BESELER

PM2L

color analyzer/instruction manual

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3. Adjust the White Program Control until the meter needle is superimposed directly over the "1" position on the PRINTING TIME scale.

4. Locate a highlight area on the projected image of the negative. This will be the darkest part of the negative where detail is still evident (do not use extremely dark areas, such as might be caused by reflections from a shiny surface or light source). Position the Probe Box under the projected image of the highlight you have located. If reading off-axis, be sure the orientation arrows are pointing toward the lens axis.

5. Read the contrast ratio off the PRINTING TIME scale. Example: A reading of "4" indicates a contrast ratio of 1:4. Similarly, readings of "8", "15", and "20" represent contrast ratios of 1:8, 1:15, and 1:20 respectively.

6. Consult the CONTRAST RATIO TABLE to determine the correct paper grade or variable contrast filter to use for this particular negative.

7. If you are printing with variable contrast paper, insert the appropriate filter into the enlarger at this time.

CONTRAST RATIO TABLE

RATIO	PAPER GRADE/FILTER
Less than 1:4	#5
1:4 - 1:6	#4
1:6 - 1:9	#3
1:9 - 1:25	#2
1:15 - 1:15	#1
Greater than 1:25	#0

NOTE: The above calibrations are based on recommendations outlined in ANSI PH2.2-1966, Appendix D. The numbers assigned to different paper grades by the paper manufacturer do not always coincide with these values, and it is therefore not uncommon for, say, a grade 3 of one manufacturer to be equivalent to a grade 2 or a grade 4 of another manufacturer. Often, the manufacturer will supply data in regard to the density range which its various grades of paper will accept. Such data, generally referred to as "Scale Index", should be used where it is available.

Having determined the correct paper grade to use, you can now enter the exposure program for that paper into the analyzer and proceed to analyze for exposure time. When using variable contrast papers, a separate exposure program for each contrast filter will produce optimum results. If it is known that two papers, or two contrast filters on a variable contrast paper, have the same printing speed, then the same program may be used for both.

Be sure to place the required variable contrast filters in the enlager before analyzing for exposure.

ANALYZING FOR EXPOSURE PROCEDURE

1. Adjust the White Program Control to the reference number (on the Program Scale) which was determined in PROGRAMMING FOR EXPOSURE PROCEDURE.

2. With the Channel Selector on White, properly position the Probe Box under the projected image of a shadow area.

3. The analyzer will now indicate (on PRINTING TIME scale) the correct exposure time to use for your *unknown negative.* Alternately, the aperture may be adjusted to bring the needle to a longer or shorter exposure time if this is desired.

MAINTENANCE

Your PM2L anlayzer does not require any specific maintenance. In order to assure the accuracy of the instrument, do not permit dirt to accumulate in the Reading Aperture of the Probe Box. This can best be avoided by keeping the analyzer and probe box covered with the plastic dust cover (probe box should be placed adjacent to front of analyzer case so cover fits over both). Where possible, avoid storing or using the instrument in locations having extremely high humidity.

LIMITED
ONE YEAR WARRANTY

Beseler Photo Marketing Company, Inc., Florham Park, New Jersey warrants its products (with the exception of lamps), to the original purchaser only, to be free from defects in materials and workmanship for a period of one (1) year from the date of purchase.

This Warranty does not apply to our products which show evidence of accidental damage, misuse or abuse by you. The Warranty also does not apply to our products which are defective or damaged by tampering or attempted repair by an unauthorized Beseler agent.

Beseler exclusively limts this Warranty to repair or replace (at Beseler's option) the defective part of its product. If you decide to send our product to our authorized repair outlet, you must insure the product and prepay all transportation expenses. Beseler will not be liable for damages caused in the course of shipping the product to you. You must allow at least six (6) weeks for correction of the defect.

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NO LIABILITY IS ASSUMED FOR EXPENSES OR DAMAGES RESULTING FROM INTERRUPTION IN OPERATION OF EQUIPMENT, DAMAGE TO FILM OR PAPER, OR FOR INCIDENTAL, DIRECT OR CONSEQUENTIAL DAMAGES OF ANY NATURE.

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IMPORTANT:

THIS WARRANTY SHALL NOT BE VALID AND BESELER SHALL NOT BE BOUND BY THIS WARRANTY IF OUR PRODUCT IS NOT OPERATED IN ACCORDANCE WITH BESELER'S WRITTEN INSTRUCTIONS.

You must prove the date of purchase by producing a sales receipt indicating that you are the original purchaser.

The "Safeguards" statement reproduced below is in accordance with Underwriters Laboratories "Standard for Safety, UL 122, Photographic Equipment."

IMPORTANT SAFEGUARDS ©

When using your photographic equipment, basic safety precautions should always be followed, including the following:

1. Read and understand all instructions.
2. Close supervision is necessary when any appliance is used by or near children. Do not leave appliance unattended while in use.
3. Care must be taken as burns can occur from touching hot parts.
4. Do not operate appliance with a damaged cord or if the appliance has been dropped or damaged—until it has been examined by a qualified serviceman.
5. Do not let cord hang over edge of table or counter or touch hot surfaces.
6. If an extension cord is necessary, a cord with a suitable current rating should be used. Cords rated for less amperage than the appliance may overheat. Care should be taken to arrange the cord so that it will not be tripped over or pulled.
7. Always unplug appliance from electrical outlet when not in use. Never yank cord to pull plug from outlet. Grasp plug and pull to disconnect.
8. Let appliance cool completely before putting away. Loop cord loosely around appliance when storing.
9. To protect against electrical shock hazards, do not immerse this appliance in water or other liquids.
10. To avoid electric shock hazard, do not disassemble this appliance, but take it to a qualified serviceman when some service or repair work is required. Incorrect reassembly can cause electric shock hazard when the appliance is used subsequently.

SAVE THESE INSTRUCTIONS

INTRODUCTION

The Beseler PM2L Color Analyzer is one of the simplest and most reliable analyzers available. A calibrated, re-settable memory bank is provided for storing color balance and exposure programs from different kinds of negatives or transparencies. Once programmed, this advanced color comparator will allow you to quickly determine the color filtration and exposure needed for producing beautiful color prints. Determining the paper grade and exposure needed for black and white printmaking can also be accomplished with this analyzer.

Solid state circuitry in conjunction with a photo-multiplier detector are incorporated into the PM2L for the utmost in sensitivity and dependability. The analyzer is internally stabilized, so any errors due to fluctuations in line voltage are eliminated. Additionally, the electrical design of the instrument provides protection against temporary "blinding" or damage to the photo-multiplier from exposure to room lighting.

Although the PM2L is easy to operate and maintenance-free, please carefully read the contents of this manual in order to obtain optimum satisfaction from the analyzer. This manual will provide you with the necessary information to fully utilize the capabilities of the instrument, and the time taken to read it will be well spent. Since the text will refer frequently to the various parts on the analyzer, it will be helpful to keep the PM2L illustration (inside front cover) folded out while reading. Components familiarization and step-by-step programming and analyzing procedures are outlined in Section I. Additional data elaborating on each procedure, plus detailed information on specific situations, black and white printing and analyzing for paper grade and exposure can be found in Section II.

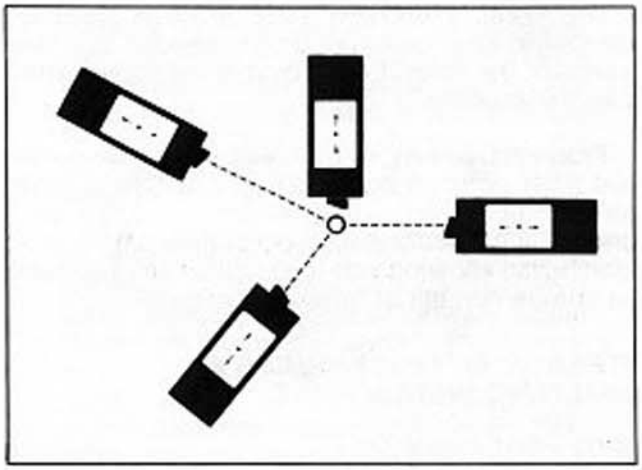
SECTION I

COMPONENTS FAMILIARIZATION

Power Switch — Located on the top of the analyzer cabinet, the power switch controls the electrical power to the instrument's solid state circuitry. When switched on, with the power cord inserted in a proper voltage electrical receptacle, the meter will illuminate.

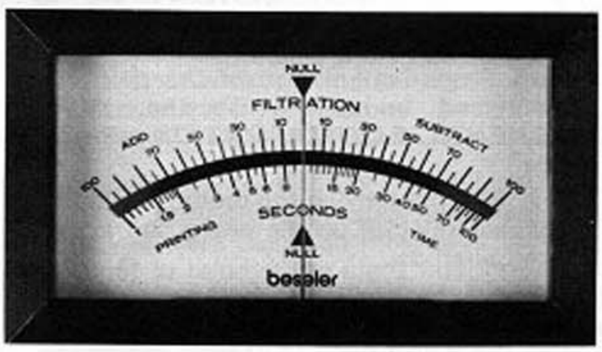
Probe Box — The separate, off-unit probe box embodies the channel selector and photo-multiplier. The channel selector determines which filter is in the optical path of the photo-multiplier, and makes the necessary electrical connections for reading the light level through that filter. The cyan, yellow, magenta and white channels are individually activated only when the selector is set to each particular filter position.

Whenever possible, the reading aperture of the probe should be placed in the center of the projected image directly under the enlarging lens. If the color being programmed (or analyzed) is off center, then place the probe under that color and turn the probe so either of the orientation arrows point toward the lens axis (see illustration). If the



color is on the outlying edge of the projected image or the probe will not sit flat on the easel (easel frame may cause probe box to lie at an angle), temporarily reposition the negative in the carrier so the color projects on the reading aperture when the probe is closer to the lens axis. After programming (or analyzing) return the negative to its original position. Once the probe box is positioned properly, it *must not* be moved during the programming or analyzing procedure, or erroneous readings will result.

Meter — The illuminated meter consists of the FILTRATION scale and the PRINTING TIME (SECONDS) scale. A mirror band is incorporated into the meter face to insure precise alignment of



the needle. When the reflection of the needle in the mirror is directly behind the needle itself, you are looking directly at the meter, and error due to eye parallax is eliminated.

The upper, FILTRATION scale is calibrated in units of color correction (commonly referred to as CC or CP units) which correspond to the values assigned to color printing filters. The range of this scale is plus or minus 100 units on either side of the NULL, or zero, position. Readings to the right of the NULL position indicate the need to subtract filtration, while readings to the left mean that more filtration is required; the exact amount being indicated by the scale.

The lower, PRINTING TIME scale is used to determine what exposure time is needed to make a print of the correct density. It is calibrated from 1 to 100 seconds.

Program Controls — The cyan, yellow, magenta and white program controls act as a storage bank for a particular color balance and exposure program. Each control has a calibrated (1-100) program scale allowing you to establish and recreate an infinite number of different programs.

STEP-BY-STEP PROGRAMMING AND ANALYZING INSTRUCTIONS

SPOT PROGRAMMING

The first step, of course, is to make a print as perfectly exposed and color balanced as you can which contains the image of a gray card, fleshtone, etc. Once this has been done, leave the enlarger *exactly as it is* and switch on the analyzer. As the circuitry of the PM2L provides protection against damage due to exposure to room light, the instrument may be left on for as long as you are working in the darkroom, regardless of how often or for how long the room lights are switched on. Switch off all room lights as well as any safelight you might be using. Position the analyer so the light from the meter face is not falling on the easel or probe box. Then proceed as follows:

SPOT PROGRAMMING PROCEDURE

1. Place the probe box under the projected image of the gray card (or fleshtone, etc.). Proper orientation of the probe is discussed under the Section, *COMPONENTS FAMILIARIZATION—Probe Box.*

2. Without moving the probe, rotate the channel selector on the probe box to the Cyan position.

3. Adjust the Cyan Program Control to center (NULL) the needle on the meter. Use the mirror band to exactly center the needle over the NULL Position.

4. Carefully rotate the Channel Selector to the Yellow position and adjust the Yellow Program Control to exactly NULL the meter needle.

5. Carefully rotate the Channel Selector to the Magenta position and again NULL the meter needle by adjusting the Magenta Program Control.

6. Carefully rotate the Channel Selector to the White position. Now, rather than adjusting for a NULL reading, turn the White Program Control until the needle is superimposed over the exact time (on the PRINTING TIME scale) that was used in making your *reference print*. This time will be your *standard printing time* for all future prints.

After completing the last step, leave the Probe positioned exactly as it is and repeat steps 2 through 6. Make any minor adjustments with the Program Controls in order to obtain exact NULL readings on all three color channels and an exact reading of your *standard printing time* on the White channel. The analyzer is now programmed to remember the exact color balance and exposure which produced the *reference color* in your *reference print*.

Record the exact numerical setting on the Program Control for all four channels. To reenter this program at any time in the future, it is only necessary to reset the controls to these positions. Additional spot programming instructions and hints can be found in Section II.

INTEGRATED PROGRAMMING

As with spot programming, the first step is to make a print as perfectly color balanced and exposed as you can, which is your reference. In the case of integrated programming, the subject matter should be representative of the type of photograph you expect to be printing in the future. You may, in fact, want to create several integrated programs for city scenes, landscapes, candids, etc. In any event, having exposed and processed your reference print, leave everything on the enlarger *exactly as it is* and proceed as follows:

INTEGRATED PROGRAMMING PROCEDURE

1. Position the Light Integrator on the enlarger's accessory filter holder so that it is directly in the optical path and turn on the enlarger. At this point, you will no longer see the image projected on the easel. Instead, the easel will be covered with a uniform illumination which represents the average color of your *reference negative* and the filters that were used to print it.

2. Position the Probe Box directly below the enlarging lens. Without moving the Probe, rotate the Channel Selector on

the Probe Box to the Cyan position.

3. Adjust the Cyan Program Control to center (NULL) the needle on the meter. Use the mirror band to exactly center the needle over the NULL position.

4. Carefully rotate the Channel Selector to the Yellow position and adjust the Yellow Program Control to exactly NULL the meter needle.

5. Carefully rotate the Channel Selector to the Magenta position and again NULL the meter needle by adjusting the Magenta Program Control.

6. Carefully rotate the Channel Selector to the White position. Now, rather than adjusting for a NULL reading, turn the White Program Control until the needle is superimposed over the exact time (on the PRINTING TIME scale) that was used in making your *reference print.* This time will be your *standard printing time* for all future prints.

After completing the last step, leave the Probe positioned exactly as it is and repeat steps 2 through 6. Make any minor adjustments with the Program Controls in order to obtain exact NULL readings on all three color channels and an exact reading of your *standard printing time* on the White channel. The analyzer is now programmed to analyze the "average" color of any negative and to determine the correct filtration and exposure to match the print to your *reference print.*

Record the exact numerical setting on the Program Control for all four channels. You can reenter this program into your analyzer at any time by resetting the Program Controls to the positions you have recorded. See Section II for additional integrated programming hints and instructions.

ANALYZING

With your unknown negative in the enlarger, compose and focus the projected image on the easel to the exact dimensions you desire. Switch off all room lights, including any safelights.

If you are using a *spot program,* position the Probe Box on the easel so that the projected image of the *reference color* falls on the Reading Aperture (refer to COMPONENTS FAMILIARIZATION—Probe Box for proper method of Probe orientation). For *integrated programs,* first place the Light Integrator on the enlarger's accessory filter holder and position it in the optical path of the enlarger. Then, position the Probe directly below the enlarging lens. Proceed as follows:[1]

ANALYZING PROCEDURE

1. Without moving the Probe Box, rotate the Channel Selector on the Probe Box to the Cyan position. Now, adjust the lens aperture to bring the needle to the NULL Point on the meter. This may require that the lens be set in between click stops, which is perfectly normal.

2. Carefully rotate the Channel Selector to the Yellow position. If your *unknown negative* requires more yellow filtration than you have in the enlarger, the needle will deflect to the left (ADD) side of the NULL point on the meter. If you have too much yellow filtration in the enlarger, the needle will deflect to the right (SUBTRACT). The amount of yellow filtration that needs to be added or subtracted will be indicated on the FILTRATION scale of the meter. If your enlarger is equipped with a continuously variable colorhead, adjust the yellow filtration to bring the needle exactly to NULL. If you are using color printing filters, add or subtract the amount of yellow filtration indicated on the FILTRATION scale of the meter.

3. Carefully rotate the Channel Selector to the Magenta position and bring the meter to NULL by adding or subtracting the appropriate amount of magenta filtration.

4. Repeat steps 1 through 3 above until the analyzer continuously reads NULL on all three color channels.

5. Carefully rotate the Channel Selector to the White position. Adjust the lens aperture to superimpose the meter needle over your *standard printing time* (the time used to make the *reference print* for the program you are using) on the PRINTING TIME scale of the meter. Alternately, for any setting of the lens aperture, the correct printing time may be read directly off of the PRINTING TIME scale. It is preferable, however, due to the printing characteristics of color paper, to keep exposure time constant and adjust the lens aperture where possible.

You should now have the correct filtration and exposure to correctly reproduce your *reference color.* (If you were using an integrated program, don't forget to remove the Light Integrator from the optical path before making your exposure.) Additional analyzing instructions and hints can be found in Section II.

Footnote 1: the procedure presented here assumes that you are printing a color negative which will require a yellow and magenta filter pack. If you are working with transparencies or with negatives which require cyan filtration, it will be necessary to modify the analyzing procedure slightly. These conditions, along with other less typical situations, are dealt with in the SPECIAL CASES section.

SECTION II

ADDITIONAL INSTRUCTIONS AND INFORMATION

BASIC OPERATING PRINCIPLES

Radiant energy (light) being emitted by the enlarger is received by a photodetector within the probe. A change in light level causes a corresponding change in voltage supplied by the photodetector to one side of a differential voltmeter. The other side of the voltmeter receives voltage which is determined by the program controls. For any light level within the range of the analyzer, the program controls can be adjusted to center (or NULL) the meter needle. Once this is done for a given light level, the instrument will always be able to indicate when that same light level is reaching the photodetector.

When a program control potentiometer is adjusted to center the needle on the meter scale, we are in effect "telling" the analyzer to remember a given light level. This is referred to as *programming.* Having done this, the instrument can be used to measure light levels at any time in the future, and depending on whether the needle registers to the left or right of NULL, we can tell whether the photodetector is receiving more or less light than that amount for which it was programmed. Furthermore, by adjusting the amount of light being measured (with a lens diaphragm, for example), we can determine when the same light level, for which the instrument was programmed, is reached by observing when the meter needle is at the NULL position. This is referred to as *analyzing.* The analyzer is in fact comparing the amount of light it is receiving to the amount of light it received when it was programmed.

Since color print materials are comprised of three separate emulsion layers, each of which is sensitive to one primary color (red, green or blue), we are concerned with the amount of exposure each layer receives. By introducing filters into the optical path of the analyzer, we are able to measure separately the amount of red, green and blue light reaching the print material. The relative amounts of red, green and blue light reaching the print material is referred to as the *color balance,* and determining this color balance for any negative or transparency we want to print is the primary function of a color analyzer, such as the PM2L.

APPLICATION OF THE PM2L

THE REFERENCE PRINT

Many people are surprised to learn that before they can use their analyzer to make a good print, they must first make one *without* the analyzer.

As we noted earlier, the analyzer is primarily concerned with determining the relative amounts of red, green and blue light required to make a color balanced print. The variables which affect this requirement are rarely appreciated, but they include such diverse factors as the type of film used, when and where it was manufactured, the time of day a picture was taken and what the weather was that day, what kind of enlarger, filters, paper, chemicals and processor you use, and how and where you look at the print after it is finished.

It can be seen then that before the analyzer can tell you how much red, green and blue light you need in a given situation, you must first tell it how much you want, considering the circumstances. In order to do this, you must have a system to make color prints, and you must use it to make one. the type of print that you make will be dictated by the type of print you will want to make in the future and the type of program you will be using. In any event, it must be as perfectly exposed and color balanced as possible. This is your *reference print,* and it is the standard that the analyzer will use for all future prints.

It is also necessary to carefully select the negative used to make this print, as this becomes your *reference negative,* and it must resemble in some aspect the type of negative you will be using in the future. The requirements for reference negatives are discussed in the section on programming. You may find it worthwhile to shoot a negative specifically for reference use with the analyzer before attempting to use the instrument.

PROGRAMMING

There are two distinct types of programs which we refer to as *Spot Programs* and *Integrated Programs.* Each has its own advantages and disadvantages, and each is best adapted to a particular type of subject matter. Selecting the appropriate program for a particular negative is the first step in using the analyzer. Your PM2L has the capability of handling as many programs as you wish and, therefore, provides you with a great deal of flexibility in your color printing.

Spot Programming

We can use the analyzer's ability to remember color by spot reading a part of the projected image of our *reference negative* which contains a color we will want to reproduce in the future. The most common examples would be flesh color or an 18% gray. Gray cards of approximately 18% reflectance are frequently used in studio photography as a reference, since it is always known exactly what color should show up in the final print. The fact that it is possible to directly compare the original gray card with the one in the print makes for an extremely critical method of determining accurate color rendition. It is, in fact, quite difficult at times for a color printer to determine how a print should look, particularly where there are no visual references such as people, trees, sky, etc. By printing to match the gray card, one is assured that all other colors are correctly reproduced as well.[2]

Since we seldom want the gray card in the final photograph, it is usually placed in a part of the picture where it can be cropped out later. A separate photograph may be taken of the gray card itself. Providing that the same lighting and film is used to photograph the gray card as is used to photograph the subject, we can use the gray card as an analytical device to determine the correct filtration to use when printing the actual subject. This application particularly lends itself to the use of a color analyzer, and it is for this reason that we will discuss spot programming as it relates to the use of a gray card. However, in practice, any color which reoccurs from one photograph to the next may be used for setting up a spot program. See Section I for step-by-step Spot Programming instructions.

This same technique can be used whenever you are entering a spot program into the analyzer regardless of what color you are using as a reference. However, it is important to realize when using flesh tone programs that there are many different colors on the average person's skin, and that skin color can vary dramatically from one person to the next. It is, therefore, better practice to have several flesh tone programs, corresponding to the types of complexions you expect to photograph. The same limitations apply to programs of sky, foliage or wood colors. The value of a gray card, considering these variables, becomes readily apparent. It is not useful to program for blacks and whites, as these tones in a color photograph do not generally convey any color information, and it is quite possible to have a terribly color balanced print with excellent blacks and whites.

Integrated Programming

Quite often photographs do not contain a color which can be singled out to use as a reference, or it is simply not convenient to do so. In these cases, we can use an alternate technique, which we call the integrated program.

Integrated programs make the basic assumption that if we were able to blend all the colors in a photograph into one uniform color (the way we mix paints), then that color would be the same for every photograph we might make. This eliminates the need for a specific reference color in the photograph, since we are working only with the "average" color of each photograph. In practice, we average or integrate the colors of the subject by projecting the negative through a diffuser or Light Integrator (supplied with the PM2L).

It is intuitively obvious that not all photographs will integrate to the same color. An extreme closeup of a vivid purple flower will not have the same average color as, say, a portrait.[3]

See Section I for step-by-step integrated programming instructions.

ANALYZING

In the preceding section, we have discussed the methods which are used in programming the analyzer. In each case we have experimentally arrived at a filtration and exposure which produced an acceptable color print, and then selected some aspect of that print to use as a reference in making future print. What we have done in programming that reference into the analyzer is to enter into the analyzer's memory a record of the relative amounts of red, green and blue light which reproduced that reference (a gray card, for example) correctly on the print. In analyzing, the instrument compares the projected image of your new negative, which we refer to as the *unknown negative,* to the memory it has of the projected image of the *reference negative.* It then determines when they are matched with respect to the relative amounts of red, green and blue they contain. All other things being equal, such as the processsing and paper emulsion, the *reference color* will be correctly reproduced on the print made from your *unknown negative.* Step-by-step analyzing instructions can be found in Section I.

Analyzing when Using Color Printing Filters

You may find that making the filtration adjustment indicated by the meter when using color printing filters does not bring the needle exactly to NULL. This does not indicate an error on the part of the analyzer, but merely reflects a discrepancy between the nominal value of the

Footnote 2: that is, assuming the color reproduction system is capable of rendering the entire visual color gamut correctly on a print. This is seldom, if ever, the case, and we often have to content ourselves with color photographs in which some colors may not be accurately rendered. This is a problem well outside the scope of this manual, and we shall not concern ourselves with it other than to mention it here. For the same reason, we will not explore the possibilities of deliberate color distortion, although many of these techniques produce aesthetically pleasing and sometimes useful results.

Footnote 3: In this particular case, if the analyzer were programmed on the photograph of the purple flower, and that program was used to analyze the portrait, the analyzer would try to make the portrait purple to match the color in its memory. This is perfectly normal and correct for an analyzer to do. Referred to as "subject failure", the blame is placed appropriately on the subject because its average or integrated color fails to match that in the analyzer's program. Understanding this principle provides a valuable insight into the correct use of an analyzer in *any* situation, and it cannot be over-emphasized.

filter's and the analyzer's response. If this should occur, add or subtract enough filtration to exactly NULL the meter. There are many reasons why your analyzer meter will not always agree with the values assigned to color printing filters (or for that matter, to the calibrations on a colorhead), yet if you exactly NULL the meter on all channels, you can be certain that you have exactly recreated the color which the analyzer had stored in its memory. In short, where there is a discrepancy between values assigned to a filter or colorhead, always do what the analyzer indicates.

You'll probably find it more convenient to simply stack your CP filters directly on top of the probe aperture while analyzing your UNKNOWN negatives.

Once you have established your filter pack, simply transfer the entire stack of CP filters into your filter drawer all at once, rather than going to the filter drawer again and again, one filter at a time while attempting to NULL the meter. The net effect is the same either way, and "stacking" the filters over the probe is faster and more convenient. You may leave the heat absorbing glass and the UV filter in your enlarger while stacking the CP filters on your probe.

SPECIAL CASES

In most cases the procedure outlined above will be sufficient to analyze any color negative. However, extreme variations in magnifications or photographing conditions may require one of the following special procedures.

Meter Cannot Be Nulled on Cyan with Lens Aperture

Most enlarging lenses have a range of about five stops. This is sufficient, in nearly all cases, to compensate for changes in exposure resulting from negatives of varying density or changes in the enlarging magnification. However, when extreme changes in negative density or magnification occur, you may find that adjusting the aperture will not NULL the meter when on the Cyan channel.

Should this occur, adjust the aperture to bring the needle as close to NULL as possible. Then, when analyzing on the Yellow and Magenta channels, bring the needle to that same position. In other words, you are selecting an alternate NULL Point on the meter face.

Actually, any point on the meter may be used for analyzing providing that the needle is brought to the *same point on Cyan, Yellow and Magenta.* For example, you might find that when using the aperture to NULL on Cyan you can only bring the needle to the "SUBTRACT 30" point on the FILTRATION scale. "SUBTRACT 30" then becomes the point to which you want to bring the needle (by means of adding or subtracting filtration) on the Yellow and Magenta channels. Note, however, that this does not at all influence the reading on the White channel. Analyzing for exposure time must be done in the normal manner.

Meter Cannot Be Nulled on Yellow or Magenta

Occasionally, you may find that the meter indicates that you should subtract yellow or magenta filtration even though you have removed all of that respective filtration on the filter pack. This suggests that your negative will probably require cyan filtration.

If this occurs, readjust the aperture to NULL the meter on the channel (Yellow or Magenta) which will not NULL with filtration. Then, go back to the Cyan channel and add cyan filtration to bring the needle to NULL. Continue with the analyzing procedure on the third color channel. Repeat the steps so that all three color channels continuously NULL the meter before switching to the White channel which is, again, used in the normal manner to determine the exposure time.

Cyan/Yellow or Cyan/Magenta Filter Packs (Printing Color Transparencies)

Typically, when making your *reference print* from a color transparency or negative shot under unusual lighting conditions[4], the final filter pack will contain cyan filtration. It will be combined with yellow or magenta, but never both of these colors. After programming the analyzer with such a filter pack, you should assume that any similar transparencies or off-color negative will also print with either cyan/yellow or cyan/magenta filtration. Therefore, when analyzing such negatives or transparencies, set the channel selector on the color which was absent from the original filter pack used in programming (Yellow or Magenta). Then adjust the lens aperture to NULL the meter while on that channel.

The appropriate color filtration is then used to NULL the meter on the other two color channels. As usual, the White channel is used in the normal manner to determine the exposure time.

CHANGING COLOR PAPER EMULSIONS

The manufacturers of color printing materials make every reasonable effort to produce each batch, or emulsion number, with the same printing characteristics, but variations inevitably find their

Footnote 4: An example of a negative shot under unusual lighting conditions might be where tungsten balanced color film was exposed under daylight or fluorescent lighting without a correction filter. These negatives would subsequently be off-color and might require a cyan/yellow or cyan/magenta filter pack in order to obtain a print with correct color rendition.

way into the process. The result is that different emulsions will require different filtrations when color printing, even if everything else is held constant.

A color program is only accurate when prints are made with the same printing material (same emulsion number) as used in producing your reference print. Using a program for analyzing a negative to be printed on a color emulsion with different printing characteristics than those used to make the reference print will impair the accuracy of the program and thereby yield an unsatisfactory print. To avoid this problem, a new program must be developed for use with the different color emulsion printing materials. The most obvious and precise way of determining the changes for the new program is to make a new *reference print* from your *reference negative* and then enter a program for the filtration and exposure used.

Additionally, the paper manufacturer's printing data which usually appear on the outside of the package may be used to adjust the program when changing emulsions. However, it is important to realize that the exact printing characteristics of a given emulsion depend to a great extent on how the paper was stored after it left the factory, and the manufacturer's data should be considered as an approximation only. This data is generally presented in the form of plus or minus filtration for cyan, yellow or magenta and an exposure factor. To apply these numbers to an analyzer program, follow the procedure below. It is necessary to have the printing data from your original emulsion, as well as the data for the new emulsion.

CHANGING COLOR PAPER EMULSIONS

1. For each color, find the filtration adjustment on the original package of paper and on the new package of paper. Subtract the value of the original emulsion from the value of the new emulsion for each color. This is your *program adjustment factor.*

2. Divide the new emulsion exposure factor by the original emulsion exposure factor. Multiply this value by your standard printing time. The result is your NEW *standard printing time.*

3. Set up as if you were going to analyze a negative, with the appropriate program set into the analyzer and the Probe Box positioned in the appropriate manner under the projected image on the easel.

4. Analyze the negative. That is, bring the needle to NULL on the three color channels, and to the *standard printing time* on White.

5. For each color where a change is indicated, turn the Channel Selector to that color. Using the analyzer Program Controls, adjust the needle so that it deflects to that reading on the FILTRATION scale of the meter which corresponds to your *program adjustment factor* for that color. A positive *program adjustment factor* indicates that the needle should be deflected to the ADD (left hand) side of the meter, while for a negative factor the needle should be adjusted to the SUBTRACT (right hand) side.

6. Turn the Channel Selector to the White position, and using the White Program Control on the analyzer, superimpose the needle over your NEW *standard printing time.*

The analyzer may now be used in the normal manner. Bringing the needle to the NULL point on the color channels will automatically introduce the appropriate correction for the new emulsion printing characteristics. The exposure factor of the new emulsion is compensated for since you have now changed your *standard printing time.*

Example: Your original emulsion printing data was −10 M, +05 Y with an exposure factor of 75.The standard printing time for your reference print was 15 seconds. The new emulsion printing data is + 10 M, + 15 Y with an exposure factor of 100.

New emulsion filtration adjustment:	+10M	+15Y
Original emulsion filtration adjustment:	(−) −10M	(−) +05Y
Program adjustment factor:	+20M	+10Y

To determine the NEW *standard printing time:*

$$\text{Original Standard Printing Time} \times \frac{\text{New Exposure Factor}}{\text{Old Exposure Factor}} = \textit{NEW Standard Printing Time}$$

which, for our example, is:

$$15 \times \frac{100}{75} = 20 \text{ seconds.}$$

Now, set up the enlarger and analyzer as described in steps 3 and 4 above. On the Magenta channel, use the Magenta Program Control to move the needle to ADD 20, and on the Yellow channel use the Yellow Program Control to superimpose the needle over ADD 10 on the FILTRATION scale. On the White channel, use the White Program Control to superimpose the needle over 20 seconds on the PRINTING TIME scale. Your program is now adjusted to the new emulsion.

BLACK & WHITE PRINTING

When printing with black and white emulsions, the PM2L may be used to determine exposure time and paper grade. When using the analyzer to determine exposure, a simple programming step is required for each type of paper that is used. This is similar to the method for determining exposure for color papers, with the exception that in black and white printing a shadow area is generally used to determine exposure.

A shadow area is defined as that part of a negative which is *just beginning* to show detail which you are interested in reproducing on the print. Note that this is not necessarily the lightest part of the negative, but will frequently be a dark piece of clothing, hair, furniture or simply inside a shadow cast by the primary source of illumination. Some judgment is required here which is for the most part a matter of experience and personal preference.

As a general rule, and in the absence of any other considerations, a useful shadow area may be regarded as that part of the negative which has a density of 0.10 above the base + fog density (gross density of film base and unexposed emulsion). This can be measured in any *unexposed* area, such as between the film frames or on an unexposed end of the film.

It is not necessary to program the PM2L for determining paper grade. After measuring for the contrast ratio of the negative, you can simply find the appropriate paper grade in the CONTRAST RATIO TABLE. Paper grades are numbers which are assigned to emulsions of different contrasts. Low paper grade numbers indicate an emulsion which is said to be "Low Contrast" or "soft." This means that a given change in exposure produces a relatively small change in print density. Low contrast papers are, therefore, suited to the reproduction of negatives with a *large density range,* since this translates into large illuminance (or exposure) differences across the projected image on the easel. It can be seen that a paper which will accept a wide range of exposure and still produce a density (or tonal) difference on the print for every density difference on the negative is required for a high-contrast negative. Furthermore, we would like our shadows to be represented on the print by very nearly the darkest black that the paper can produce, and our highlights to be represented by very nearly the lightest white of which the paper is capable.

In the case of negatives having a *small density range,* we require a paper which produces relatively large changes in print density for small changes in exposure. We can then produce a print with a full range of tones from black to white, even though the density range of our negatives is small. Papers of this type are given high paper grade numbers, and are referred to as "High Contrast" or "hard" papers.

It can be seen that the principle is to match the negative contrast to the paper contrast — high contrast negatives requiring low contrast paper and low contrast negatives requiring high contrast papers. The procedure outlined below will enable you to use the PM2L for this purpose.

Exposure Programming

For each type of paper you will be using, it will be necessary to program the appropriate exposure information into the analyzer. In order to do this, it will first be necessary to make a perfectly exposed *reference print* on that paper. The *reference print* should have an easily identifiable shadow area which is reproduced as dark as possible while still holding some detail. Having made the *reference print,* do not make any changes to the enlarger elevation or lens aperture. Switch off all safelights, turn the enlarger on and proceed as follows:

PROGRAMMING FOR EXPOSURE PROCEDURE

1. Rotate the Channel Selector to White and position the Probe Box under that portion of the projected image which corresponds to a shadow in the print. As previously described, this is the lightest part of the negative in which some detail is present. Proper orientation of the Probe is discussed under the section, COMPONENT FAMILIARIZATION — Probe Box.

2. Adjust the White Program Control until the meter needle is superimposed directly over the expossure time (on PRINTING TIME scale) used to make your *reference print.* Write down the exact numerical setting on the White Program Control. Your analyzer is now programmed to determine exposure whenever you use the same paper as was used to produce the *reference print.* You will probably want to repeat this procedure for every paper you intend to use.

ANALYZING FOR PAPER GRADE PROCEDURE

1. Once the enlarger is set up for printing your *unknown negative,* turn off all room lights (including safelights) and turn on the enlarger.

2. With the Channel Selector on White, position the Probe Box under the projected image of a shadow area; that is, the lightest part of the negative in which there is detail. Proper orientation of the Probe is discussed under the section, COMPONENT FAMILIARIZATION — Probe Box.

3. Adjust the White Program Control until the meter needle is superimposed directly over the "1" position on the PRINTING TIME scale.

4. Locate a highlight area on the projected image of the negative. This will be the darkest part of the negative where detail is still evident (do not use extremely dark areas, such as might be caused by reflections from a shiny surface or light source). Position the Probe Box under the projected image of the highlight you have located. If reading off-axis, be sure the orientation arrows are pointing toward the lens axis.

5. Read the contrast ratio off the PRINTING TIME scale. Example: A reading of "4" indicates a contrast ratio of 1:4. Similarly, readings of "8", "15", and "20" represent contrast ratios of 1:8, 1:15, and 1:20 respectively.

6. Consult the CONTRAST RATIO TABLE to determine the correct paper grade or variable contrast filter to use for this particular negative.

7. If you are printing with variable contrast paper, insert the appropriate filter into the enlarger at this time.

CONTRAST RATIO TABLE

RATIO	PAPER GRADE/FILTER
Less than 1:4	#5
1:4 - 1:6	#4
1:6 - 1:9	#3
1:9 - 1:25	#2
1:15 - 1:15	#1
Greater than 1:25	#0

NOTE: The above calibrations are based on recommendations outlined in ANSI PH2.2-1966, Appendix D. The numbers assigned to different paper grades by the paper manufacturer do not always coincide with these values, and it is therefore not uncommon for, say, a grade 3 of one manufacturer to be equivalent to a grade 2 or a grade 4 of another manufacturer. Often, the manufacturer will supply data in regard to the density range which its various grades of paper will accept. Such data, generally referred to as "Scale Index", should be used where it is available.

Having determined the correct paper grade to use, you can now enter the exposure program for that paper into the analyzer and proceed to analyze for exposure time. When using variable contrast papers, a separate exposure program for each contrast filter will produce optimum results. If it is known that two papers, or two contrast filters on a variable contrast paper, have the same printing speed, then the same program may be used for both.

Be sure to place the required variable contrast filters in the enlager before analyzing for exposure.

ANALYZING FOR EXPOSURE PROCEDURE

1. Adjust the White Program Control to the reference number (on the Program Scale) which was determined in PROGRAMMING FOR EXPOSURE PROCEDURE.

2. With the Channel Selector on White, properly position the Probe Box under the projected image of a shadow area.

3. The analyzer will now indicate (on PRINTING TIME scale) the correct exposure time to use for your *unknown negative.* Alternately, the aperture may be adjusted to bring the needle to a longer or shorter exposure time if this is desired.

MAINTENANCE

Your PM2L anlayzer does not require any specific maintenance. In order to assure the accuracy of the instrument, do not permit dirt to accumulate in the Reading Aperture of the Probe Box. This can best be avoided by keeping the analyzer and probe box covered with the plastic dust cover (probe box should be placed adjacent to front of analyzer case so cover fits over both). Where possible, avoid storing or using the instrument in locations having extremely high humidity.