.07
Critical Zone: 0.07+

N=8

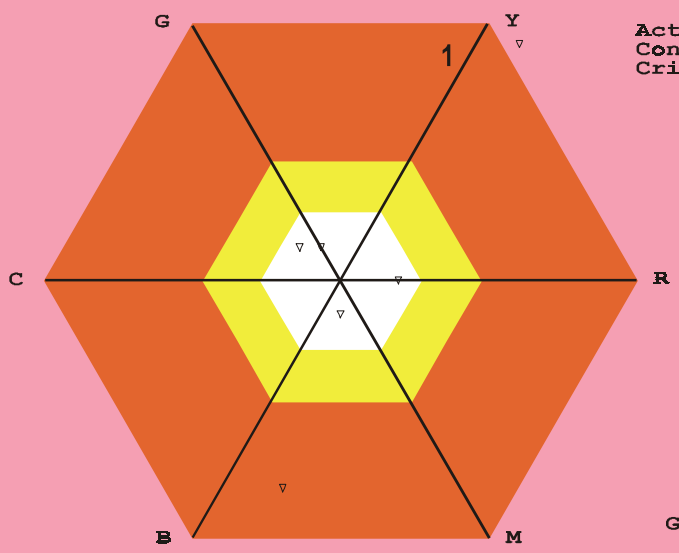
Example 6

The color-balance summary for Machine 1 shows why it is important to track the color balance at three levels—HD, LD, and TD. The LD balance shows that the process is in marginal control and is slightly blue; the HD balance is out of control and is very yellow; and the TD balance is out of control and is very blue.

This condition represents a contrast mismatch—a mismatch occurs when color balance varies between the 3 density levels. The upper-scale contrast and lower-scale contrast of this process are affected. Photographers ***cannot*** properly compensate for a process with a contrast mismatch by using filters. Careful process control is the only method of detecting, correcting, and preventing contrast mismatches. Example 3B shows a less severe contrast mismatch.

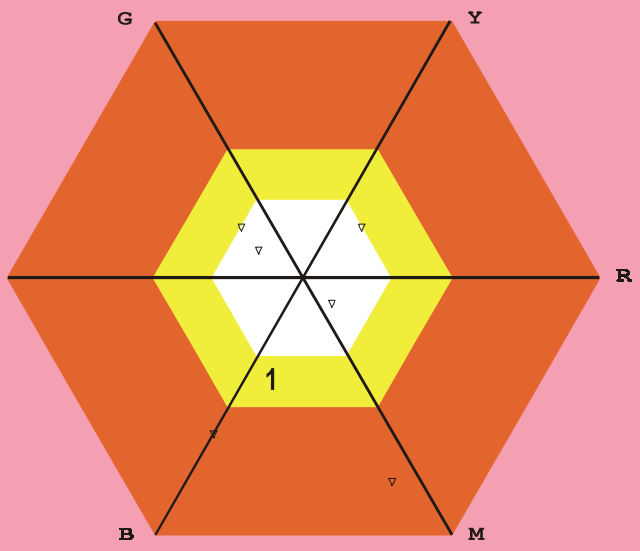
Color Balance Summary -- mm/dd/yr to mm/dd/yr

HD Balance



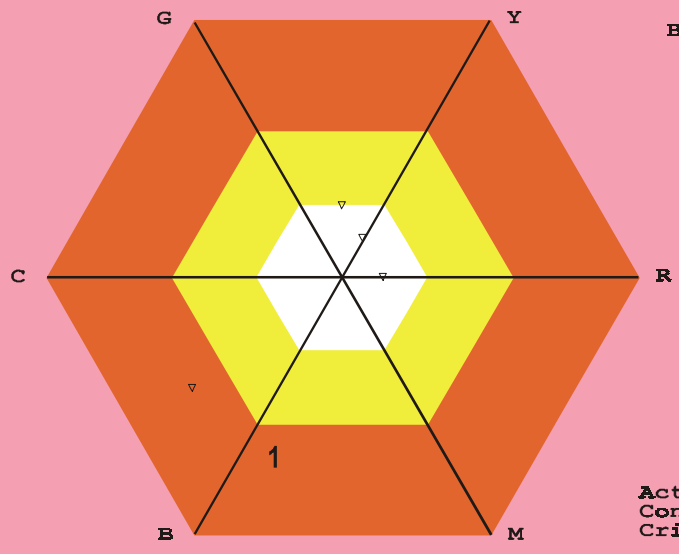
Action Zone: 0.04 - 0.07
Control Zone: 0.07 - 0.15
Critical Zone: 0.15+

LD Balance



Action Zone: 0.03 - 0.05
Control Zone: 0.05 - 0.10
Critical Zone: 0.10+

TD Balance



Action Zone: 0.02 - 0.04
Control Zone: 0.04 - 0.07
Critical Zone: 0.07+

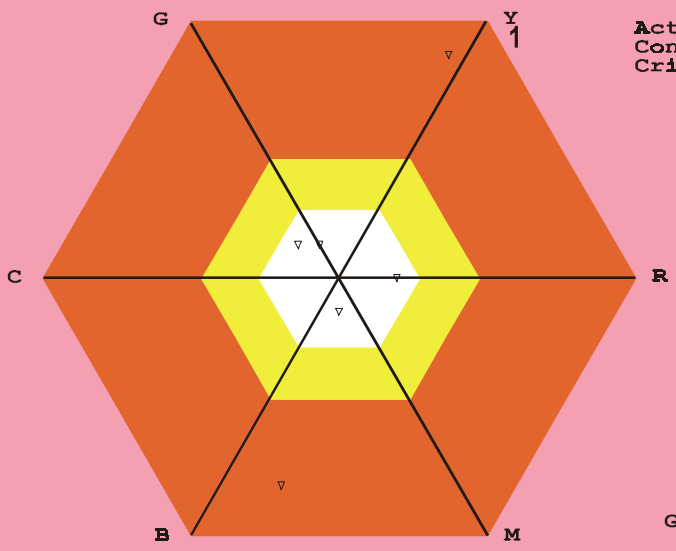
N=8

Example 7

The color-balance summary for Machine 1 shows an extremely yellow color balance at HD. This process is in good control at the LD and TD levels, but the HD color balance is in the critical zone—it is significantly and unacceptably different from professional standards. Photographers would detect yellow shadows in their transparencies.

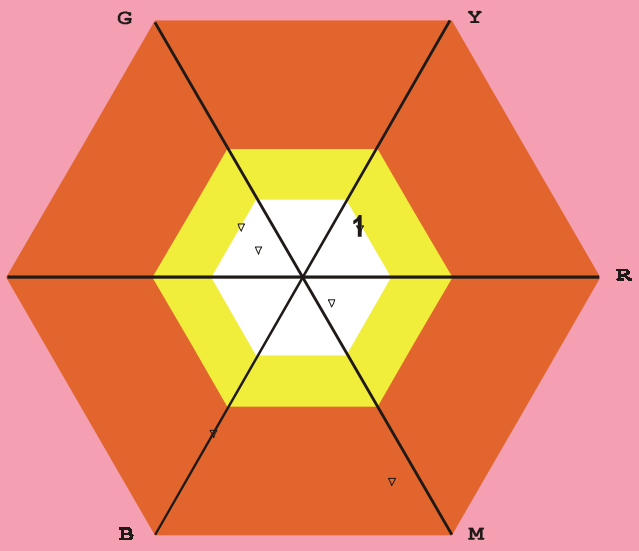
Color Balance Summary -- mm/dd/yr to mm/dd/yr

HD Balance



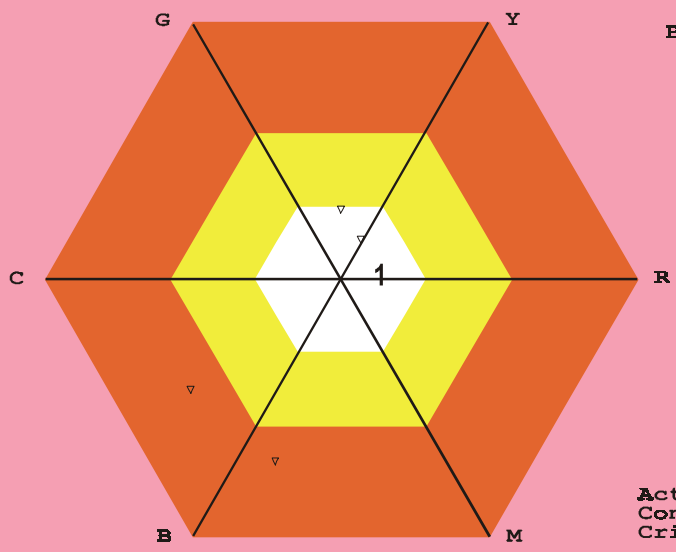
Action Zone: 0.04 - 0.07
Control Zone: 0.07 - 0.15
Critical Zone: 0.15+

LD Balance



Action Zone: 0.03 - 0.05
Control Zone: 0.05 - 0.10
Critical Zone: 0.10+

TD Balance



Action Zone: 0.02 - 0.04
Control Zone: 0.04 - 0.07
Critical Zone: 0.07+

N=8

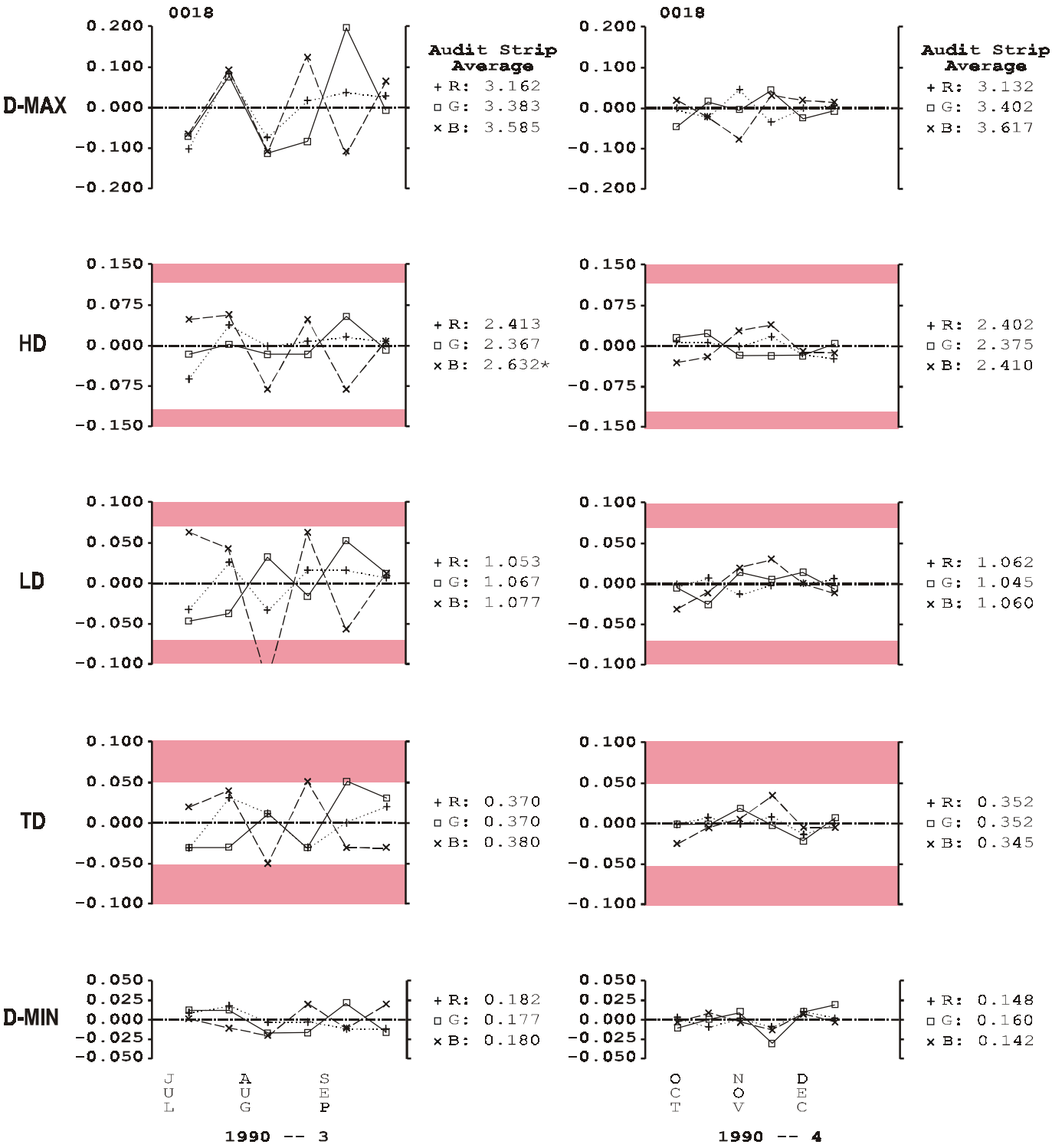
Example 8

The audit-strip consistency summary for this process shows a high level of variability in the data for the third quarter (the grids at the left of Example 8A), particularly in the blue densities. Note that the lab's average audit-strip densities were different from aim. The average blue density for HD was significantly different from aim (identified by the asterisk). On the LD color balance consistency summary (Example 8B), the color balance of most of the runs of audit strips plots outside the large circle that represents the consistency requirement for Q-LAB Service. High variability caused the lab to have a very high variability rating for the third quarter. This rating is shown in the bar chart at the bottom of Example 8B; the rating plots in the red zone.

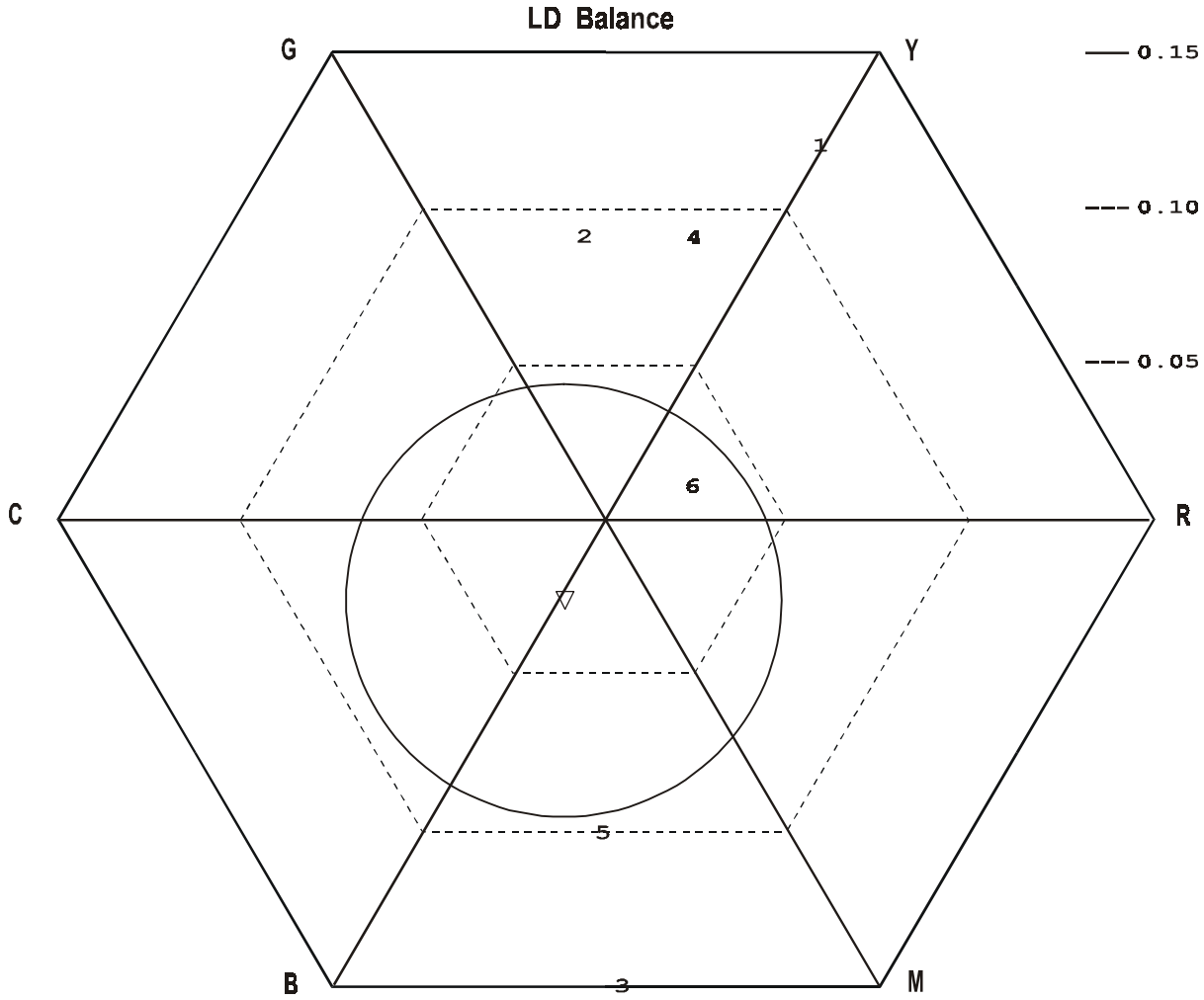
This lab's Kodak representative offered assistance in reducing the variability of the process. After a thorough check of all process parameters, the lab determined that the pump for the reversal-bath replenisher concentrate was delivering too much concentrate and the water pump was delivering too little water. The replenishment rate was correct (100 mL/sq ft), but the ratio of concentrate to water was incorrect, causing the reversal bath to become overconcentrated and the process to drift blue. The lab was adding sodium hydroxide to the color developer to correct the blue color balance. However, the pH of the color developer was not the cause of the problem (i.e., the pH did not need to be increased), so the process continued to drift blue. By making an adjustment that did not eliminate the cause of the problem, the lab unintentionally increased the variability of the process, as indicated by the data for the third quarter on the audit-strip consistency summary.

The lab's audit-strip data for the fourth quarter (the grids at the right of Example 8A) are much more consistent. On the LD color balance consistency summary (Example 8C), the color balance of each run of audit strips plots close to the average balance of all the strips for the quarter, indicating reduced variability since the third quarter. The LD variability rating for this quarter shows a great improvement.

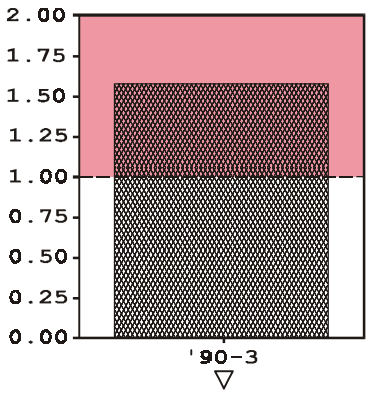
Audit Strip Consistency -- Fourth Quarter, yr



LD Color Balance Consistency -- Third Quarter, yr



LD Variability Rating



LD Color Balance Consistency -- Fourth Quarter, yr