Introduction

SCAMAX® document scanners are primarily used to digitize business documents and forms. Therefore, the standard calibrations of the devices are designed for the creation of compressed, clear color images, with the best possible qualitative conversion (*binarization*) into B/W images for subsequent processing, from a wide range of documents.

For some time now, the guidelines of international quality standards such as ***ISO*** (*International Organization for Standardization*) or ***FADGI*** (*Federal Agencies Digitization Guidelines Initiative*) have been used as assessment criteria for processing in the field of cultural assets (*archives, libraries, etc.*). Since these guidelines were developed for still image capturing by photo, reflected light or flatbed systems, it was previously considered unlikely that document scanners with rotating paper transport would be able to meet the necessary requirements.

Due to the excellent image quality of the cameras used and the precise transport system of the ***SCAMAX®*** document scanners, we are able to comply with the standard values of ***ISO 19264-1 Level B*** and ***FADGI ******.

The following description contains all steps for the special calibration of the scanner scanner and the creation of device-specific color profiles.

1. Scanner Calibration

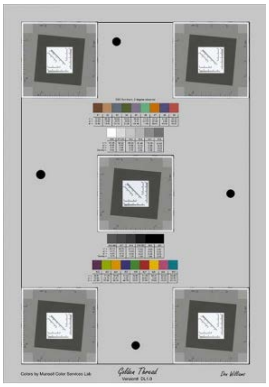
The following calibration should be accomplished by someone who has completed a technical training for this type of scanner, as access to the scanner's service menu is required beside a clean sheet of InoTec white balance paper (*Art.No. s9100002 - please do **not** use other kind of paper!*).

The first step is a Gain Calibration to a ***Target Value*** of ***210*** (*default is 250*). For this purpose, the value of the fields ***Target Value Front/Back*** in the corresponding mask of the ***Gain Calibration*** button in the menu Service-> Calibration is changed accordingly and, after inserting the white balance paper, the calibration is started with the button ***OK***. The last used target value will be stored in the scanner and thus also used in the future during a gain calibration performed via the similar button in the menu *Administration->Calibration*.

Also the White Calibration, as 2nd step of this calibration, is performed with a lower target value of ***224*** (*default is 260*). Like at the gain calibration, the value of the ***Target Value Front/Back*** fields is also changed here in the associated mask and saved for future calibrations from the areas *Service* and *Administration*. Then, as usual, perform the White Calibration with the paper provided for this purpose.

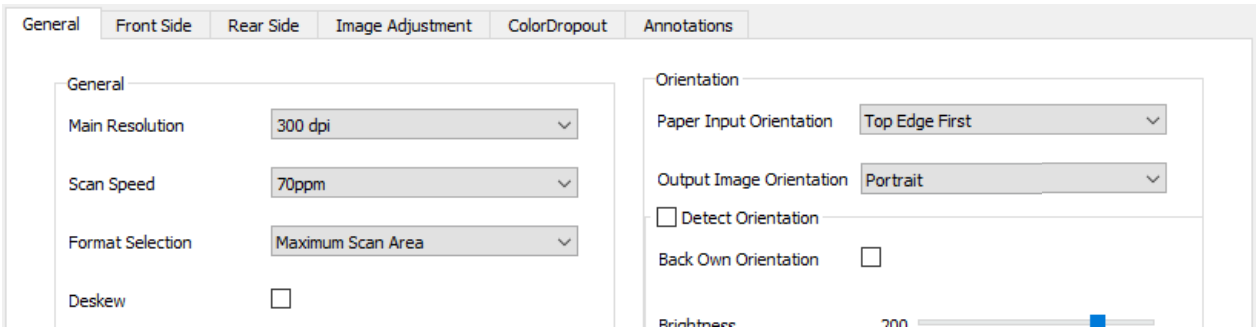
2. Creating ICC/ICM color profiles

After performing the special calibrations from the previous chapter, a camera-specific color profile must be created for the scanner. For this we use parts of the OpenSource system *ArgyllCMS* which we have integrated into the specially created tool ***InoICC***. It enables to create color profiles *(*.icc/*.icm*) based on up to two templates. The tool ***InoICC*** can be downloaded and installed via the download area of our website. .

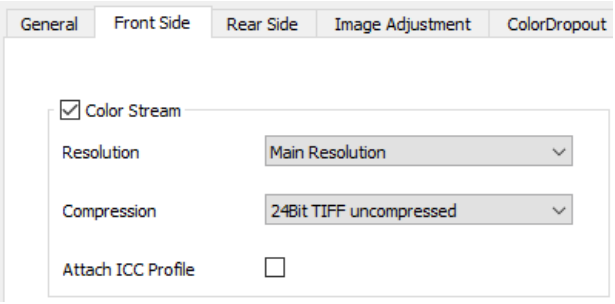


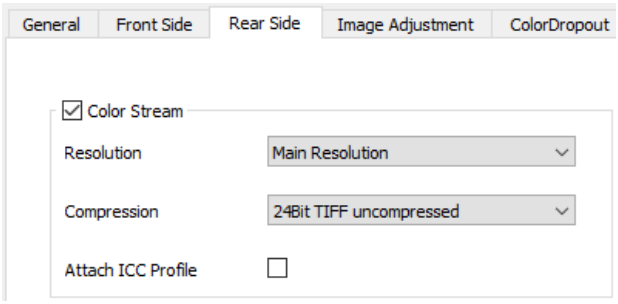
In addition, a target from *Image Science Associates* (*ISA*) is required, which is used as a basic for the color profiles creation. The images of the target are also used for subsequent analysis regarding compliance with the FADGI guidelines. A ***DICE*** target (figure *left*) or in the future also a ***FADGI-ISO-19264*** target (*figure right*) incl. the corresponding reference file (*Excel format*) and also the image analysis software ***Golden Thread*** can be obtained directly from the manufacturer if required. In our example we refer to a ***DICE*** target. The targets must be handled with care, because only a clean target will give correct values. To create the color profiles, the target must be scanned per camera and saved as *24Bit TIFF uncompressed.*

The scanner should be turned on *several minutes* before scanning reference images so that it is already at *operating temperature*! In addition, the *Paper Passage Setting* in the scanner (*see chapter 5.4.2 in the User Manual*) should be turned to the smallest value. For scanning, any program that is able to connect to the scanner and open its driver dialog can be used. Based on *default values*, the following scan settings should be used:

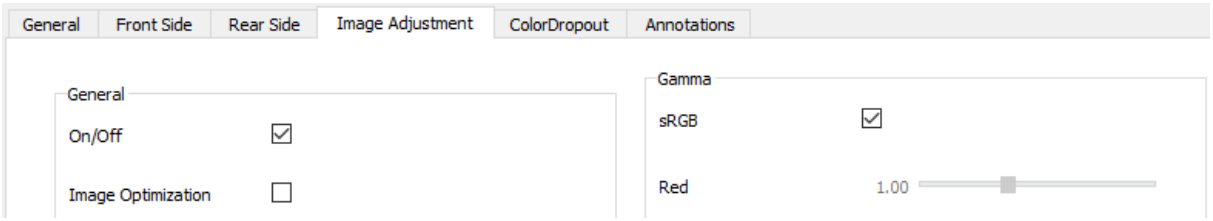


In the *General* tab, the required *Main Resolution* (*here* ***300 dpi***) and a *Scan Speed* of ***120 ppm*** or (*with Slow Mode option*) even slower should be selected. At *Format Selection*, ***Maximum Scan Area*** must be selected and in the section *Orientation* the *Paper Input Orientation* must be set to ***Top Edge First*** while the *Output Image Orientation* stays at ***Portrait***. Whether *Deskew* is activated or not should depend on the productive use.





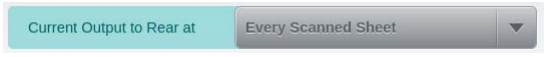
On the tabs *Front* and *Back*, the *Color Stream* must be ***activated*** and the *Compression* must be set to ***24Bit TIFF uncompressed***. The option *Attach ICC Profile* remains deactivated, but can be activated after creating and importing the color profiles to the scanner in order to transfer these color profiles together with the color images to the scan software.



On the *Image Adjustment* tab, keep the option *On/Off* marked, but *Image Optimization* must be ***deactivated***. For this, the option *sRGB* on the right side has to be ***activated***. These settings in the driver dialog must now be saved.

To protect the Targets to be scanned, additional settings should be made. To do this, use the button **More settings** to switch to the Profile Management on the scanner display. Via the mask *Input* in the *Input/Output* menu, the *Feeder Mode* should be switched to ***Manual*** and the *Separation* should be ***deactivated***.

The targets should be ejected to the rear output tray by setting the corresponding option to *Current Output to Rear at* ***Every Scanned Sheet*** in the *Output* mask.



Using the setting screen *Operation* at the menu *Scanner* the option *Black Pages Permitted* should be activated.

Now changes must be saved via the corresponding button configuration on the scanner screen must be left pressing the end edit button. This puts control back in the hands of the driver's user dialog, which can be used to directly perform a test scan with the selected settings after the target has been inserted correctly to the input tray. With CTRL-S, the displayed image in the Testscan Viewer can be saved as an uncompressed color tiff. To create a target image of the rear side, simply insert the target with the rear side facing up in the input tray, perform a test scan and switch to the ***Back*** tab before saving the image.

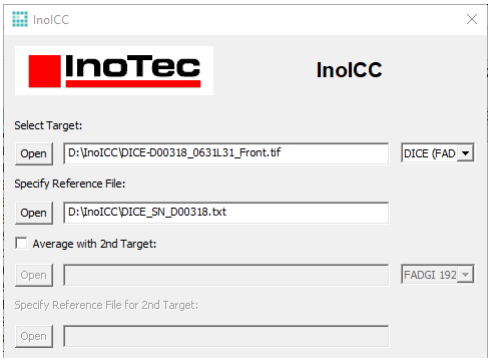
To carry out the following steps, the area of the guide paper must first be cut off from the images of the target. This can be done with any image processing software, which can save the images again as uncompressed color Tiffs.

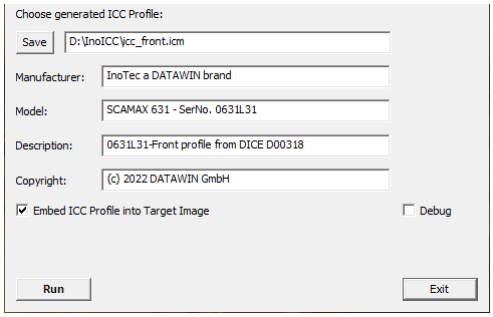
To create the color profile with our tool ***InoICC***, a reference file must be available in text format (*CGATS*). Using the reference examples, available for download next to ***InoICC*** on our website, the required reference file can be created manually. To do this, replace the three values behind each *Sample ID* in the data area of the sample reference (*DICE_Ref.txt*) with the measured values of the corresponding patches from the original DICE reference. The modified sample reference is to be saved under a different name after completion.

Alternatively, an Excel workbook named ***DICE-QR2TXT*** can be used, which we also offer for download. This saves entering the individual values and thus also avoids input errors. For this purpose, the value of the QR code, which is applied to the DICE target, must be read and copied into cell ***A2*** of the table *QR Code Content* in this workbook. The serial number of the target now appears in cell ***A5*** for checking purposes and the values are transferred to the table *DICE-QR2TXT* of the workbook. After switching to this table, cell ***B4*** can be filled with a date. Afterwards, the dialog *Save as* is opened via the ***F12*** key, in which path and file name are entered. ***Text (MS-DOS)(*.txt)*** must be selected as file type. The two messages that are displayed during the following saving process must be confirmed with ***OK*** or ***Yes***. Afterwards this workbook should be closed without saving it again.

	A	B	C	D
1	TARGET	DICE		
2	ORIGINATOR	Don Williams		
3	MANUFACTURER	Image Science Associates		
4	CREATED			
5	SERIAL	D00318		
6	NUMBER_OF_FIELDS	4		
7	BEGIN_DATA_FORMAT			
8	SAMPLE_ID	LAB_L	LAB_A	LAB_B
9	END_DATA_FORMAT			
10	NUMBER_OF_SETS	30		
11	BEGIN_DATA			

Once the necessary images of the target and the reference file have been created, the color profiles can be generated using our ***InoICC*** tool. In the upper part of the corresponding dialog, the target image that is to be used for generating the color profile is selected via the ***Open*** button at *Select Target*. The field *Specify Reference File* below loads the previously created reference file in text format. Via the selection to the right of the Target field, in addition to the FADGI-Targets *DICE* and *FADGI-19264*, an *IT8* can also be chosen as source image. This can make sense if a color profile is to be created without reference to FADGI and thus no such target is available. By activating the *Average with 2nd Target* option, a second image with reference file can be selected to create a color profile based on average values from both images. In the lower part of the dialog, the ***Save*** button is used to select name and path of the color profile to be created. If the color profile should be imported on the scanner later on, we recommend using the name ***icc_front.icm*** for a front side profile and ***icc_back.icm*** for a back side profile. Information about the color profile can be entered in the four fields below. The field *Description* is automatically filled with to the selected profile name and represents the reference used as main information by image programs when using this color profile. The option *Embed ICC Profile into Target Image* ensures that the generated color profile is additionally embedded into the image of the target. This is useful if the image should also be used for analysis in ***OpenDICE*** (*next chapter*). Next to the button ***Run***, which is used to start the profile creation, status





messages are displayed, whereby the successful creation of the profile should be reported last. If this is not the case, by activating the *Debug* option, debug files can be created in the output path of the profile during a new run, which can possibly provide information about the cause.

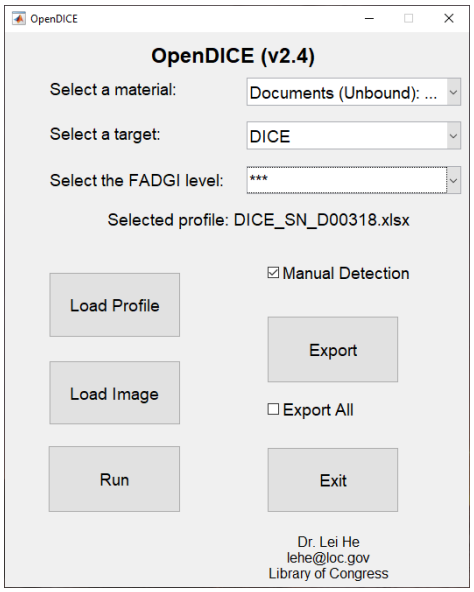
3. Checking the Effectivity via OpenDICE

In the final step, it must be checked whether the previously performed scanner calibration, in conjunction with the created color profiles, is sufficient to meet the requirements of FADGI ***. In practice, the ***GoldenThread*** analysis software from the target manufacturer *Image Science Associates* is used to check the reference images or, as in our example, the open source solution ***OpenDICE***. This solution can be downloaded together with a description, a material table (*Config_materials.xlsx*) and an example of a reference file for the used target from the official FADGI website - see:

http://www.digitizationguidelines.gov/guidelines/digitize-OpenDice.html

For the check, it is simplest to use the target image that was also used to generate the color profile which was already embedded in the image while creation. Otherwise the color profile must be assigned to the used image manually. This can be done, for example, with the free image editing program ***GIMP***.

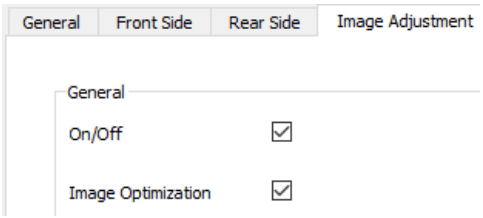
After installing ***OpenDICE***, a reference file according to the downloaded example with the values of the target used must be created and stored in the path of the reference image together with the material table. If a reference was previously created in text format (last chapter) via the Excel workbook ***DICE-QR2TXT***, the reference file for ***OpenDICE*** can also be created from it, by saving the contained table *OpenDiceReference* as a separate Excel file. After starting the tool a dialog appears (*see left*), where in the first field the material must be changed to *Documents (Unbound): General Collections*. By that, a window opens for selecting the material table. Afterwards the used *target* (*here DICE*) and the desired *FADGI level* have to be selected. The activation of *Manual Detection* isn't required according to the description, but our experience shows that an automatic detection of the evaluation zones often leads to a hint to use it after all. Now the button *Load Profile* is used to load the created table with the reference values and then the button *Load Image* must be clicked to load the last created reference image. When *Manual Detection* is activated, the loaded reference image is now displayed in a viewer, with the option to first define the detection area and then, in a new display, to correct the placement of the detection zones. Further details can be found in chapters 5 and 6 of the OpenDICE description. After correcting the zones, the evaluation is started, while the viewer stays open, via the button *Run* in the main dialog and the result is displayed in several overview windows. An explanation of these overviews and the various export options can be found in the description of the software.



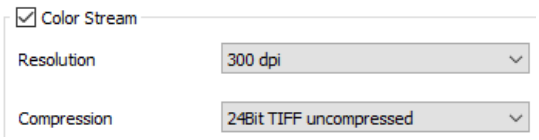
We strongly recommend to follow the sequence of steps described here, otherwise the OpenDICE software may behave incorrectly. If an analysis has to be performed several times on the basis of different reference images, e.g. due to optimizations (see next chapter) or for front and back sides, it is sufficient to close all overview windows and load the new reference image in the main dialog.

4. Improvements

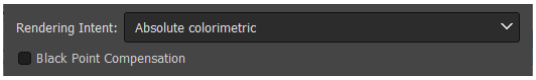
If there are too high deviations due to *Noise* in dark gray areas, this can be counteracted by using specially designed *Camera Curves* (*LUTs*). The file *DarkCorrectionLUTs.zip,* available for download next to ***InoICC*** on our website, contains the files ***lut_front.csv*** and ***lut_back.csv***, which can be used as *Camera Curves* on the scanner. To do this, they first has to be copied to the root directory of a USB stick. After the USB stick is connected to the scanner, switch to the *Export/Import - Updates* screen in the menu *Service* on the scanner display and select the button ***Cam Curves Import*** to transfer the correction values. After that, ***Chapter 2*** and ***Chapter 3*** must be performed again. However, this time the *Image Optimization* on the *Image Adjustment* tab must be ***enabled*** again. This will gray out the enabled *sRGB* option. These settings in the driver dialog must now be saved



If the test is performed with a lower resolution than 400 dpi and without ***Deskew*** enabled, it is very likely that the limits of the horizontal resolution will be exceeded. This is due to the very high sharpness of the optics used in these resolution ranges. Although this is not a disadvantage in terms of quality, it still ensures that the test is not passed. If this is considered an issue, the sharpness can be artificially reduced for resolutions lower than 400 dpi by scanning with a *Main Resolution* of ***400 dpi*** and saving the color image with a *reduced resolution*. This can be selected in the *Colour Settings* of the Scan Profile if a higher main resolution was **previously** set.



If deviations occur in the *Color* test range, it should first be checked whether the correct color profile was assigned to the reference image. This can be done by reloading the image in GIMP, since the attached profile is pointed out during loading and a processing option is offered. If the profile has already been processed with the image, make sure that an *Absolute colorimetric* has been selected and the *Black Point Compensation* has been disabled. In case of doubt, the test (***Chapter 3***) should be repeated with a newly created reference image. If the listed reasons can be ruled out as causes, the creation of a new color profile (***Chapter 2***) should be considered. Therefore it must be checked that the (DICE-) target used is not too old and that the appropriate reference file is used. In connection with a new color profile, ***Chapter 3*** must be performed again.



In case of doubt or for further assistance, please contact our support.