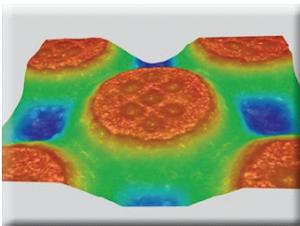


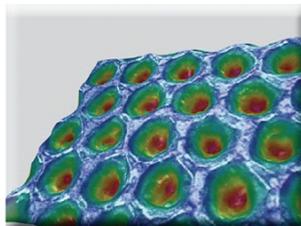
## How to improve press setup times and reduce waste using Troika's AniCAM and QC applications



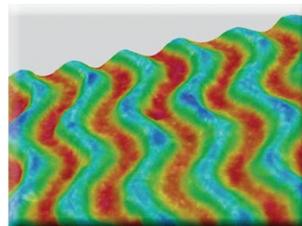
**AniCAM** and **SurfaceCAM** – Over 800+ world-wide installed systems of Troikas affordable and easy-to-use 3D Scanning Microscopes and applications for Quality Control and Management of Anilox rolls, Gravure Cylinders, Coating rolls and Flexo Plates/Sleeves help to optimise setup procedures, ink adjustments and reduce waste and production cost.



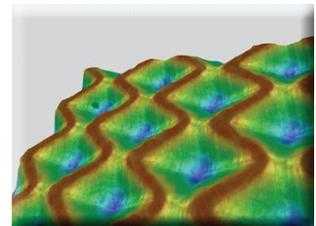
FLEXO PLATES/SLEEVES



ANILOX ROLLS



COMPLEX ENGRAVINGS



GRAVURE CYLINDERS

### Why would Printers need to manage their Roll/Cylinder Inventory ?

Troika offers comparable QC- and Management-Solutions for both worlds – Flexo printing and Gravure Printing. In the following we describe the functionality of the Anilox measuring and QC solution: With high quality flexo and gravure printing it is unquestionable that there are a number of parameters influencing the quality, amount of press setup time and waste. One factor not to be underestimated is the quality, volume and wear of the Anilox rolls.

What if the printer knew all parameters of each roll in his inventory before mounting them on press? He could actually pre-select a perfectly matched set of rolls - regarding Volume, Variance (*volume differences along the roll*), screen-count and cell shape. This would definitely reduce the press setup times and waste, improve quality and subsequently lead to additional press availability and improved print quality.

## AMS - Roll Overview Report

Site:	Flexo Printer: Cardiff								
Group count:	10								
Group name:	Screen: 1200								
Roll count:	8								
Roll ID:	Manufacturer	LPI	cm3/cm2	Variance	Capacity	Suitability	Last reading		
1200 - 2.2	Sandon	1271	2.7			Process cyan	28/09/2012		
1200 - 2.8	Sandon	1295	3.1	1228	3.6	Process cyan	28/09/2012		
1200 - 3.7	Sandon	1221	3.2	1192	4.0	Process cyan	28/09/2012		
1200 - iPro5 - 002 152	Sandon	1228	3.6	1228	3.7	Process cyan	28/09/2012		
1200 - iPro5 - 002 164	Sandon	1200	4.0	1209	4.4	Process cyan	28/09/2012		
1200 - iPro5 - 002 365	Sandon	1228	3.7	1209	4.0	Process cyan	28/09/2012		
1200 - iPro5 - 002 396	Sandon	1209	4.4	9%	100%	Process cyan	28/09/2012		
1200 - iPro5 - 002 93	Sandon	1209	4.0	10%	100%	Process cyan	28/09/2012		

Older rolls show lower volume  
(Too much variation!)

Should be sent  
for refurbish  
(Variance 10%)

Group name:	Screen: 1000									
Roll count:	4									
Roll ID:	Manufacturer	LPI	cm3/cm2	Variance	Capacity					
1000 - 6.5 - 002195	Sandon	1039	5.9	1039	5.9	2%	perfectly matched (minimum difference & minimum variance)			
1000 - 6.5 - 002196	Sandon	1078	5.8	1078	5.8	2%				
1000 - 6.5 - 002507	Sandon	1058	6.0	1058	6.0	3%				
1000 - 6.5 - GG25319-1	Sandon	1058	5.8	1058	5.8	0%				
					0%	100%				

*The listing of all rolls in the inventory provides a direct comparison of the roll parameters.*



### Roll History



	Date	Examiner	1	2	3	4	5	cm3/m2	Variance	Capacity
Reference	28/04/2012	Phil James	5.1	5.2	5.3	=	5.2	4%	100%	
Historical	10/07/2014	Phil James	4.7	4.2	4.4	=	4.4	11%	85%	
	15/10/2013	Tim Collings	4.8	4.5	4.8	=	4.7	6%	90%	
	10/02/2013	Jon Jordan	5.1	4.8	5.2	=	5.0	8%	97%	
	26/06/2012	Phil Hall	5.1	5.0	5.2	=	5.1	4%	96%	

*Extract of an individual roll report, showing the first reading at the top and the subsequent readings underneath in reverse order.*

Due to different measuring methods and reference roll calibrations used by the anilox manufacturers, a printer often can not just rely on the readings supplied with a shipped roll. Also historically inexact methods of measurement could result in receiving aniloxs of varying volume, forcing the printer to make adjustments on press to achieve the desired colour densities. There has also been no reliable method for the printers to check the wear of their rolls, if their cleaning processes are efficient, or when a roll is out of tolerance.

## Remarkable and achievable cost savings

The costs of poor press setups are obvious: A production enhancement by just 1 hour per press per day (it's usually much more) mostly leads to a typical annual saving of:

**Label printer:**

charge out of €300 / hour would benefit from approximately €90,000 / year / press.

**Wide web printer**

charge out of €500 / hour would benefit from approximately €150,000 / year / press.

With several thousand presses at sites globally the financial and ecological benefits to the industry are enormous.

## How to achieve an effective Anilox Quality Control and Management



The printer needs an affordable, portable and easy to use instrument, allowing him to perform reliable and repeatable readings of all required anilox roll parameters (*especially volume and volume variance*). Before Troika introduced their **AniCAM 3D scanning microscope, Anilox QC application and Anilox Management System AMS**, the available solutions were either too expensive for printers (*e.g. interferometers - only affordable by anilox manufacturers*) or not really reliable (*e.g. ink drawdown or manual/optical systems*).

## 3 Studies with interesting and surprising results

Troika utilised three studies to get more transparency into the measuring and measuring method confusion. The first study shows the influence of volume changes on ink densities, the second study shows the limitations and disadvantages of ink draw down measurements and the third study analyses the different methods and calibrations used by Anilox manufacturers.

### Study 1: How Anilox volume changes effect density (of process colours)



*This test - carried out at one of the Paragon (now Coveris) Label sites in the UK, July 2011 - showed the relationship between very fine volume changes (on a 4 band anilox roll) and to determine the density changes it caused for each colour. The Anilox was cleaned between colour changes.*

	Band 1	Band 2	Band 3	Band 4	Delta
Volume & Depth (Manufacturer)	3,1 cm <sup>3</sup> / m <sup>2</sup> 11μ	3,2 cm <sup>3</sup> / m <sup>2</sup> 12μ	3,3 cm <sup>3</sup> / m <sup>2</sup> 13μ	3,5 cm <sup>3</sup> / m <sup>2</sup> 15μ	0,4 cm <sup>3</sup> / m <sup>2</sup>
Cyan Density	1,14	1,17	1,20	1,22	0.08D
Magenta Density	1,17	1,18	1,19	1,24	0.07D
Yellow Density	0,96	0,98	1,01	1,04	0.08D
Black Density	1,43	1,46	1,52	1,62	0.19D

*Products used: A specially engraved 4-band anilox roll (300 lpcm | 750 lpi) with an engraved and measured volume differences of 0.1 cm<sup>3</sup>/m<sup>2</sup> between bands and a Troika AniCAM 3D scanning microscope with Anilox QC application.*

*The printed results correlated with the anilox engraving and Anilox QC data. The difference in density on all colours became discernible to the eye when Band 1 was placed on top of Band 4.*

*Conclusion: A difference of more than 0.4 cm<sup>3</sup>/m<sup>2</sup> (0.26BCM) volume in the process colours will show a visible difference to the eye; approximately 3deltaE (CIE2000).*

*Acceptable tolerances for volumetric measurement of process colours should be better than half of the 0.4 cm<sup>3</sup>/m<sup>2</sup> (0.26 BCM) found in this study - which defined a measurement specification and engraving tolerances.*

### Study 2: Limitations of Ink Drawdown measuring systems

Initially there was no accurate volume reference to work from. Ink Draw Down systems did a good job for a rough estimate but were notoriously inaccurate and very operator dependent (Ref: Clemson University study for FTA 2009).

The second study Troika utilised was done in September 2006 by Dr. Paul Royo at Praxair Switzerland. This practical study took place with 8 of their competent ink draw down users taking readings on their 5 banded master roll using their URMI system.

Anilox LPCM	Min Reading	Max Reading	Difference	Average	% Variance	Operator	Reading
80	14.30	19.30	5.00	17.10	29%	1	16.60
120	10.20	11.36	1.16	1.16	11%	2	18.00
160	7.70	9.03	1.33	1.33	16%	3	16.94
200	5.60	6.12	0.52	0.52	8%	4	17.98
320	5.30	6.20	0.90	0.90	16%	5	16.50
						6	14.30
						7	16.60
						8	19.30

Readings in cm<sup>3</sup>/m<sup>2</sup> – 8 skilled operators took ink draw down readings on the same banded master roll.

Readings on the 80 lpcm band

**Conclusion:** The result showed that volumetric measurements could be (and often were) manipulated and did not represent a true and accurate volumetric reading.

### Study 3: Differences in volumetric measurements at manufacturer sites

The subsequent study was performed by Troika Systems Ltd in 2007 and proved a significant volume readings variance between manufacturers which finally gave rise to the realisation for an accurate measurement rather than assumed to be correct measurements based on reference readings on master rolls only.

	LPI   LPCM	Minimum volume reading	Maximum volume reading	Difference between manufacturers readings
Band 1	1200   500	1.70 cm <sup>3</sup> /m <sup>2</sup>	2.80 cm <sup>3</sup> /m <sup>2</sup>	1.10 cm <sup>3</sup> /m <sup>2</sup> = 65%
Band 2	1000   400	2.63 cm <sup>3</sup> /m <sup>2</sup>	4.00 cm <sup>3</sup> /m <sup>2</sup>	1.37 cm <sup>3</sup> /m <sup>2</sup> = 52%
Band 3	800   320	1.99 cm <sup>3</sup> /m <sup>2</sup>	4.80 cm <sup>3</sup> /m <sup>2</sup>	2.81 cm <sup>3</sup> /m <sup>2</sup> = 141%
Band 4	700   280	4.50 cm <sup>3</sup> /m <sup>2</sup>	8.30 cm <sup>3</sup> /m <sup>2</sup>	3.80 cm <sup>3</sup> /m <sup>2</sup> = 84%
Band 5	500   200	5.12 cm <sup>3</sup> /m <sup>2</sup>	9.80 cm <sup>3</sup> /m <sup>2</sup>	4.68 cm <sup>3</sup> /m <sup>2</sup> = 91%
Band 6	400   160	6.25 cm <sup>3</sup> /m <sup>2</sup>	12.80 cm <sup>3</sup> /m <sup>2</sup>	6.55 cm <sup>3</sup> /m <sup>2</sup> = 105%

Extraction from the 12-Band readings, performed by 15 manufacturers using their standard method

15 manufacturers in Europe and North America, volunteered to measure a 12 banded roll with their own individual measurement methods. The differences were astonishing, proving the need for accurate measurement to make the desired savings, rather than each manufacturer using their own measurement standard.

What is the consequence for the printer? He must be aware that he could get different volumes when ordering the same rolls from different manufacturers. The manufacturers had to follow their own internal standards for many years because historically there was no accurate method of volumetric measurement. But this has changed since there is now a mathematically proven method – implemented in Troikas AniCAM and SurfaceCAM applications.

## Which measuring tolerances are acceptable?

From the various studies and work with printers and anilox manufacturers the following tolerances were established to optimise production and minimise waste.

### Requirements of the measuring equipment:

**Repeatability** – of repeated volumetric measurements on one unit:

Above 240 lpcm | 600 lpi

To within ± 0.1 cm<sup>3</sup>/m<sup>2</sup> (0.06BCM): ± 1 µ

Down to 80 lpcm | 200 lpi

To within ± 0.2 cm<sup>3</sup>/m<sup>2</sup> (0.12BCM): ± 1 µ

**Interoperability** – Repeatability of readings when different operators use the equipment:

Differences should not be acceptable

**Accuracy** – A statement of values to within a specification.

Greater than 240lpcm / 600 lpi:  $\pm 0.1 \text{ cm}^3/\text{m}^2$  (0.06BCM)

Less than 240lpcm / 600 lpi:  $\pm 0.2 \text{ cm}^3/\text{m}^2$  (0.12BCM)

**Consistency** – of repeated volumetric measurements between different measuring units:

Above 240 lpcm | 600 lpi To within  $\pm 0.2 \text{ cm}^3/\text{m}^2$  (0.12BCM):  $\pm 1 \mu$

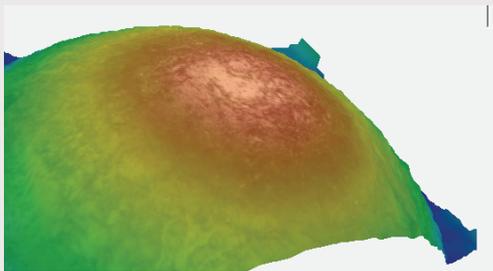
Down to 80 lpcm | 200 lpi To within  $\pm 0.4 \text{ cm}^3/\text{m}^2$  (0.24BCM):  $\pm 2 \mu$

## How does Troika achieve accurate dimensional and volumetric readings?

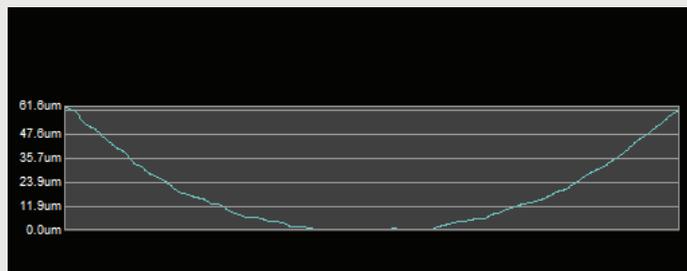
Whilst Repeatability & Interoperability have been proven for some time a statement of Accuracy has not been possible and therefore Consistency between units could not be stated. However in recent years a reliable method of volumetric measurement has been recognised, and has proven to be a practical method of measurement in the field.



The solution with demonstrable, accurate calibration in X,Y & Z axis, and also for volumetric measurement was proven in 1998 by the introduction of the measurement of Spheres. (Ref: Elssner, Burow, Grzanna & Spolaczyk, "Absolute Sphericity measurement" Appl. Opt.28, 4649-4661 [1998]) (Ref: Elssner, Burow, Grzanna & Spolaczyk, "Absolute Sphericity measurement" Appl. Opt.28, 4649-4661 [1998])



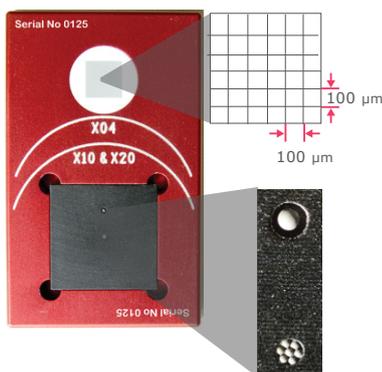
Top 90° of a sphere used to calculate dimensions and volume



Top of sphere inverted for closer representation to an anilox

*Using a sphere of a known size gives unequivocal dimensional and volumetric X, Y and Z-data from which the AniCAM can be calibrated.*

## Troika's mathematical Sphere calibration



Troika implemented the Elssner, Burow, Grzanna & Spolaczyk measurement system for its own requirements using an optical graticule for X & Y calibration and 2 sphere sizes for Z-axis and volumetric calibration which is being implemented into its AniCAM 3D scanning microscope production from September 2014.

A test at Swansea University in 2014 proved that the accuracy and consistency of the AniCAM measuring system is well within the required measurement requirements of the industry (Dr. David Deganello [WCPC], 2014).

## How to ascertain continuous correct readings ?



**ANICAM:**



### CERTIFICATE OF TEST & CALIBRATION

AniCAM serial no: (v7.2 345)  
20x lens serial no: (345)  
10x lens serial no: (345)  
04x lens serial no: (345)

Calibration Plate serial no: (101)  
Optical Graticule: (100) micron  
20x & 10x sphere size:(397) micron  
04x sphere size:(1000) micron

Target	x20			x10			x04		
	X:Y	Z (Depth) (15)µ	Volume (0.14) nL	X:Y	Z (Depth) (58)µ	Volume (1.90) nL	X:Y	Z (Depth) (146)µ	Volume (30.4) nL
Tolerance		±1µ	±0.01nL		±1µ	±0.02nL		±2µ	±0.04nL
Zoom 1	✓	15	0.14	✓	58	1.90	✓	146	30.44
Zoom 2	✓	14	0.13	✓	58	1.89	✓	144	30.18
Zoom 3	✓	15	0.14	✓	59	1.90	✓	145	30.45
Default	✓	14	0.14	✓	58	1.92	✓	148	30.72
Zoom 5	✓	15	0.15	✓	58	1.90	✓	148	30.40
Zoom 6	✓	15	0.14	✓	57	1.88			
Zoom 7	✓	15	0.14	✓	58	1.90			



Signature  
*H. Morgan*

Having a proven standard of measurement has allowed the development of on-site annual calibration and certification of the units to meet printers internal and ISO requirements. The package is named AniCAM Certification Package (ACP), which consists of a software application, the calibration plate with a graticule for X- and Y-calibration and embedded spheres for volume calibration.

The system is checked for correct electronic, mechanical and optical operation with pass or fail results. With each of the lenses it is checked and corrected for X:Y:Z and volume accuracy.

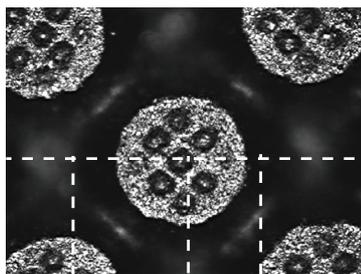
Only if all tests and calibrations were successfully completed, the operator can print out a certificate - proving that the system provides reliable readings.

## AniCAM for 3-dimensional Flexo Plate Quality Control



The time and cost of defective plates increase waste, reduce productivity and profitability. Printers often charge trade-houses for lost productivity if the fault is proven to be theirs – trade houses need to check and maintain their quality to ensure they meet their customers needs.

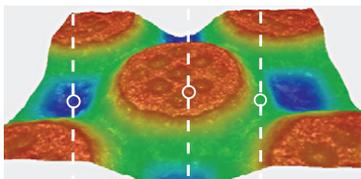
Cost savings made over time through Quality Control on dot shape, relief depths and dot sizes can be significantly high and will result in a fast Return of Investment.



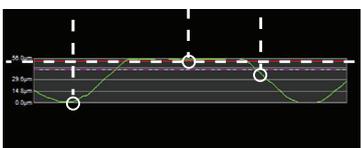
With its 3D measuring method, ingenious illumination system of 18 software controlled LEDs and dedicated flexo plate QC application, Troikas AniCAM can even be used for measuring and analysing black direct laser engraved rubber sleeves.

### Viewed from the top most dots look fine . . .

A three-dimensional view and analysis of the surface and dots is extremely informative and helpful. It exposes problems which could never be identified by a two-dimensional reading!



In contrast to two-dimensional readings an electronic profile cut across dots will show much more. Shoulder angles as well as relief and intermediate depths can be measured exactly.



With this system the smallest highlight dots and even the depth and dimensions of top surface screenings can be measured. Linear measurements and angle readings can be conducted by click-and-drag cursor movements directly in the graphical display.

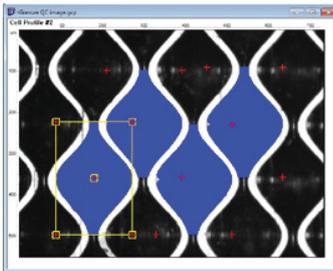
## AniCAM for Gravure Cylinder Quality Control



Troika's way of analysing and measuring Gravure cylinders is quite similar to the Anilox roll QC. The system can analyse all kinds of engravings (mechanical, laser, chemical etching) The 3D Scan provides all information needed – Cell Depth, Width, Height, Channel, Volume, Volume Variation across the cylinder etcetera.



Depth, Volumen, Wall width, Channel, Opening, Angles and wear of cylinder engravings



There are certain demands which are different from the Anilox QC – especially regarding the wear analysis which is provided as numerical and graphical information.

## Who can benefit from Troikas Gravure Cylinder Quality Control?

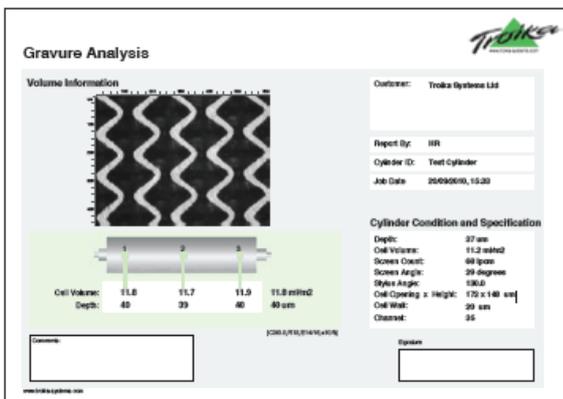
### Engravers

Measuring the actual opening, depth and volume on copper and subsequently chrome cells is becoming more important for quality control purposes during the manufacturing process. Engraving mechanically with styluses or using a laser – it is important to analyse the engraving results regarding volume, shape, depth, angles and consistency. Variations can lead to considerably different depths and volumes which cannot be detected when making theoretical calculations.

### Printers

Using the AniCAM System and Gravure QC application helps to establish the quantity of ink required for a job. The quality of worn, refurbished or replaced cylinders can be compared to the original – important when establishing the characteristics for print. Knowing the condition and wear of each cylinder in the inventory enables the printer to schedule refurbishing and replacements of cylinders. Knowing that the cylinders have been properly cleaned and do not hold ink or varnish residue can save many hours of press set up time.

## Converting the reading into reports



The measuring results can be printed as a report or simply transferred to the Cylinder Management System CMS data base for continuous tracking of each cylinders condition and wear (see bottom left).

Graphs visualise the wear (depth or volume) of individual cylinders or a set of cylinders used for a particular job. The Depth Usage-to-Wear Analysis lets you select one of three warning values. The values describe the maximum acceptable difference to the initial Reference depth readings. The value is marked with a red line.

## CMS - Cylinder Inventory Report

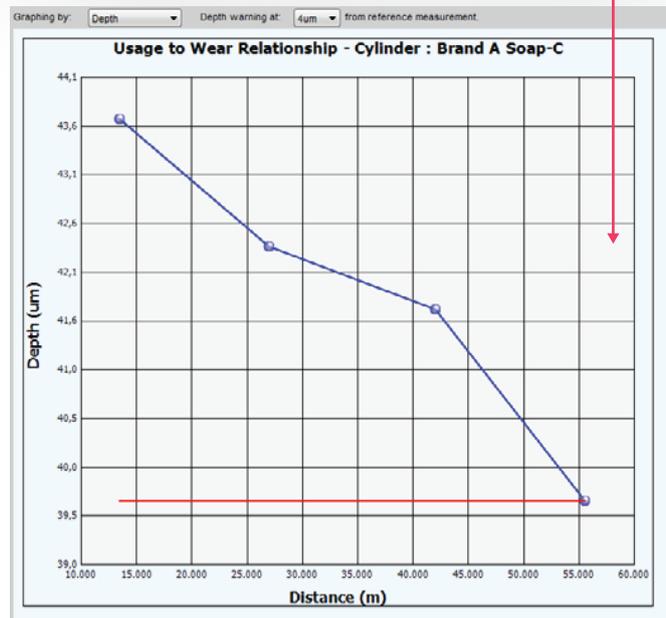
Filter: Show All - No Filters  
Sorted by: Cylinder ID (Ascending)  
Report generation date: 07/06/2013

Job name: 'Brand A' Soap			Current volume	Volume Difference to original	Variance across the cylinder	Current depth	Depth difference to original	Printed meters
Cylinder count: 4								
Cylinder ID	Last profited	cm3/cm2	Trend / Variance	Depth	Trend	Distance		
7014-C	03/06/2013	10.9	-2.7 / 0.3	40	-4	54500		
7015-M	03/06/2013	8.8	-1.8 / 0.0	32	-5	54500		
7016-Y	03/06/2013	11.4	-1.7 / 0.0	38	-4	41000		
7017-K	03/06/2013	7.5	-1.3 / 0.0	27	-4	54500		
Job name: TastyBisc Belgium			cm3/m2	Trend / Variance	Depth	Trend	Distance	
Cylinder count: 2								
Cylinder ID	Last profiled	cm3/m2						
Cyan	24/04/2013	0.0						
Magenta	25/04/2013	2.3						

The Cylinder Management System CMS provides detailed information on the condition of each cylinder in a job. Whenever the cylinder is measured, the readings are transferred into CMS, which builds a cylinder and volume/wear history from the AniCAM Gravure QC application.

Wear of the cylinders can be monitored numerically and graphically at relevant points in the cylinders life.

Every job is entered with its job name, its cylinders subsequently have their own unique ID, screen count, date received and all measurement details.



### About Troika Systems

Troika Systems Limited is a privately owned company with development, manufacturing and sales operations based in Highworth, United Kingdom. Since the foundation in 1996 Troika focusses on development of solutions for the printing industry including **dry film image setters** (1998) with Ricoh mostly for the corrugated markets and **In Register Duplex Proofing Systems** (2004) on wide format HP and Epson printers. "During this time Troika has gathered a lot of experience and knowledge in the prepress and press environments and decided to concentrate on the development of Quality Control solutions for the flexographic, gravure printing and coating industry - with over 800 installed AniCAMs and applications. Troika have become the leading manufacturer for accurate volumetric measurement.

Tel: +44 (0) 1793-766-355  
Fax: +44 (0) 1793-766-356

info@troika-systems.com  
www.troika-systems.com

1 Blackworth Court Blackworth Industrial Estate Highworth,  
Wiltshire, SN6 7NS United Kingdom

