

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 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 image shows a 'Gain Calibration' dialog box. It has a title bar 'Gain Calibration'. Inside, there is a dropdown menu 'Adjust on' with 'Both' selected. Below it are two input fields: 'Target Value Front' and 'Target Value Back', both containing the value '220'. At the bottom are 'Cancel' and 'Ok' buttons.

The first step is a Gain Calibration to a **Target Value** of **220** (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*.

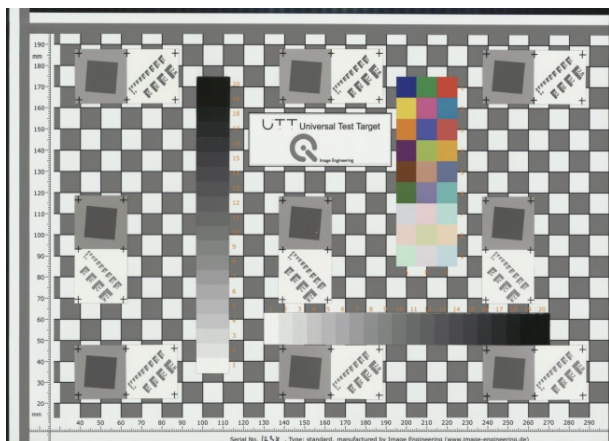


The image shows a 'White Calibration' dialog box. It has a title bar 'White Calibration'. Inside, there is a dropdown menu 'Adjust on' with 'Both' selected. Below it are two input fields: 'Target Value Front' and 'Target Value Back', both containing the value '231'. At the bottom are 'Cancel' and 'Ok' buttons.

Also the White Calibration, as 2nd step of this calibration, is performed with a lower target value of **231** (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.

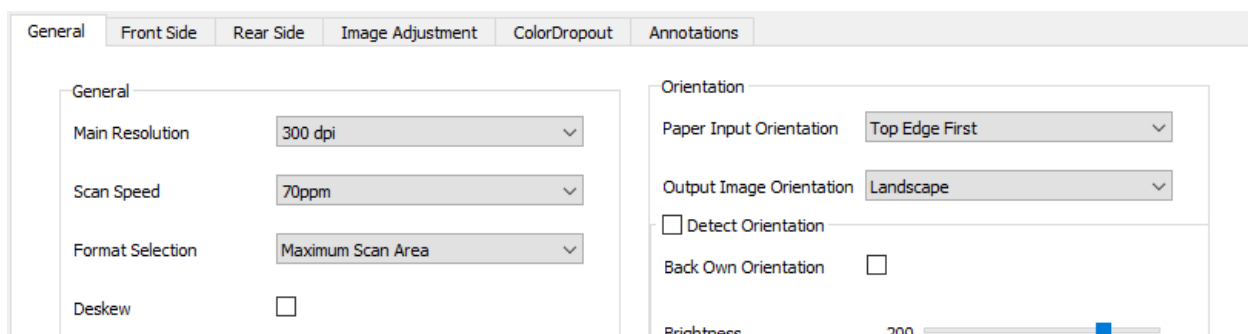
2. Creating ICC/ICM color profiles

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.

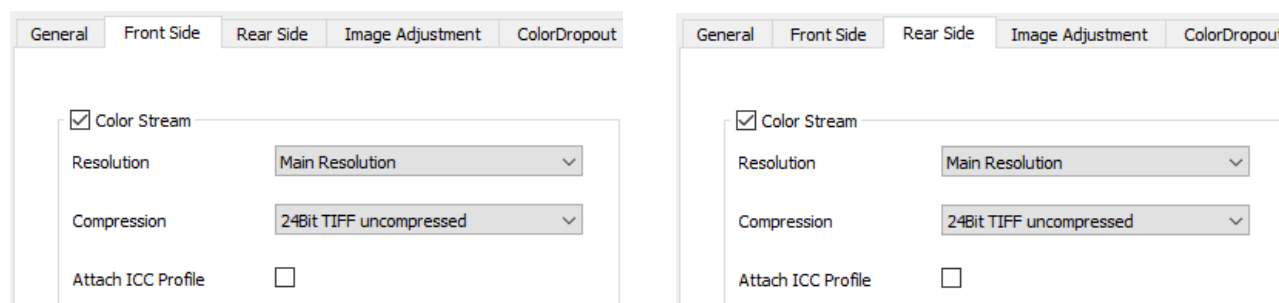


A **Universal Test Target TE-262 (UTT)** from *Image Engineering* in A4 (figure left) or A3 format is also required. This target incl. the corresponding reference file (*Excel format*) and the also used image analysis software **iQ-Analyzer** can be obtained directly from the manufacturer if required. The targets must be handled with care, because only a clean target will give correct values. To create the color profiles, per camera the **UTT** must be scanned and saved as **24Bit TIFF uncompressed**.

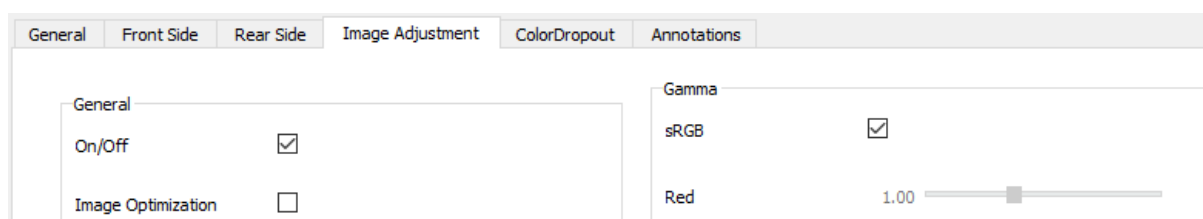
The scanner should be turned on *several minutes* before scanning reference images so that it is already at *operating temperature*! In addition, the *Paper Passage Setting* in the scanner (see *chapter 5.4.2 in the User Manual*) should be turned to the smallest value. For scanning, any program that 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 **Landscape** for *Image Output Orientation*. The *Paper Input Orientation* depends on the UTT format used. Select **Top Edge First** for A4 and **Right Edge First** for A3. Whether *Deskew* is activated or not should depend on the productive use.

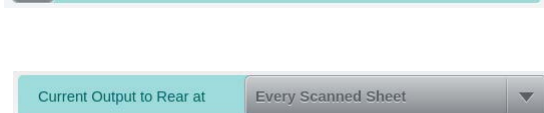


On the tabs *Front* and *Back*, the *Color Stream* must be **enabled** and the *Compression* must be set to **24Bit TIFF uncompressed**. The option *Attach ICC Profile* remains deactivated, but can be activated after creating and importing the color profiles to the scanner in order to transfer these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

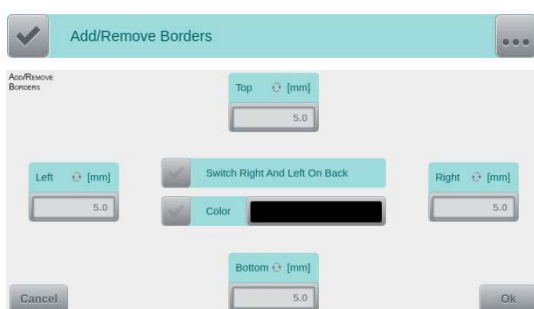


On the *Image Adjustment* tab, keep the option *On/Off* marked, but *Image Optimization* must be **disabled**. For this, the option *sRGB* on the right side has to be **enabled**. These settings in the driver dialog must now be saved.

To protect the UTTs 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 **disabled**.



The UTT's 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.



If the UTT is to be scanned with the *Deskew* option enabled, we recommend using the **Overscan function** to keep enough margin around the image to analyze the target. To do this, activate the *Add/Remove Border* item in the *Image Presettings* menu and define a value of **5 mm** on all sides in its mask. In addition, the *Color* option must be **disabled** in the center so that the original background remains as a frame.

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 UTT image of the rear side, simply insert the UTT 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 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 with the

	A	B	C	D	E	F	G	H
3								
4								
5	Color Patches	Reference Values			Insert measurement values here			
6		L*	a*	b*	L*	a*	b*	Delta E
7	A1	18	24	-61	19,4053	23,5587	-61,3267	1,51
8	A2	82	3	90	81,9987	1,3787	90,9122	1,86
9	A3	61	38	74	61,6905	38,7438	77,5232	3,67
10	A4	21	35	-32	21,1211	38,027	-33,3165	3,20

measured values of the corresponding patches from the original UTT reference. They are located in columns **E - G** of *Tabelle1*. For the A4

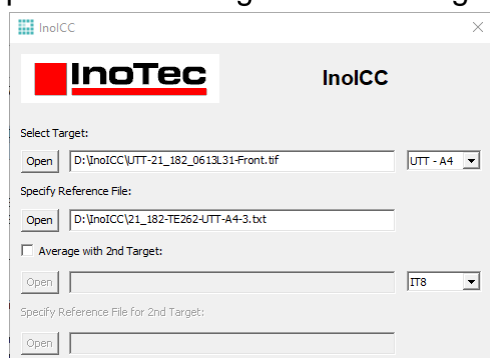
target these are 67 rows and for the A3 target 134 rows. The modified sample reference is to be saved under a different name after completion.

Alternatively, an Excel workbook named **UTT-XLS2TXT** can be used, which we also offer for download. This saves entering the individual values and thus also avoids input errors. To do this, replace the contents of *Table1* in the **UTT-XLS2TXT** workbook with the

	A	B	C	D
1	UTT			
2	ORIGINATOR "Image Engineering"			
3	MANUFACTURER "Image Engineering"			
4	CREATED "August 08, 2022"			
5	SERIAL "21_182"			
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 67			
11	BEGIN_DATA			
12	A1	19.4053	23.5587	-61.3267
13	A2	81.9987	1.3787	90.9122
14	A3	61.6905	38.7438	77.5232
...
76	GS_R_18	9.6001	-0.5807	0.0686
77	GS_R_19	5.4773	-0.4952	-0.9402
78	GS_R_20	5.4263	-0.4596	-0.5715
79	END_DATA			

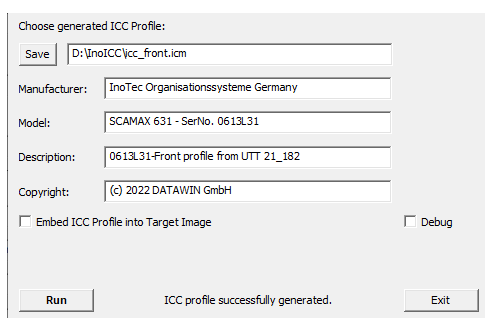
contents of *Tabelle1* from the original reference. In addition to *Tabelle1*, there are also the tables *UTT-A4* and *UTT-A3* in this workbook. These are automatically filled with the relevant reference values from *Tabelle1*. After switching to the table of the UTT format used, the content of the first five lines can still be customized. 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.

Once the necessary UTT images 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 UTT 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 UTT formats A4 and A3, an *IT8* can also be chosen as source image. This can make sense if a color profile is to be created without reference to ISO-19264-1 and thus no UTT is available as a target. 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.



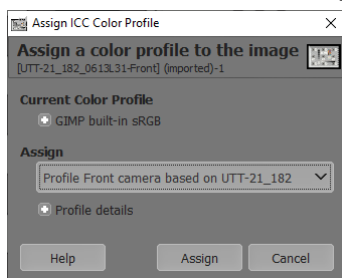
In the lower part of the dialog, the **Save** button is used to select name and path of the color profile to be created. If the color profile should be imported on the scanner later on, we recommend using the name **icc_front.icm** for a front side profile and **icc_back.icm** for a back side profile. 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 **iQ-Analyzer** (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 IQ-Analyzer

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 *ISO 19264-1 Level B*. The already mentioned image analysis software **iQ-Analyzer** is used for this purpose.

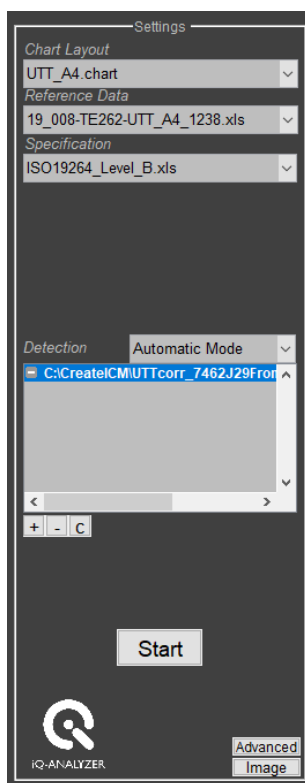
For the check, it is simplest to use the image of the UTT that was also used to generate




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 the image of the target has been loaded, the previously created color profile is assigned to the image in the menu item *Image->Color Management* by selecting the item *Assign Color Profile...* via a corresponding dialog (see left). Afterwards the image must be saved (*exported*)

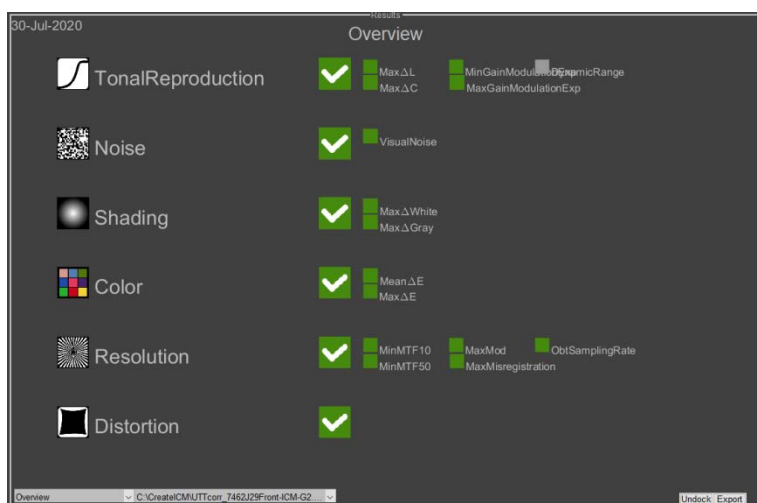
again in the same uncompressed TIFF format. Make sure that the assigned color profile is saved as well.

Furthermore, the reference file of the UTT target must be copied manually to *c:\Program-Data\Image Engineering\iQ-Analyzer V6.2.2.1\Data* (version may differ).



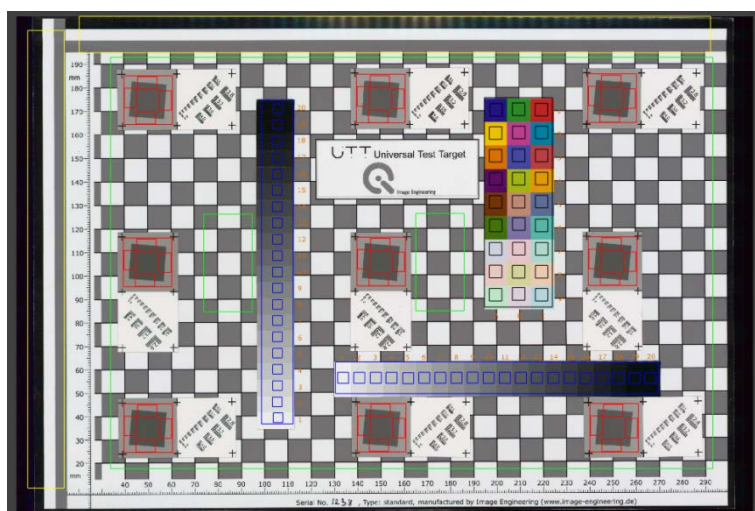
After starting **iQ-Analyzer**, a drop-down list in the upper left corner will only appear, when the  button (top right) is pushed. Selecting **UTT** there, the contents of the application screen will change completely and the section **Settings** will appear on the left side. First choose **UTT_A4.chart** as **Chart Layout** and select the previously copied reference file at the **Reference Data** section below that. For **Specification**, **ISO19264_Level_B** is the item to be used. Below **Detection**, which should remain in **Automatic Mode**, the last image of the UTT target can be entered using the small **+** button. If an image for the rear camera of the scanner was also created, it can be added to be analyzed together with the front camera image. The IQ Analyzer automatically uses the attached color profile to analyze the target image. However, this can also be controlled manually via the **Advanced** button in the lower right corner of the area.

Pushing the **Start** button the image analysis is initiated. At the same time a status bar appears in the upper right corner. The occurring warning regarding a "Dynamic Range" can be ignored.



Once the image analysis has been completed, an **Overview** appears in the main screen of the application, ideally showing green checkmarks in all six checked points (figure left). This means that the points have been passed the tests of the selected specification. If one or more points show a red cross here, the specification were not met in the corresponding kind of test.

At the lower edge of the application screen, a numerical summary and the individual test areas can be opened as detailed views via a drop-down list, in order to correctly evaluate individual deviations.

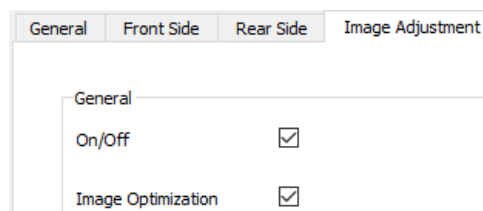


patches can be found in the description of iQ-Analyzer.

If not all points have been passed, first check if the analysis fields have been placed correctly on the image of the target. This can be done with the button *Image* (right bottom edge at *Settings* area), which switches from the *Overview* to the display of the target image with entered fields (called *patches* - see left). If there are significant divergences, either the scan of the UTT target should be repeated or the *Detection* can be changed to **Manual Mode**. The further procedure for adjusting the

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 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 UTT 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.