Ferrania
Imaging Technologies

LabLine Training Series

Part Five

Process Monitoring Basics

The Ferrania Imaging Technologies LabLine Training Series will provide a primer on many subjects related to photofinishing technology, theory and application. The subject discussed in this and the next issue will be Chemical Process Quality Control. The study of the color negative film and the print from color negative paper processes, along with their monitoring and control, will be presented in these issues. A general knowledge quiz on the subjects covered in each issue will also be included. The information in this and following features will furnish the reader with a ready reference on the subject and supply a source of information and materials to train new employees.

Introduction

This issue of the LabLine Training Series will discuss many of the basic principles and practices of which a lab operator must be knowledgeable to monitor and evaluate the wet processes in the lab. The information presented is written in regard to the C-41 and RA-4 processes, however, these basic principles may be applied to other photographic processes such as the EP-2, E-6 and the B&W processes.

The information discussed in this issue will inform the reader of the type of information that needs to be gathered to monitor a process and the means by which it is gathered. Topics discussed will include; densitometer care and calibration, process control strip storage and use, process control forms, processing log books and process review. The next issue will cover process troubleshooting and how to interpret the information gathered and actions to be taken to correct an out or nearly out of control process.

Editor's Note: This publication should not be used as a sole source for process monitoring, but rather as a common sense guide for process monitoring techniques. Most major film, paper and chemical manufacturers publish process monitoring manuals which should be used in conjunction with this material.

Processing Monitoring, What Is It?

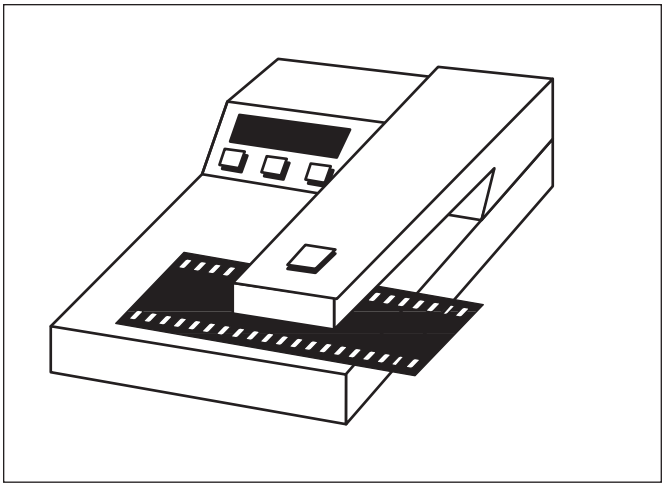
Process Monitoring is a daily procedure by which quality levels in a process are measured and evaluated through the comparison of a reference strip of film or paper, the "standard," with that of a processed strip, the "control." The reference strip supplies the operator with the "standard density values" for the process, and the control strip provides the actual results being produced by the process.

An operator, as part of a daily startup procedure, will process a control strip. The control strip densities are then read with a densitometer and recorded or plotted on a "process control form" using the standard density values as an aim for the process. At this point, an evaluation can then be made. The principal aim of process monitoring should be problem avoidance. If properly performed, process monitoring will detect potential problems. The operator may then take actions to correct the process before an actual problem arises. However, many potential problems will not surface until they become actual problems. In these instances, errors in the process can be detected, identified and corrected through this process monitoring procedure.

Although processing control strips is the primary essential in process monitoring, the regular maintenance of a process control form is an equally essential part of process monitoring. It provides the photofinisher with very important information. It will indicate if the process is running within acceptable limits or tolerances. If not within tolerance, it will indicate what way it is out (i.e. density, contrast, color balance, etc.). The control strips, when recorded daily over time, will show trends in the process, allowing corrections to be made before a problem develops. By interpreting the control strips and trends, this process monitoring

technique will give evidence as to what is going wrong with the process so that corrective measures may be taken to prevent the process from going out of control or bring it back in control if the process is currently out.

Densitometer



The densitometer is a highly sophisticated precision instrument which is used to measure dye densities in color photographic films and papers, dye densities in chromogenic black and white films and papers (B & W films and papers which utilize color processes), and metallic silver densities in black and white photographic films and papers. The densitometer typically has a screen which displays the measured densities. It is critical that the density measurements displayed are accurate, for these measurements are the basis by which the processes are evaluated. This accuracy is maintained by the proper care and calibration of the densitometer. It is recommended that the operator become well acquainted with the densitometer's operation or instruction manual. This manual will present all the necessary information related to care, use, maintenance and calibration requirements for your model.

Following are some basic usage and handling guidelines which can be applied to all models and brands of densitometers:

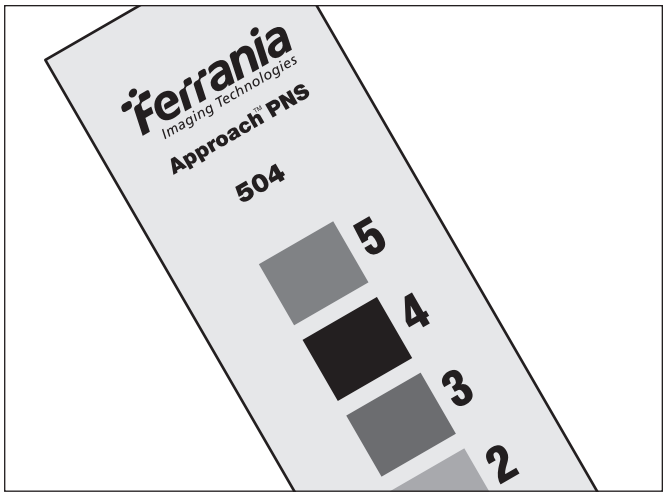
1. Handle the densitometer with care at all times. It is a precision instrument and it needs to be treated as such. When repositioning the densitometer, move it gently and do not drop it on any surface. When purchasing a densitometer it is recommended that the original packing material and box be retained for future transportation of the instrument.

2. The densitometer should be placed in a position such that a strong light is not allowed to enter the aperture opening of the densitometer. High temperature and humidity locations must be avoided. Place it in a environment that is a clean and dust free as possible. Follow the manufacturer's recommendations for cleaning, adjustment, periodic maintenance and repair.

3. The densitometer should be calibrated or calibration checked every day as part of a startup procedure. Use the calibration tool; plaque, strip or patches, that were supplied by the manufacturer. If you do not have them, it is recommended that you order a new set from the manufacturer. Take very good care of the calibration tools, for the accuracy of the densitometer is directly related to the care given to them. When finished with the calibration tool, place it in a protective case and store in a dark place. Keep the tool clean and free from fingerprints. It is recommended that printing gloves are used to handle the calibration tools.

4. Return the densitometer to the manufacturer for periodic maintenance as recommended by the manufacturer. Replace calibration tools as recommended by the manufacturer or if damaged, scratched or stained.

Process Control Strips



Each box of control strips will contain a number of pre-exposed, unprocessed strips which all have the same code number. Included in the box will be a single reference strip with the same code number and a set of correction factors for that particular code. The reference strip and correction factors are used to determine aims for the process for that code of control strips and are recorded on the process control form.

Following are few guidelines which should be followed when purchased or used:

1. When received from the manufacturer, the control strips should be immediately placed in a freezer with a temperature of 0°F (-18°C) and stored there. Prior to processing a control strip, the strips should be removed from the freezer long enough to allow the film or paper to come up to near room temperature. This will typically take from thirty to sixty minutes.

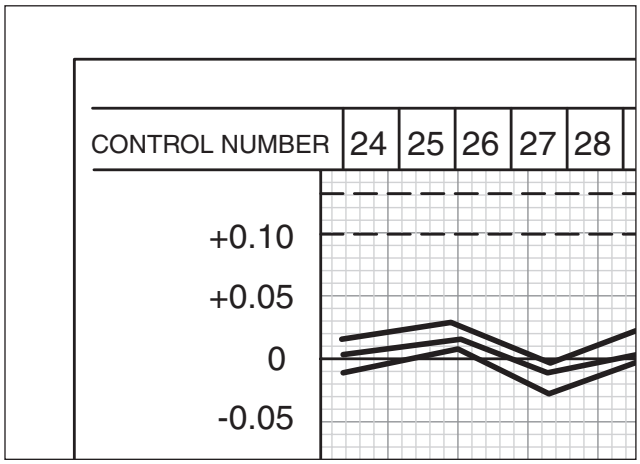
2. It is advisable to purchase three to five boxes at one time. This will allow you to read, with the densitometer, more than one reference strip and average the readings. This will generally yield more accurate aims than the reading of only a single reference strip. When a new shipment of control strips is received, remove the reference strips from the boxes and determine the new aims for the new code. Then process three of the new strips along with three of the old code and compare each to its aims for each and compare the results. If the new strips indicate a significantly different process level, contact your control strip manufacturer for assistance to determine the cause.

3. At least one control strip should be run daily in each of the processors at startup. It is extremely important that the control strip be run in the processors before any customer work is processed. It is much easier to run a control strip before customer work than it is to explain to the customer why their film was ruined by an out of control process that was in control the previous day. Contaminated processing solutions are not that uncommon, in today's competitive market, good customers are. Don't process customer work prior to running a control strip, ever.

4. Once a control strip is processed, record the results on the process control form immediately. Do not try to evaluate the process until this is done. A single control strip may be in control, however it is also possible that density values may have moved .10 density units or more from the prior day and would probably not be noticed until recorded. That large of a change is a strong signal that there is a problem in the process and further examination of the process is necessary.

5. Process an additional control strip after any chemical or mechanical changes and whenever any trouble is suspected.

Process Control Forms



A Process Control Form should be set up and maintained for each processor in the lab. There are a number organizations which make available process control forms. Most of the major photographic manufacturers have forms which are available to their customers for purchase. There are also many computerized forms and programs available for process monitoring on the market. The type used in an individual lab is generally one chosen through personal preference, and all do a very good job if maintained properly.

All printed or computer generated forms contain areas in which to record vital information concerning the processor, control strips and the process itself. The form will also contain an area which looks similar to graph paper on which the daily control strip results, when compared to the standard for the process, are recorded. The following information should be contained on each form:

1. Control and reference strip code number. Each batch of control strips has its own code. You may have one or several boxes with the same code, all will use the same aims. Each code will have slightly different aims for the process, therefore it is very important that each control strip run on the processor is compared to the aims derived from reference strip with that same code.

2. Process machine number and process type. Each machine should have a form which is dedicated to that machine only. Do not record control strips from multiple processors on the same form. It will be impossible to monitor trends for an individual processor if this is done. Record the complete process type on the form: C-41 Film, C-41RA Film, RA-4 Paper, etc.

3. Aim values for the process. These include D-min (density minimum or stain), LD (low density or speed), HD-LD (high density minus low density or contrast), D-max (density maximum), D-maxR - D-maxG (density maximum red minus density maximum green or leuco cyan dye), D-maxB-YB (density maximum blue minus yellow blue or retained silver), and/or others. The aims are derived from the reference strip or strips of that code to which the correction factors (also unique for that code) have been applied. Contact your control strip manufacturer for specific details on how actual aim values are determined for the control strip brand you use.

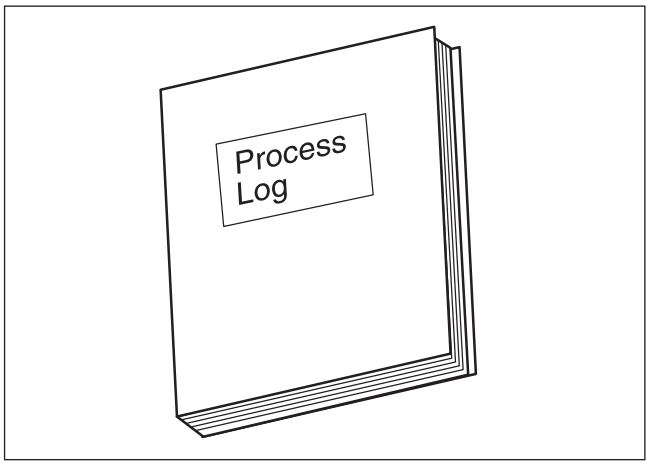
4. The chart should contain action and control limits for the individual categories recorded as listed above. The action and control limits will vary for each category, consult your film, paper or chemical supplier for their recommendations. Action and control limits are boundaries within which the process should run. The boundaries use the aim values as the center for the process. Each will have an upper and lower limit. For example: the action limits for LD of the C-41RA process may be ±.06 density units and the control limits ±.08 from aim values. This means that the process can be considered to be in control if the LD readings are within .08 density units above or below the aim values, however if the control strip LD readings are at least .06 above the aim values, action should be taken to bring the process in tighter alignment with aims. If the LD readings are beyond ±.08 the process is considered out of control and customer film or paper should not be processed until adjustments are made to the process to bring it back in control within these limits.

5. Each of the control strips run on the process should be recorded or plotted as compared to the aim values on the form. Connect the plotted points from day to day to give a continuous graph. The date and time each control strip was processed should also be included on the form.

6. Any change made to the processing equipment, process or any unusual occurrence which may affect the process should be recorded on the form on the corresponding line for the control strip which was processed during the period of the change or unusual occurrence. (A control strip should be processed after any change or occurrence!) These changes would include; new tank mixes, additions of any chemicals, mechanical or process factor adjustments, etc.

A typical process control form is large enough to record information from twenty to thirty processed control strips. Once filled, the form should be filed and a new form filled out with the proper information as listed above. The used forms will supply the lab operator with a record or history of the process. These should be kept for at least two years. If properly filled out, they will provide the operator with a source for problem and solution identification and can be used as a training resource for employees.

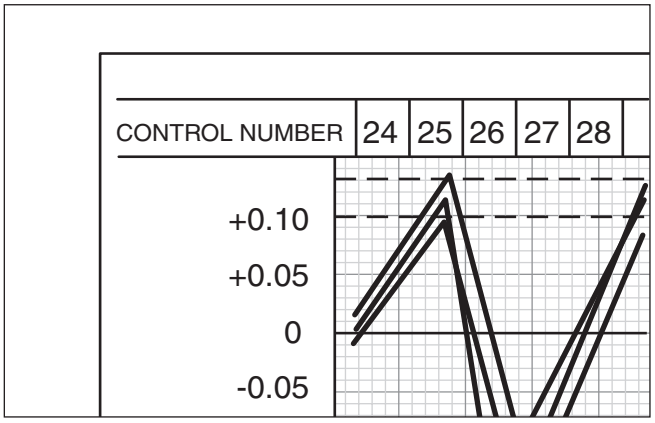
Processing Log Book



A Processing Log Book should be maintained in the lab. The processing log is a journal of events in the lab recorded when and as they happen. A description of an event, along with the date and time of the event, should be recorded in each log entry. Entries into the log book should include any event which could affect the process or provide further information about the process or processor. These could include the following: processing control strips, the mixing of replenisher solutions, additions of water or chemicals to the processing tanks, solution temperature changes, replenishment or agitation rate changes, chemical filter replacement, squeegee changes or adjustments, processor part changes (including gears, pumps, racks, lines etc.), power outages, routine maintenance procedures, spills, leaks and the many other daily or periodic events that take place in the course of normal lab operation.

Along with the process control forms, the processing log book provides the lab operator with a valuable resource for tracking the day to day events conducted in a photographic processing lab. Should a problem arise within one of the processes, a processing log book will provide clues as to what may have taken place in the lab that caused or contributed to the problem.

Process Review



As stated earlier, a control strip should be processed on each of the processors as part of the daily startup procedure. The processed control strip should then be read on a calibrated densitometer and then those values as compared to aims plotted on the process control form. Once plotted, an evaluation of the process can be made. If plotted values are within the action limits in all categories on the process control form, the process is in control and should be left alone. If the plotted values are outside of the action or control limits proceed as follows:

1. Check the code number on the control strip to determine if it matches the code number on the process control form or reference strip used to determine aims. Verify that the control strips were stored properly and that the control strip was processed properly.

2. Recalibrate the densitometer and reread the control strip to verify that the original values read were correct.

3. If the process still exceeds the action or control lim its, immediately process another control strip to verify the problem.

4. If the second strip exceeds the action or control limits, proceed as follows:

    a. If the Action Limits are exceeded, continue to run customer work, but determine the cause of the out-of control conditions and correct them. Be sure to note any corrective actions on the process control form and in the process log book.

    b. If the Control Limits are exceeded, stop processing customer work and determine the cause of the out-of control conditions and correct them. Process another control strip to verify that the action taken had the desired effect and the process is back in control. Be sure to note any corrective actions on the process control form and in the process log book.

Next Issue:
Process Troubleshooting

Color Processing Quiz

Indicate whether the following statements are True or False.

1. T F The principle aim of process monitoring should be problem solving.

2. T F The densitometer should be calibrated or calibration checked every day or if a problem with calibration is suspected.

3. T F Aim values are taken directly from the reference strip.

4. T F The values for aims from one code of control strip to the next will be the same.

5. T F A control strip should be processed on each processor before any customer work is processed.

6. T F It is not necessary to plot or record every control strip processed on the process control form.

7. T F You may record control strips from more than one processor on the same control form provided both processors are of the same type, i.e. C-41RA.

8. T F Any unusual occurrence in the lab should be recorded in the processing log book.

9. T F A process control form is unnecessary if a process log book is maintained.

10. T F Always run an additional control strip to verify a problem if one arises.

11. T F It is never necessary to process more than one control strip per processor per day.

12. T F Once filled, the process control form should be filed for future reference.

13. T F Control strips do not need to be stored in a freezer.

14. T F The densitometer check plaque must be handled with great care to insure the accuracy of the densitometer.

15. T F Customer work may be processed if the D-min values are outside the control limits.

Answers:
True: 2,5,8,10,12,14 False: 1,3,4,6,7,9,11,13,15

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