FASTER PRESS MAKEREADY AND PRINT QUALITY CONTROL BY NEW COMPUTERIZED SCANNING DENSITOMETER TYPE APS 400

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Abstract: This presentation deals with the benefits of automatic density measurement across the whole sheet width and introduces the new automatic scanning densitometer type APS 400. It shows how, with spectral density measurement, the cooperation between proofing printers and production printers can be made more effective and how makeready times can be reduced considerably. The paper gives information on the elements of the APS 400 scanning densitometer, it's operation and shows an example of the video display output in graphical form and some printing measurement reports. It describes how to control printing quality of presses with remote ink key control as well as of conventional presses by means of APS 400.

General Description of the APS 400

The APS 400 is a reflection densitometer which automatically scans across a color control bar printed either at the sheet front edge or tail end. While scanning across the color bar, it takes measurement of the ink density for solid and screen areas. The quality characteristics are calculated frome these data.

The most important characteristics of the APS 400 are already included in the product name:

The letter "A" stands for "automatic ink density measurement" which means that the APS 400 scans across the color bar and takes the measurements automatically.

The letter "P" stands for "polarized ink density measurement". All grapho metronic densitometers are equipped with polarization filters. Polarization filters suppress the gloss so that there are practically no differences between the density values of wet and dry

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sheets. Another benefit can be seen in the fact that polarized densitometers generally read higher density values than conventional densitometers do.

The "S" finally stands for spectral ink density measurement and indicates the high technology standard of the APS 400.

What Acutally Means "Spectral Ink Density"?

Since densitometers have been manufactured, the printing industry demands an inter-instrumental agreement, that is, that all densitometers measure the same density value on the same color patch within narrow tolerances.

Conventional densitometers are equipped with wide-band filters. These wide-band filters are the main reason for different readings among different densitometers: First, the remission curve of these filters is not defined exactly enough. Furthermore the spectral sensitivity changes with ageing of the filters. Also, when using wide-band filters, the optical elements, that is the receiver cell, the light source and the densitometer optics cause a different spectral overall sensitivity.

This results in considerable difficulties for proofing printers and production printers when communicating about the desired coloring of the print. Measuring data cannot be transferred. The printing plants must help themselves by providing samples from which the proofing printer can determine the set point densities for the proofing sheet.

The solution to this problem is called "spectral ink density measurement". In the past, however, the technical standard was not high enough to permit the production of densitometers which employ spectral ink density measurement *and* polarization filters. These densitometers would have been much too expensive. An inter-instrument agreement is achieved within narrow tolerances by using narrow-band spectral interference filters instead of the conventional wide-band filters. Figure 1 shows the difference between conventional wide-band filters (shaded in light grey) and narrow-band filters (shaded in dark grey). You will note that the narrow-band filters are exactly adapted to the absorption maxima of the printing inks yellow, magenta and cyan. The half band width of the narrow band filters is 20 nm.

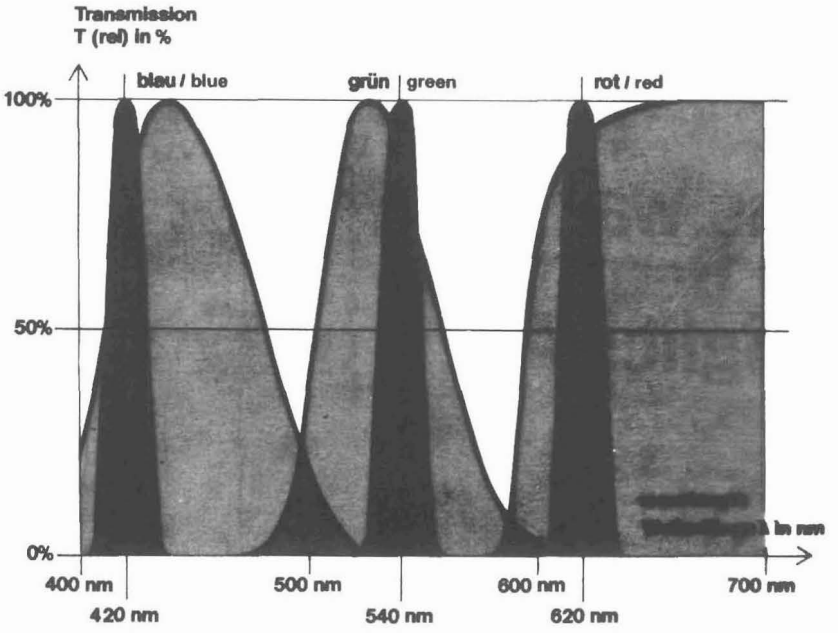

Figure 1. Spectral curves of wide-band and narrow-band filters

The use of narrow-band filters only, however, does not solve the problem. A very important factor is the blocking of the side bands. Side bands are the wavelength ranges towards UV and IR. The blocking of these side bands leads to "true density" as only those measuring signals are received that come from the filter transmission range. grapho metronic has put much importance to the blocking of the side bands. If these points are carefully met, the variations within the optical elements can be neglected.

Aps 400 for Proofing

Many proofing printers have now recognized the importance of supplying their customers with a proofing sheet in production quality. The term "production quality" applies to proofing sheets which comply with the following conditions:

- defined ink density in solid tone corresponding to the customer's requirements. This defined density should be

even across the whole sheet width;
- defined dot gain in production quality as agreed with the customer. Also this defined dot gain should be even over the whole sheet width;
- defined and even ink trapping across the whole sheet width;
- use of production paper and ink with the same pigments as the production ink but with reduced tack.

To achieve this, it is necessary to measure the ink density of solid and screen patches over the whole sheet width. Although this can be done with hand-operated densitometers, it is not recommendable for economical reasons. The proofing printer should spend most of his time printing sheets and not measuring them.

Therefore modern proofing printers employ high technology automatic ink density measuring systems as, for example the APS 400 and even ink control systems as, for example the M.A.N.-ROLAND CCI-system. These systems provide complete information on all quality characteristics over the whole sheet width in a matter of seconds.

APS 400 for Production Printing

Printing plants which deal with one of these proofing printers have reason to be satisfied: The proofing sheets they receive are of production quality. If the printing plant also uses a modern ink density measuring system, a comparison of the set values with the actual values may be made starting with the first makeready sheet, on the basis of the set point densities supplied by the proofing printer.

The direct advantage for the printer is a significant reduction in makeready times, resulting in more production time and less waste.

If proofing printers and printing plants both use a grapho metronic densitometer of the new generation, such as the APS 400 or the M.A.N.-ROLAND CCI-system, the proofing printer can even telephone the set point densities through to the printing plant since all densitometers of this generation supply the same measuring values from the same color sample within narrow tolerances.

System Components

The APS 400 components are:
- a measuring table
- the computer system with video terminal
- the high-speed matrix printer.

Figure 2. APS 400 automatic scanning densitometer

The measuring table includes the measuring head and the measuring rail as well as the electronics system. The measuring head has been designed as scanning densitometer and automatically measures all color patches of a color control strip. The measuring head and the corresponding software are identical to that of the M.A.N.-ROLAND CCI-system as grapho metronic also manufactures the densitometric part of the CCI-system.

For data processing and data output an intelligent terminal with video screen, keyboard, dual disk drive and a high-speed matrix printer have been connected to this highly sophisticated densitometer, all of these instruments being included in a movable operator's console.

Important Characteristics of APS 400

The APS 400 can simultaneously monitor the quality of printed sheets of up to six different offset presses. By employing APS 400, all the offset presses of a printing plant which are not yet equipped with automatic color control systems, can now be upgraded to the newest technical standards. It should be mentioned, however,that APS 400 is not suitable to automate inking of a press equipped with the M.A.N.-ROLAND RCI-system. By using APS 400 the printer will control his press manually based on objective measuring data and not on sensual perception as he did before. By this, a significantly better quality may be achieved.

APS 400 is the only system on the market that can measure all commerially available color control strips. for example the Heidelberg CPC-strip and the M.A.N.-ROLAND CCI-strip. The only condition is a dimension of each color patch of 6 mm in printing direction and of 4 mm across it. This makes it possible to measure as many as 250 patches per meter of control strip. Presently no other system - apart from CCI-system, of course - can measure the CCI-strip as this strip is composed of patches with a width of 4 mm across the printing direction.

APS 400 is easier to handle than all other automatic densitometers on the market that we know of. No extra personnel are required to operate the APS 400. Any printer or assistant on the presses can measure the sheet from the press himself in the printing room using APS 400. The APS 400 specifies all the necessary operating steps on the display screen, one after the other. The only data which are needed to be input, mainly consist of a number or a letter. The operator can see at a glance from the display on the screen whether the printing quality meets his requirements. If corrections are needed he takes the easy to read measurement printout to the press and adjusts the ink zones manually.

APS 400 provides measurement and a printout of solid tone and screen tone values within 25 seconds from positioning of the sheet to be measured. This figure is related to a color control strip of 1 m length containing 250 individual control patches. This makes the APS 400 the fastest density measuring system on the market that we know of.

Positioning of the sheets to be measured is facilitated

by means of suction and due to the fact that the system automatically recognizes the first measuring field.

Paper stretch and shrinkage is taken care of via the software.

The measured data are processed by the intelligent video terminal and are displayed in graphical form on the screen or on a graphical printout. The density values are related to the ink zones of each press. The density values may either be displayed as absolute figures or as deviations from pre-set values.

Figure 3 shows schematically how data transfer is performed within the system.

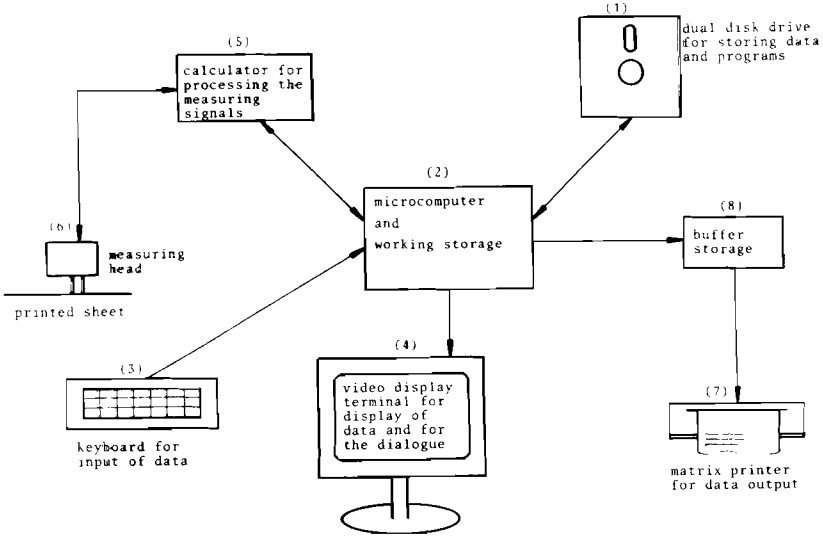

Figure 3. Organization of the data transfer within the system

The program is loaded via disk (1) into the central computer unit (2). The program sequence is performed between operator and computer by dialogue; the inputs are made via keyboard (3) and the reports of the computer are communicated to the operator via video terminal (4). The computer forwards the operator's commands to the calculator (5), which controls the measuring head (6). The measured density

values are processed in the central computer and converted to graphical video displays or graphical printouts. As the matrix printer (7) employs a separate storage (8), the measuring run and the printed reports may be performed simultaneously, this results in an extremely fast measuring cycle.

APS 400 employs a dual disk drive and disks with an extremely high storing capacity. By this, sheets from different printing presses with different types of color control strips may be measured one after the other without the need to change a disk. There is no waiting time for the loading of the individual programs. The desired data are immediately accessible. Owing to the high storing capacity of the disks the printer need not change the disk when measuring a sheet from another job. This fact is especially important as often the printer's hands are ink-stained which could damage the disks.

The APS meets the harsh requirements of industrial environment by employing a dustproof disk drive housing with air conditioning.

Steps of Operation When Measuring a Production Run

It has been mentioned already that with the APS 400 it is possible to monitor up to six different presses simultaneously. When defining the jobs to be measured, each press is given a special number and a special code for the used color control strip. From now on the different presses are assigned by simply depressing one special key within the keyboard and the sheet may be measured immediately as no waiting time is required for the loading of the new program.

It has been mentioned already that the dialogue between the system and the operator is very easy to understand. Only simple numbers or letters are to be input.

The printed sheet is placed in position and fixed by suction. This method of fixing the sheet to the measuring rail is perfectly suited to ensure that the sheet lies perfectly plane on the measuring rail.

While the measuring head is scanning across the sheet, the printer may call a video density graph as figure 4 shows.

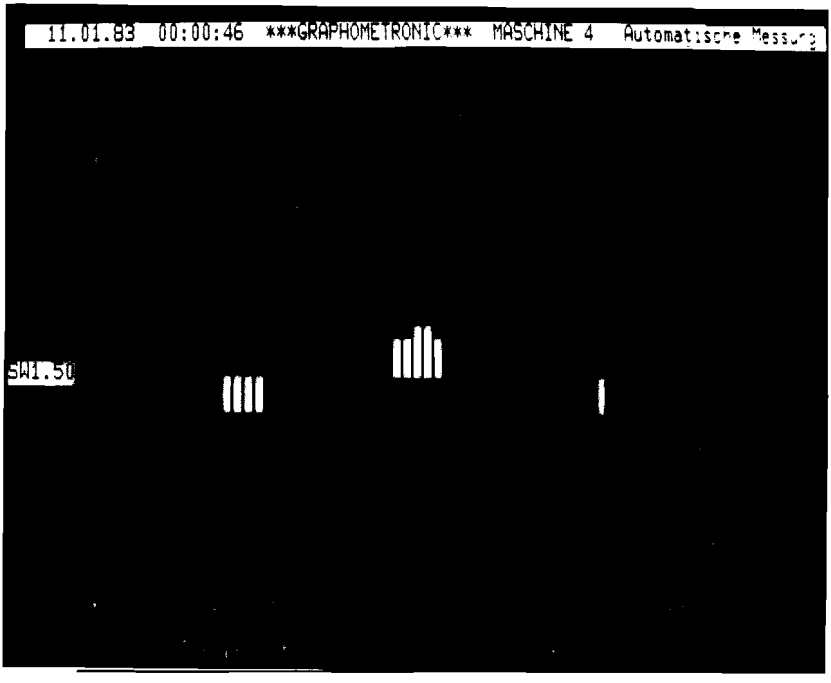

Figure 4. Example of a density profile for Magenta

The video graph shows to the printer whether he is within the preset solid density, dot gain and ink trapping or whether he has to adjust the ink. The figure shows a density profile of magenta for solid patches over the whole width of the sheet. Each segment of the density profile represents the deviation in each ink zone with an accuracy of .01 or - if required - of .02 density units. The printer can see at a glance whether any tolerance limits have been exceeded and if so (in this case the corresponding section is colored in light-green or is flickering), he may call a graphical printout as the next figure shows.

The printer takes the printout, walks to his press and adjusts the ink zone keys as required until the density values are within the tolerance limits.

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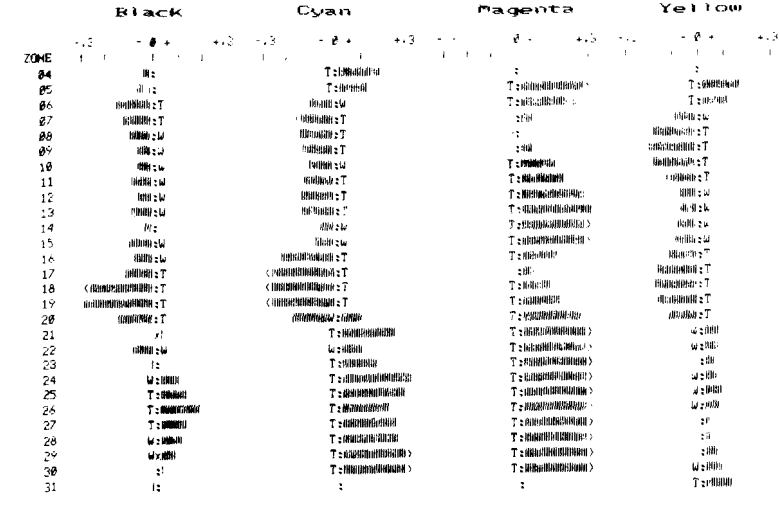
GRAPHIC REPORT - Machine 1 - Measurement 0003

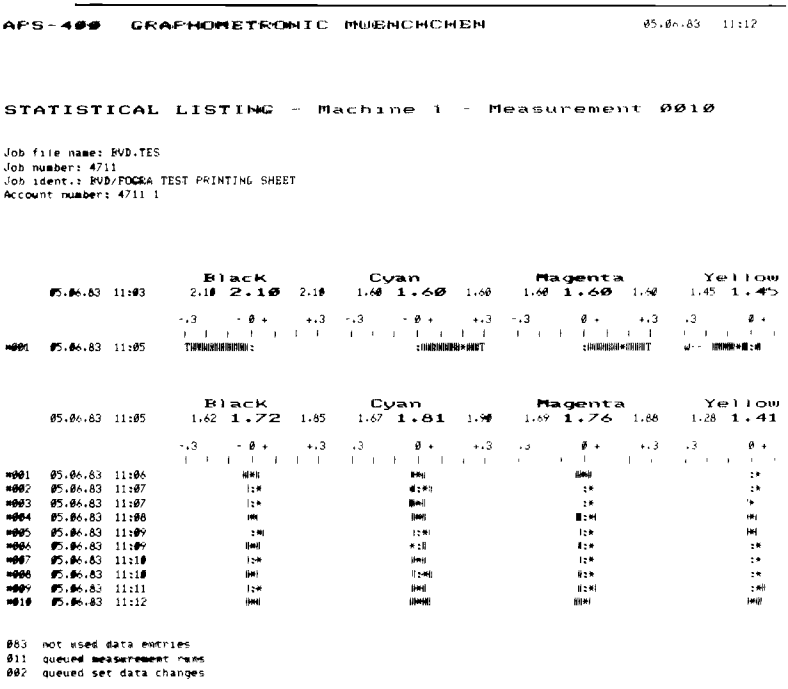
Job file name: WALTER.PRU
Job number: STRIP:CC14.382
Job ident.: STREIFEN. LOSR
Account number: 10



	Black	Cyan	Magenta	Yellow
Solid tone				
Warn. limit:	0.05	0.05	0.05	0.05
Toler. limit:	0.10	0.10	0.10	0.10
Set data:	1.51 1.51 1.51	1.29 1.29 1.29	1.24 1.24 1.24	0.99 0.99 0.99
Meas. data:	1.19 1.47 1.68	0.90 1.29 1.60	1.23 1.52 1.73	0.79 0.95 1.15
Screen tone 40%				
Set data:	57% 57% 57%	57% 57% 57%	57% 57% 57%	57% 57% 57%
Meas. data:	53% 56% 59%	46% 49% 52%	49% 52% 56%	48% 50% 52%
Screen tone 80%				
Set data:	91% 91% 91%	91% 91% 91%	91% 91% 91%	91% 91% 91%
Meas. data:	87% 89% 91%	87% 87% 87%	86% 89% 92%	64% 85% 86%

Figure 5. Example of a graphical printout

At the end of the production run, a print management report may be called up which provides information on the quality of the whole production. The management report may be used, for example, to prove the quality of the printed product to the customer or to establish statistical data on the printing quality of each press.



APS-400 GRAPHOMETRONIC MUENCHCHEN 05.06.83 11:12

STATISTICAL LISTING - Machine 1 - Measurement 0010

Job file name: BVD.TES
Job number: 4711
Job ident.: BVD/FOGRA TEST PRINTING SHEET
Account number: 4711 1

			Black			Cyan			Magenta			Yellow		
	05.06.83	11:03	2.10	2.10	2.10	1.60	1.60	1.60	1.60	1.60	1.60	1.45	1.45	1.45
#001	05.06.83	11:05												

			Black			Cyan			Magenta			Yellow		
	05.06.83	11:05	1.62	1.72	1.85	1.67	1.81	1.90	1.69	1.76	1.88	1.28	1.41	1.48
#001	05.06.83	11:06												
#002	05.06.83	11:07												
#003	05.06.83	11:07												
#004	05.06.83	11:08												
#005	05.06.83	11:09												
#006	05.06.83	11:09												
#007	05.06.83	11:10												
#008	05.06.83	11:10												
#009	05.06.83	11:11												
#010	05.06.83	11:12												

003 not used data entries
011 queued measurement runs
002 queued set data changes

Figure 6. One page of the print management report

Conclusion

We feel that this automatic scanning densitometer type APS 400 forms the missing link in the chain proofing - production printing and helps cutting makeready time and at the same time helps increasing the productivity of a press. Another very important factor is a considerably better printing quality when employing modern automatic scanning densitometers.