Solutions to test imageQuality

Image Engineering
Product Catalog

2013/2014

EDITORIAL

DEAR CUSTOMERS,

Thank you for your interest in our products for camera testing.
We hope that you will find everything you need in this catalog. Our product range covers the whole system beginning with test chart illumination, over test chart and camera mounting, the test charts, all the way to the evaluation software. Our emphasis lies on image quality analysis but we also provide devices to measure timing values, image stabilization, and spectral sensitivities.

Image Quality evaluation requires high quality test equipment. Besides producing this equipment, we also use it ourselves. In our own test lab we run tests every day for manufactures, system integrators and magazines. This way we ensure the high quality of our system and that our equipment fits the needs of your test lab as well.

We listen to our customers. Therefore please do not hesitate to contact us if you miss something. We are happy to provide individual solutions for you, from custom designed charts to individual software solutions. Need a specific test? Ask our iQ lab for assistance.

We are happy to share our experience in individual training courses with you and you are always welcome to visit us at our headquarters in the Cologne area in Germany.

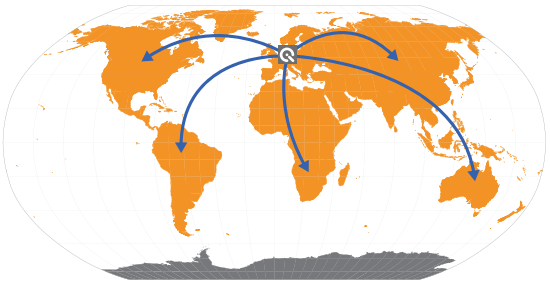
Dietmar Wueller
CEO

Uwe Artmann
CTO

Image Engineering GmbH & Co. KG

Augustinusstraße 9d
50226 Frechen / Germany

	INFORMATION	SALES	SUPPORT
TELEPHONE	+49 2234 995595 0	+49 2234 995595 50	+49 2234 995595 60
E-MAIL	info@image-engineering.de	sales@image-engineering.de	support@image-engineering.de
FAX	+49 2234 995595 10		
WEB	www.image-engineering.de		



A list with all distributors can be found on our website www.image-engineering.de. For worldwide delivery please see our webshop www.image-engineering-shop.de.

CONTENT

SOLUTIONS for your special needs

iQ dingus // Worldwide leading and practically used **TEST EQUIPMENT**

iQ lab // Whatever information is needed about your imaging system - whether resolution, spectral sensitivity, dynamic range, color reproduction quality, signal to noise ratio, or visual noise etc. – iQ lab measures it.

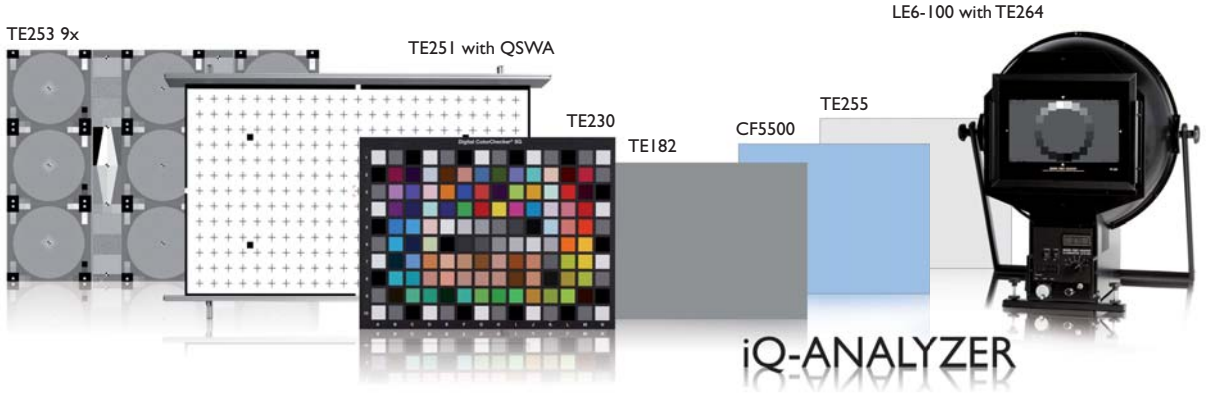
iQ spy // This is one of the highest performance **ANALYSIS TOOLS** in the area of digital imaging worldwide.

iQ data // Image Engineering provides data for several applications - like camera test results or spectral reflectances of natural objects - in online **DATABASES**.

iQ puzzle // Comprehensive, highly specialized assortment of more than 260 **TEST CHARTS**.

PHOTO

STARTER KIT PHOTO



Based on our experience in camera testing, we have prepared a kit with the most important equipment to check a digital still camera. There is no reliable way to measure the dynamic range without using a transparent target. So we have a TE264 to measure noise, OECF, dynamic range and ISO speed (ISO 14524, ISO 15739 and ISO 12232). A transparent target needs a uniform illumination, for which the LE6 is a very good choice. The integrating sphere illuminates the TE264 with tungsten light and can be changed to daylight using the color conversion filter. Together with the TE255, you get a very uniform light source to measure luminance and color shading (upcoming ISO17957).

We add a basic wall mount which holds the reflective targets. For color reproduction a reflective X-Rite Color Checker SG is in the package and distortion as well as lateral chromatic aberration can be measured using a TE251 (upcoming ISO 17850) chart.
And last but not least, the Starter Kit also allows for measuring resolution using sinusoidal Siemens stars as well as slanted edges according to ISO 12233 (upcoming 2013 revision). In order to evaluate all the images taken with the sample cameras the kit includes the most flexible analysis software for image quality evaluation called iQ-Analyzer.

LE6-100	Spherical transparency illuminator	TE251	Distortion · chromatic aberration crosses · A1066
TE264	OECF 20 ISO 14524 / 15739 revision · D280	TE230	X-Rite ColorChecker SG to be mounted on TE182
TE255	Diffusor plate · vignetting · D280	TE253 9x	Modulated sinusoidal Siemens star (slanted edge · kurtosis) · A1066
TE182	Neutral gray 18% remission · A1066	iQ-ANALYZER	Software to analyze digital camera including first year maintenance
CF5500	Conversion filter 5500 K · D280	QSWA	Wall mounting frames for four reflective test charts from size A280 up to A1066

The STARTER KIT PHOTO can also be modified for the special needs in **MACHINE VISION** or **SECURITY**, see our website for further information.

AUTOMOTIVE

STARTER KIT AUTOMOTIVE

In the area of automotive imaging two image quality aspects dominate the requests from our current customers. These are OECF in combination with high dynamic range and spatial resolution. Therefore our Starter Kit consists of an integrating sphere LE6-100 and a TE264 OECF chart with a contrast of 1.000.000:1 which equals a 120 dB dynamic range. A TE261 reflective chart with slanted edges in the A1066 size allows to measure the spatial frequency response (SFR) even for cameras with a high level of geometric distortion. The iQ-Analyzer allows the analyzing of these two image quality aspects in addition to a lot of others. With its flexible concept, it can be integrated into customer applications using the API or be used in stand-alone mode with its own graphical user interface.

LE6-100	Spherical transparency illuminator	iQ-ANALYZER	Software to analyze digital camera including first year maintenance
TE264	OECF 20 ISO 14524 / 15739 revision · D280	QSWA	Wall mounting frames for four reflective test charts
TE261	Slanted Edges 16:9		

MEDICAL / ENDOSCOPY

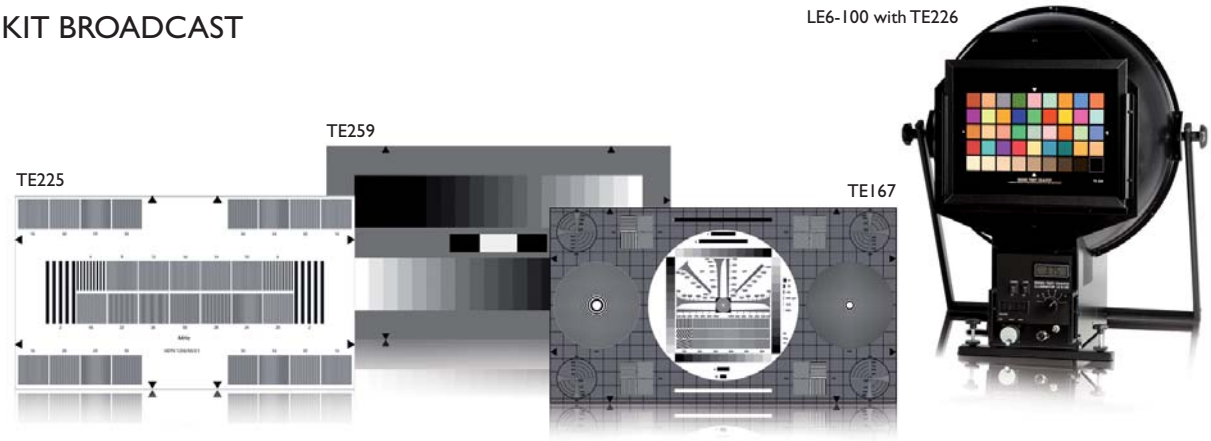
STARTER KIT MEDICAL

Most medical imaging applications are designed to capture images in a macroscopic or microscopic scale. Therefore the test charts have to be small. To ensure uniform illumination with the same light source used for the final images an integrating sphere with a diameter of 30 cm is recommended with a flange for the typical light sources (light source is not provided with the kit). Perpendicular to the illumination the integrating sphere has an opening with a chart holder for the 5 x 5 cm charts. A TE253 9x (according to ISO 12233) with sinusoidal Siemens stars is provided in D28 size for resolution measurement. In order to measure the OECF, dynamic range, and noise a TE240 chart with 24 gray steps (according to ISO 21550) is part of the package. Color can be checked with a transparent version of the Macbeth ColorChecker called TE188 D28 and for visual determination a TE136 and a TE132 resolution chart standardized in ISO 3334 for microfilm analysis is included.

IS30	30 cm integrating sphere (without light source)	TE188	Color rendition chart (X-Rite ColorChecker) · D28
TE253 9x	Modulated sinusoidal Siemens star · slanted edge · kurtosis · D28	TE132	ISO Test pattern No. 2 (1-18 LP/mm – sheet with 12 patterns) · D28
TE240	ISO 21550 dynamic range chart · available with max density of 4.0 or 6.0 · D28	TE136	USAF 1951 Target · D28

BROADCAST

STARTER KIT BROADCAST

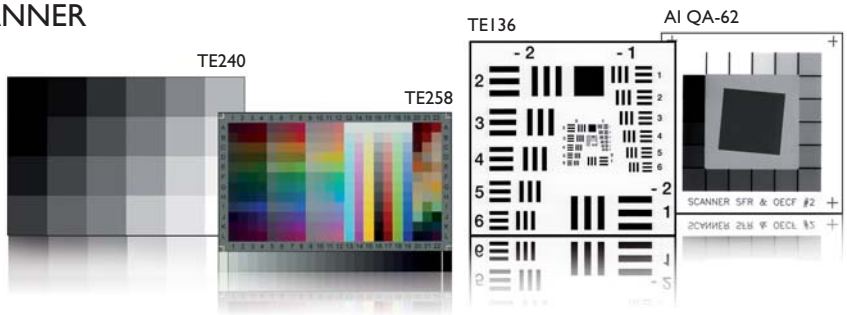


The Starter Kit Broadcast consists of a TE259, a TE225, a TE167, a TE226, and a LE6 illuminator. The TE259 is an OECF chart with horizontal gray scales and therefore suitable for analysis using a waveform monitor. The color rendition chart TE226 in combination with the LE6 illuminator allows to analyse and to help control the color reproduction of multiple cameras. TE225 is a resolution chart using regular line structures for visual analysis as well as analysis using a waveform monitor. Last but not least a multipurpose chart TE167 is part of the package in order to address several remaining aspects including the optical performance of the system.

LE6-100	Spherical transparency illuminator
TE167	HDTV Universal test chart · D280
TE259	OECF/Noise test chart · 20 steps · contrast 10.000:1 · D280
TE225	HDTV Resolution test chart · D280
TE226	HDTV Color rendition test chart · D280

SCANNER

STARTER KIT SCANNER

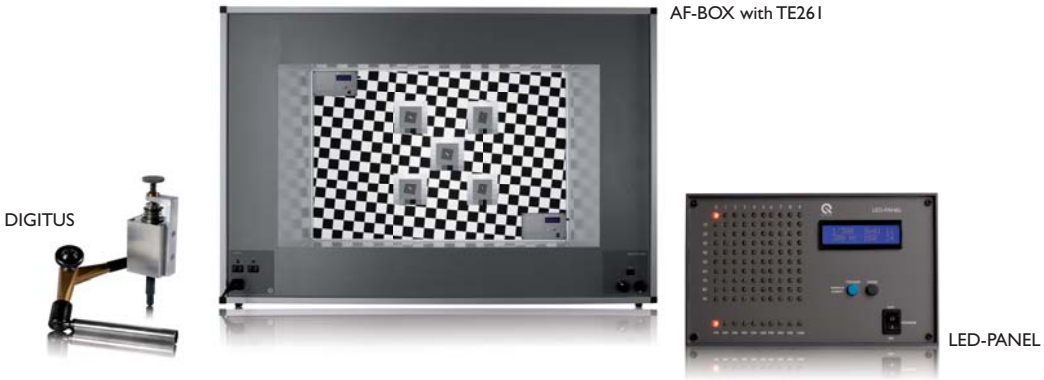


The image quality of scanners and cameras in general is tested using charts that are a degree better than the expected test result of the scanner. The TE240, to measure the dynamic range according to ISO 21550, is available as a transparent and reflective chart. In reflection, the achievable contrast is limited to about 2.4 densities. In transmission, the user can select between 4.0 densities and 6.0 densities. The IT8 color target (TE258) is the standard target for color profiling and testing scanners. We provide them in reflection and transmission with a large color gamut. The TE136 is used for visual resolution analysis and is also available as a transparent and reflective chart. Resolution measurement for scanners according to ISO 16067 is traditionally done with the slanted edge target QA-62. Unfortunately this target is currently available as a reflective chart only.

		reflective	transparent
TE136	USAF target	145 x 155 mm	D35 mm
TE240	ISO 21550 Scanner dynamic range chart	150 x 100 mm possible density 2.0	D35 mm possible density 4.0 or 6.0
TE258	IT8 Scanner characterization chart	127 x 178 mm (5" x 7")	D35 mm
AI QA-62	Slanted edge target / scanner SFR & OECF	95.25 x 76.2 mm (3.75" x 3")	

TIMING MEASUREMENT

TIMING MEASUREMENT KIT ACCORDING TO ISO 15781



An international standard on how to measure shutter release time lag, shooting time lag, shooting rate and startup time is available now. Since Image Engineering is part of the ISO group that developed this standard and Dietmar Wueller has been the editor of the document we know it very well and have designed a "Timing Kit according to ISO 15781" to meet the ISO requirements.
The AF-Box with dimmable fluorescent tubes illuminates the TE261 test chart that is slightly more sophisticated than the chart printed in the standard itself. With its slanted edges it can also be used for resolution measurements and focus accuracy tests. Two LED-Panels in the upper left and lower right corners are electronically connected to be started simultaneously from a single switch. Which ever LED-Box shows the earlier LED lighting up in the image after pressing the shutter release button is the one that will be used for the analysis. We deliver a DIGITUS with the kit to operate the switch accurately. DIGITUS can be attached to a tripod and adjusted to operate the exposure button and the switch at the same time.

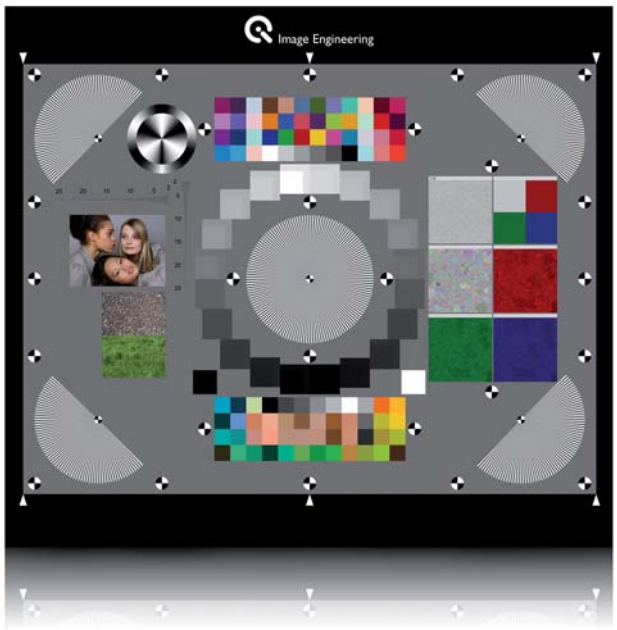
AF-Box with TE261 chart	Autofocus Box - Illumination box with four fluorescent lights
2x LED-Panel	Timing measurements in the range from 10 µs to 10 s
DIGITUS	Device to press shutter release button within less than 5 milliseconds

TE42 // FORTY TWO

The test chart FORTY TWO is capable to measure the following parameters with one single chart: OECF (Opto Electronic Conversion Function), dynamic range, resolution, shading, distortion, lateral chromatic aberration, color reproduction, and texture loss. These characteristics are measured according to ISO standards and analysed with the corresponding software (iQ-Analyzer).

The TE42 is a multipurpose chart and is suitable for cameras with sampling rates between 2 and 25 megapixels.

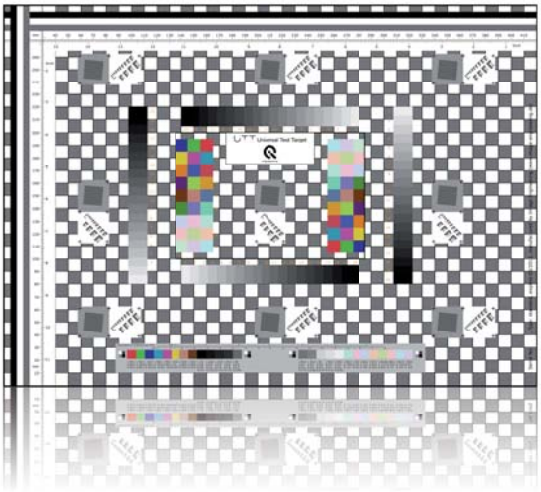
1. The **dynamic range** can be measured up to 10 f-stops (due to the limitations of a reflective target).
2. **Resolution** is measured in the center and the corners of the image.
3. **Distortion** is measured as TV-distortion.
4. **Delta E** is measured with ColorChecker SG comparable colors.
5. A colored random circles structure (dead leaves) is used to evaluate **noise reduction effects.**



ARCHIVING

TE262 | UTT (UNIVERSAL TEST TARGET)

The Universal Test Target is designed to evaluate the image quality of scanners and other digital input devices for archiving and is available in various sizes ranging from A4 to A0. For further information on the target specification see: www.universaltesttarget.com

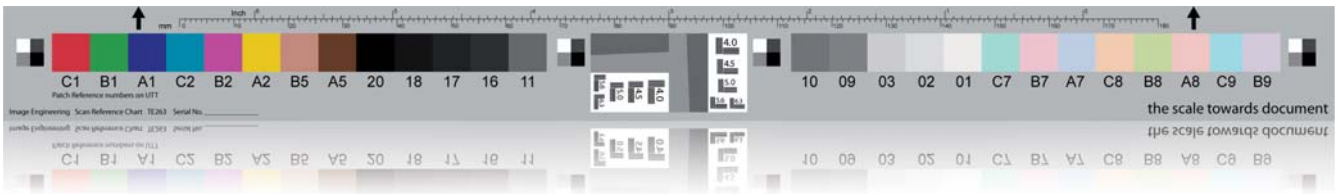


The chart covers the following TOPICS IN ARCHIVAL SCANNING

- » uniformity
- » banding and registration
- » distortion and deviations
- » resolution (slanted edge and visual)
- » dynamic range and OECF
- » noise evaluation
- » color reproduction
- » color registration
- » the use of additional reference charts

TE263 | SCAN REFERENCE CHART

The chart consists of gray steps, color patches, a scale and resolution pattern. It allows automatic analysis of each scanned page and – in combination with the right software – indicates information for the reason if a specific page happens to be out of specs.

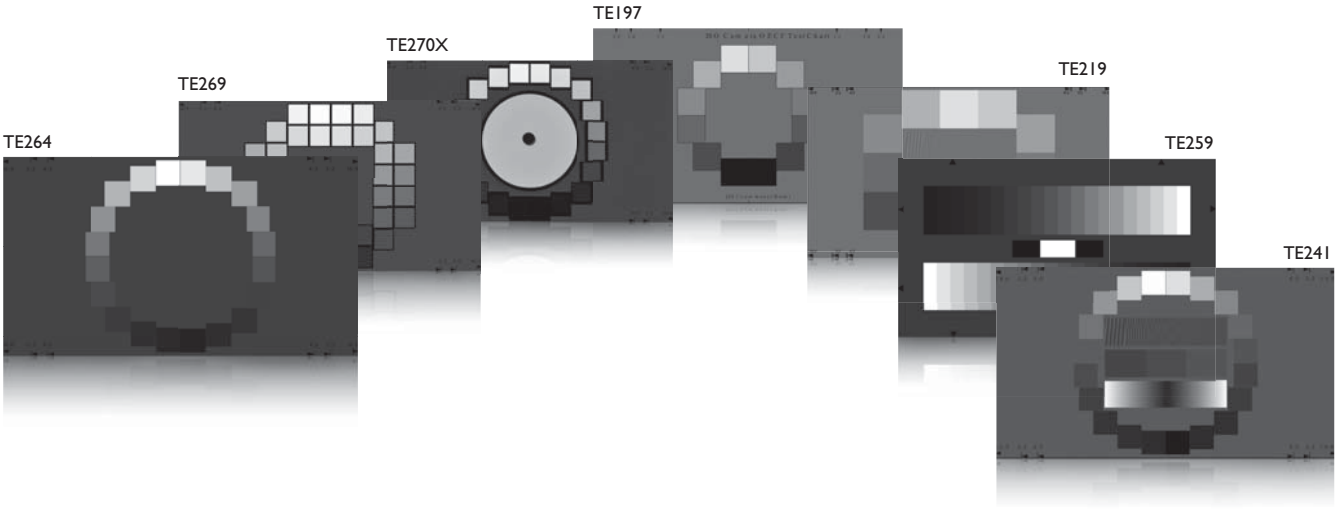


COLOR

Color rendition targets are used to check the quality of color correction (rendition) in cameras. On the one hand this can be a subjective analysis for pleasing colors or it can be a measurement for color reproduction quality. For the latter the image is converted into CIELAB space and the color values are compared to the measured colors of the original target. In order to calibrate color correction in cameras, the best way is to measure the spectral sensitivities with a camSPECS device. The most common chart in this area for cameras is the X-Rite ColorChecker which we sell under TE188 and the IT8 for scanners TE258. The TE226 is an extended transparent version of the ColorChecker. For cameras, an extended version is the X-Rite ColorChecker SG, which has become a standard target sold under TE230.

OECF

Measuring the characteristic curve of a camera is one of the most important tests. The resulting function is called the opto electronic conversion function (OECF). OECF measurements can be done based on the ISO standards 14524 and 15739, with one of our well-known charts TE197, TE219, TE241, TE259 or TE264. The TE241 follows the current ISO 15739 standard, but an upcoming revision of the standard has led to TE264. For the standard charts, the gray levels are generated on lithographic film using a half toning process. This could cause problems with high-resolution cameras which can be solved by slightly defocusing the camera. In addition we have designed the optional X-version of the TE264 on fine grain photographic material for cameras where defocusing is no option (like cell phone cameras). The TE264X is offered at almost any contrast level up to 1.000.000:1. For analysis with a waveform monitor we recommend TE259 with its horizontal gray scales. Cameras without manual exposure control can be tested using the TE270X chart. It uses two polarizing filters in the center of the chart to fool the automatic exposure. By turning the filters the density (transmission) of the central part of the test chart is modified. TE269 is one of our newest charts and provides more data points with its 36 patches. The selection of the suitable OECF chart should be based in general on the dynamic range of the test device. The chart should have a contrast ratio that is higher than the expected dynamic range of the camera under test.

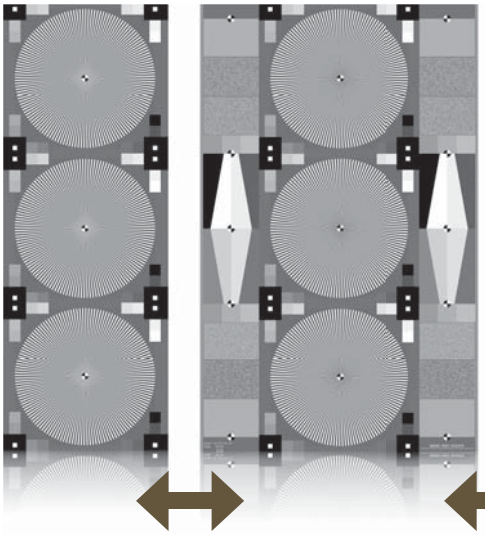


RESOLUTION

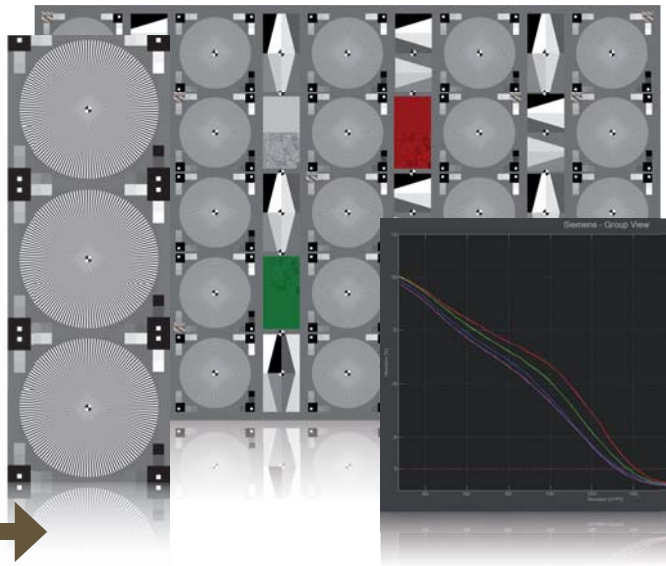
One of the most important values when testing a digital camera is the resolution. Although many people think that the number of pixels that a digital camera creates per image is a value for resolution, this is not the case. Resolution, according to ISO 12233 (digital still cameras) and ISO 16067 (scanners), is the ability of an image capture device to reproduce fine details in the captured scene. The number of pixels is a necessary but not sufficient requirement to get to a certain resolution. Optical parts like the lens and the antialiasing filter, as well as image processing, also have a significant impact on the resolution of a camera. And the smaller the pixels get the higher the influence of optical components on the resulting resolution.

We have several test charts in our portfolio to measure resolution. There are some charts for visual analysis only: TE170 (the original ISO 12233 chart), TE132 (No. 2, ISO 3334), TE143 (No. 1, ISO 3334), and TE136 (USAF). Our standard chart for resolution measurements is the sinusoidal Siemens star chart (part of the upcoming ISO 12233 revision). It can be used for all types of cameras, regardless of the amount of image processing applied to the images because each frequency is checked individually. The chart allows the analysis of the resolution at 9 positions in the image, in order to evaluate the fall off from optical center to the corners. The fact that it comes in 3 separate columns allows the adjusting of the chart to various image aspect ratios.

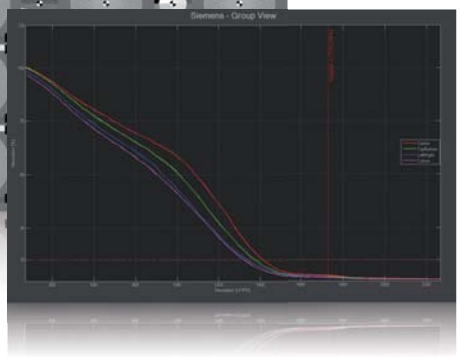
TE253 9x



TE268



MTF



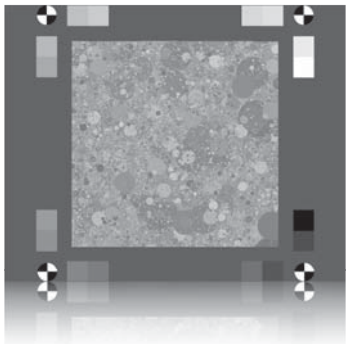
To get even more information over the image height TE268 consists of 25 Siemens stars. Another approach for measuring the resolution of a camera is the analysis of a slanted edge. This method is described in detail in ISO 12233, but can only be applied to images where almost no sharpening and compression is used because these image processing steps affect edges in a way that the edge analysis no longer represents the resolution of the camera.

A pilot study published at the Electronic Imaging Conference 2008 has shown that both methods, the Siemens star and slanted edge, deliver the same results when applied to uncompressed and unsharpened images.

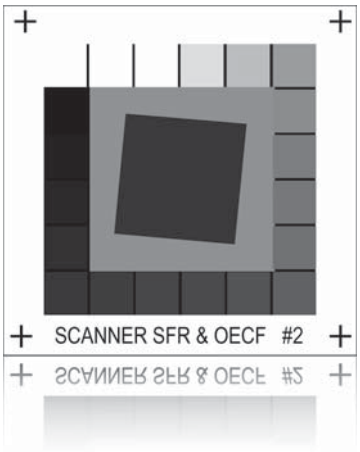
The TE253 and TE268 are equipped with slanted edges and some dedicated slanted edge charts are used for specific applications. Among these are the TE261 for focus analysis in the AF-Box, and the QA-61 and QA-62 for scanner analysis. For scanner analysis the multi-purpose Universal Test Target (TE262) also includes slanted edge structures.

For special purposes the power spectrum analysis performed on a white noise target (included the TE253) or a dead leaves structure (TE265) can also be an interesting method to measure resolution.

TE265



QA-62



WHITE NOISE PATCH

LE6

The spherical illuminators work on the principle of an integrating sphere.

A light source illuminates the interior of a sphere, which is coated with a special white diffuse coating. A plane (measuring window), which usually needs to be small compared to the diameter of the sphere and oriented perpendicular to the incident light, is illuminated extremely uniform. Due to our internal design the measuring window can be much bigger.

A special construction allows the dimming of the light down to approx. 1% of the maximum illumination without changing the color temperature. The color temperature is 3200 K +/- 50 K. Different filters are avaible for changing the color temperature as well as a 50 W and a 100 W version.

LE6-S is a cost efficient, not dimmable version of LE6-50 with constant illuminance of more than 3000 lux.

The standard test chart size for the illuminators is our D280 format. D240S has the same slide format but a smaller picture format. Therefore it fits without an adapter. Adapters are available for the chart sizes D240 and D205.

LG2

The most uniform light box that works with four fluorescent tubes.

One remarkable feature of the illuminator is its compact design. It even fits on the smallest laboratory table. An additional frame of solid metal provides high standing stability. The color temperature of approx. 4700 K can be filtered to achieve other correlated color temperatures.

The standard test chart size for the illuminators is our D280 format. A dimmable version is also available with the LG2-D.

	LE6-50	LE6-100	LE6-S	LG2	LG2-D
Principle	Integrating sphere	Integrating sphere	Integrating sphere	Light box	Light box
Light source	12 V / 50 W halogen bulb	12 V / 100 W halogen bulb	12 V / 50 W halogen bulb	4 x 24 W fluorescent tubes 32 kHz	4 x 24 W fluorescent tubes 32 kHz
Color temperature	3200 K +/- 50 K	3200 K +/- 50 K	3200 K +/- 50 K	app. 4700 K +/- 200 K	app. 4700 K +/- 200 K
Illuminance of test charts	> 3000 Lux	> 8000 Lux	> 3000 Lux	> 8000 Lux	> 8000 Lux
Uniformity of illumination	> 96%	> 96%	> 96%	> 80% (4:3 charts) > 90% (16:9 charts)	> 80% (4:3 charts) > 90% (16:9 charts)
Display	LC display showing illuminance (Lux) on test chart	LC display showing illuminance (Lux) on test chart	-	-	-
USB interface (optional)	+	+	-	-	-
Dimmable	1-100% of max. illumination	1-100% of max. illumination	not dimmable	not dimmable	1-100% of max. illumination
Integrated illuminance meter	+	+	-	-	-
Remote control	+	+	-	-	-
Tripod	+	+	+	optional	optional
Height of chart center	440 mm (table) 1300-1800 mm (tripod)	440 mm (table) 1300-1800 mm (tripod)	440 mm (table) 1300-1800 mm (tripod)	200 mm (table)	200 mm (table)
Power input	80 W / 90-260 VAC 50/60 Hz	120 W / 90-260 VAC 50/60 Hz	80 W / 90-260 VAC 50/60 Hz	US 110 - 130 VAC / 60 Hz EU 220 - 260 VAC / 50 Hz	US 110 - 130 VAC / 60 Hz EU 220 - 260 VAC / 50 Hz
Weight	11 kg	11 kg	11 kg	7 kg	7 kg
Dimensions	630 x 710 x 488 mm	630 x 710 x 488 mm	630 x 710 x 488 mm	590 x 450 x 110 mm	590 x 450 x 110 mm
Filters	filters from 2500 K - 6500 K are available			filters from 2000 K - 8000 K are available	

LE7 WITH iQ-LED

A revolution in test chart illumination and camera calibration

LE7 with iQ-LED

The iQ-LED is the latest development project of Image Engineering. It is a multi channel LED light source that provides the possibility to generate the spectral characteristics of nearly every required light source in just one device.
With its 22 different software controlled LED channels it is possible to generate a spectral match of standard light sources such as D50, D55, D65, A, B, C etc. with very high accuracy. You can generate your own spectrum, for example to match a given light source. The technical characteristics of the iQ-LED are particularly designed for the high requirements in the field of camera testing and camera calibration.

The LE7 with iQ-LED is the first Image Engineering product that uses this new kind of tunable light source. The integrated spectral radiometer combined with the iQ-LED control software, enables the user to select from different predefined spectra, and also allows to create custom spectral distributions and save these to be recalled at any time. Using different LEDs over a broad range of the spectrum enables narrowband illumination in different spectral areas to basically create any kind of color. Changing between different light settings is possible without any delays and can be defined individually by using the control software. The basic design of the LE7 is close to our previous LE6, so all the test charts can still be used.

Prototype, final design might vary - see www.image-engineering.de for latest developments.

The user interface of the control software in prototype stage set to D65.

The 22 channels of the iQ-LED.

ILLUMINATOR ACCESSORIES

Support with wheels and precise height adjustment for the LE6/LE7 series.

Tripods for the LE6/LE7 and LG2 series.

Case for storage, protection and transport of the spherical illuminator LE6/LE7 and the light box LG2.

STEVE

The Stabilization Evaluation Equipment (STEVE) is designed for qualitative analysis of image stabilizing systems under reproducible, realistic conditions.

STEVE is calibrated to provide the best performance at the most significant frequency / ampiltude combination of the human tremor of 4 Hz and 0.2 degrees. The whole range of available frequencies and angles of the movement corresponds to the properties of the typical tremor. For the initial setup, the mounting stage allows to adjust the camera position. The movement parameters of the two axes can be controlled separately. Moving about a single axis (yaw or pitch) is possible, as well as simultaneous operation in parallel or antiparallel way. Both, simple sine shaped motion and individual curves (e.g. to simulate a real handshake) can be realized and logged.

To determine the influence of the handshake it is neccessary to combine STEVE with a test chart. We recommend our AF-Box with TE261.

Camera weight	up to 5 kg
Moving frequency	1 - 12 Hz (optimized for 4 Hz)
Moving angle	0.1 - 0.5 degrees (optimized for 0.1 - 0.2 degrees)
Motion type	sine wave or individual curve
Mean position error	< 5% within optimized range
Standard accessory	camera mounting stage, controller box, USB cable
Optional accessory	DIGITUS
Minimal system requirements	Microsoft Windows XP SP3, USB interface
Weight	ca. 19.2 kg
Dimensions w x h x d	71 x 35 x 28 cm

AF-BOX

The Autofocus-Box is designed to illuminate a test chart at different light levels.

In combination with the LED-Panel the AF-Box can be used for low light / bright light shutter and shooting time lag measurements of digital cameras. By using the two rotary conrol units it is possible to switch from one light level to the other immediately. So two different light levels can be preset by just using a switch without remeasuring the illumination level again.

Illumination level	20 - 3200 Lux
Size of used test chart	A1066 (124.5 x 83.5 cm)
Provided test charts	TE261 (other on request)
Lamps	4 pcs. 18 W and 4 pcs. 36 W D50 (can be switched on/off separately)
Setting of light level	two rotary control units
Weight	ca. 30 kg
Outer dimensions w x h x d	128 x 86.5 x 87 cm

LED-PANEL

This is the ideal measurement device to determine shutter and shooting time lag, autofocus time, burst frame rate and the exposure times of digital imaging devices.

Extremely precise measurements with accuracy better than one millisecond are possible with this device. It meets all the requirements of the upcomming standard ISO 15781, which describes the measurement of shooting time lag, shutter release time lag, shooting rate and start-up time.

The LED-Panel has an interface which, can be controlled from a computer. Using a standard USB port, the different operation modes of the LED-Panel can be selected. Shutter and shooting time lag through adjusting the LED frequency can be activated as well as the display refresh mode and the continuous mode for exposure time and frame rate measurements. Of course the rolling shutter mode with its 10 LED rows moving simultaneously can also be selected through the command line API interface.

Using the USB interface, the maximum speed is already suitable for most applications with 5 kHz (200 µm). If you deactivate the USB connection and control the LED-Panel directly at the front panel, you can go up to 50 kHz, which is extremely fast. Therefore you have the choice whether to operate the device in USB or non-USB mode.

Operating mode	external trigger/single internal trigger/continuous
Adjustable times	via USB: 200 µs to 10 s manually: 20 µs to 10 s
Maximal reading measurement time	x 1000 of set time
LED running direction	left to right, right to left, top to bottom, bottom to top
Accuracy	< 0,06% from 1 ms to 10 s
Display refresh rate measurement frequency	from 1.0 Hz to 100 Hz
Dimension	215 x 131 x 82 mm
Supply voltage	8 - 15 V DC / 300 mA
Line voltage for included power supply	100 - 240 V AC 50/60 Hz

Measurable parameters
» shooting time lag (shutter lag with autofocus)
» shutter lag without autofocus
» autofocus time
» burst frame rate
» display refresh rate
» exposure time
» rolling shutter artifacts
» startup-time

DIGITUS

Timing is a critical measurement for imaging devices. The human finger can be a source of inaccuracy which you want to avoid in a lab environment. DIGITUS is like a mechanical finger and can press the release button within 25 ms. For touch screens, the finger tip can be changed.

It can be used for different measurement tasks and works well in combination with other devices, like STEVE and the LED-Panel.

CAMSPECS

camSPECS is a fast and affordable solution for measuring the the spectral response of a digital camera system (access to RAW image files* required). It contains the hardware and software tools, which are necessary to perform the measurement.

modified slide projector

one of the 39 filter mounting-plates with interference and reference filter

The light source is a modified slide projector with a stabilized power supply, a special light source filtering, and a customized optical system. A set of 39 narrow-band interference filters is used to generate monochrome light. The projector´s slide transportation system is used to place the filters subsequently into the optical path. Located next to the interference filters, reference neutral density filters are used to correct for different exposure levels. Thus it is possible to perform the measurement even with a camera set to automatic exposure control.
Customized versions of the camSPECS filterset, e.g. with extended IR capability, are available on request (not available for camSPECS express).

HARDWARE
Illumination device with filter set
Spectro radiometer for recalibration

TECHNICAL SPECS	
Light source	Halogen (24 V / 55 W) JCD24V55WDX
Durability of light source	1000 h
Wavelength range	380 - 720 nm (10 nm steps), 750, 800, 850 and 905 nm
Bandwidth	10 nm (380 - 720 nm), 40 nm (750 nm), 50 nm (800 - 905 nm)
Off band rejection	4.0 optical densities
Diameter interference filters	12.5 mm
Diameter ND filters	6 mm
Stabilized power supply	Adjustable 100 - 230 V, 50 - 60 Hz
Power input	Approx. 150 W
Dimensions (w x h x d)	291 x 136 x 304 mm
Weight	6 kg
Minimum distance camera lens to filter	12.5 cm

CAMSPECS EXPRESS

camSPECS express is a further development of camSPECS, which makes the measurement of the spectral sensitivity more convenient because all interference filters are mounted in a single "test chart".

39 interference filters and neutral density filters

The camSPECS express hardware consists of a metal housing with a stabilized power supply for the halogen light source. The 39 interference filters are mounted to the front plate. The interference filters provide monochromatic light from 380 nm to 905 nm. Inside the housing the device is equipped with a heat-absorbing filter, a diffusor plate and neutral density plates for each interference filter. The latter provides equal power output for the interference filter, so that the dynamic range of cameras is not exceeded. Neutral density filters in the front plate are used to compensate for possible non-uniformities over field.

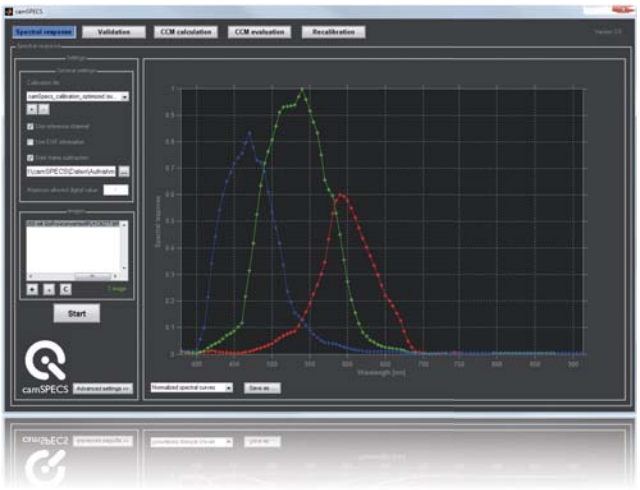
HARDWARE
Illumination box with filter panel
Spectro radiometer for recalibration

TECHNICAL SPECS	
Light source	Halogen (24 V / 250 W) Osram 64655 EHJ
Durability of light source	50 h
Color temperature	3550 K
Wavelength range	380 - 720 nm (10 nm steps), 750, 800, 850 and 905 nm
Bandwidth	10 nm (380 - 720 nm), 40 nm (750 nm), 50 nm (800 - 905 nm)
Off band rejection	4.0 optical densities
Diameter interference filters	12.5 mm
Diameter ND filters	8 mm
Stabilized power supply	Automatic adjustable 110 - 230 V, 50-60 Hz
Power input	approx. 300 W
Dimensions (w x h x d)	295 x 295 x 540 mm
Weight	7 kg

CAMSPECS SOFTWARE

The evaluation software makes measuring fast and convenient. It calculates the spectral sensitivity with the image data and the provided calibration data.
It reads image files like TIFF or common RAW files* and can perform a dark frame subtraction if needed. Additional features are the calculation of 3x3 color correction matrices with three different algorithms and the assessment of the measurement setup by comparing real camera data with predicted RGB values.
Non-Bayer pattern sensors (for example sensors with RGB-IR or RGBC pattern) can also be evaluated. In this case all four channels are displayed independently.

In order to characterize the colorimetric reproduction of a digital still camera, the spectral sensitivity curves gained with camSPECS can be evaluated using the Sensitivity Metamerism Index (DSCM/SMI) as described in ISO 17321-1. This standard conform procedure uses training data of eight patches from a ColorChecker to measure the camera metamerism. The index ranges from 0 to 100 (best) and is therefore easy to interpret.

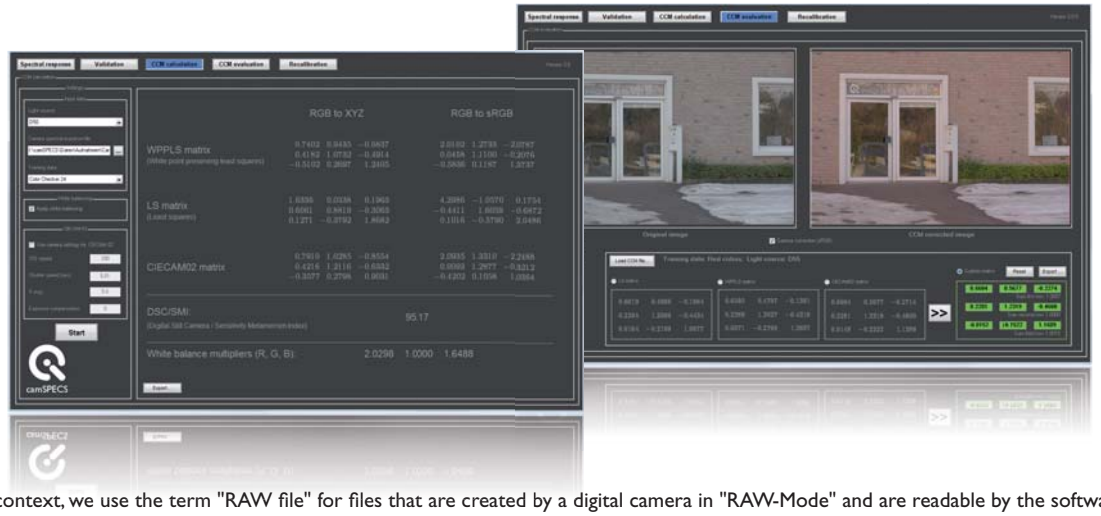


SOFTWARE
Spectral response measurement
RAW file* processing / dark frame subtraction / batch processing
Validation by comparing camera and predicted RGB values
Generation of the 3x3 color correction matrices (RGB to XYZ and RGB to sRGB) with tree different algorithms
Calculate white balance multipliers
Calculation of Digital Still Camera – Sensitivity Metamerism Index (DSC/SMI)
Visual evaluation of the CCMs with real images
Recalibration with included sprectroradiometer
Export all results to XML or plain text files

Determination of CCMs (color correction matrices)

The spectral sensitivity of a camera is interesting to look at but the real benefit is to use it to calculate the best color correction matrix for the camera. In order to do so the camSPECS software comes with a module that allows the calculation of such matrices. Three different algorithms are implemented, a least-squares linear regression, a white-point preserving least-squares regression and the CIECAM02 model. The required input data is the spectral response of the camera, the spectral distribution of the illumination and spectral training data.

The needed training data can either be the provided spectra of a ColorChecker or measured spectra from natural objects. Image Engineering can provide access to a huge database of in situ spectral radiance data (see page 22). A white balancing can optionally be incorporated into the calculation of the matrices.



* In this context, we use the term "RAW file" for files that are created by a digital camera in "RAW-Mode" and are readable by the software dcraw. This does not include RAW-files that do not follow any readable image file format. You will have to convert these files to e.g. 16 bit Tiff first.

MODULAR CAMERA TEST STAND

Image Engineering has developed a huge variety of components for camera test stands over the past years. A whole range of products has been constructed from simple chart holders to fully automated production line solutions. Now these components have been put together to form a modular system that can easily be customized for individual requirements.

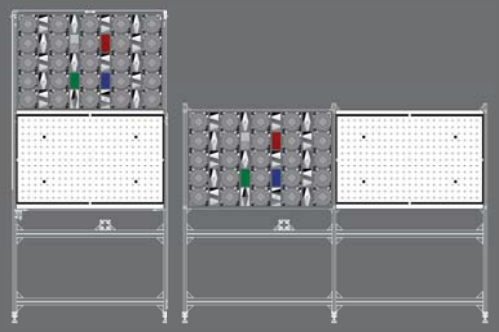
Every customer can configure his own test stand according to his needs. If there is a missing part it can be added without constructing a whole new solution. Therefore camera stands can be constructed faster and more cost efficient than ever before.

A camera test stand can be divided into the following BASIC PARTS. For each of these parts Image Engineering offers a variety of solutions that can be composed into a complete stand:

- chart mounting
- camera to chart distance
- camera positioning
- camera to chart alignment
- chart illumination sources
- illumination directions
- housing
- software

// CHART MOUNTING

For chart mounting we offer different versions from a simple wall and table mount through a horizontal sliding mount with integrating sphere holder to the manually operated iQ-ChartMount, a vertical sliding chart holder with integrating sphere support. The iQ-ChartMount is also available as a fully automated version. Currently only the vertical chart mount has the potential to be automated.



iQ-ChartMount vertical iQ-ChartMount horizontal

// CAMERA TO CHART DISTANCE

We offer two different systems to adjust the chart camera distance. One is based on a traditional camera stand that consists of a rail and a studio stand with vertical camera adjustment. This system is for manual operation only and large distances can be covered. We use this system with a 28 m rail in our own lab in Cologne. The second one is the iQ-CameraBench, a system based on a linear guide that can be motorized. In principle it can also cover large distances but it requires a certain height to be stable enough for larger cameras. It can also be operated manually.

iQ-CameraBench

// CAMERA POSITIONING

On the traditional camera stand the camera stand itself is used for vertical camera positioning and a special slide can be obtained if horizontal positioning is required. On the other system the special iQ-CameraMount is used for the vertical and horizontal (perpendicular to camera chart axis) camera movement.

iQ-CameraMount

// CAMERA TO CHART ALIGNMENT

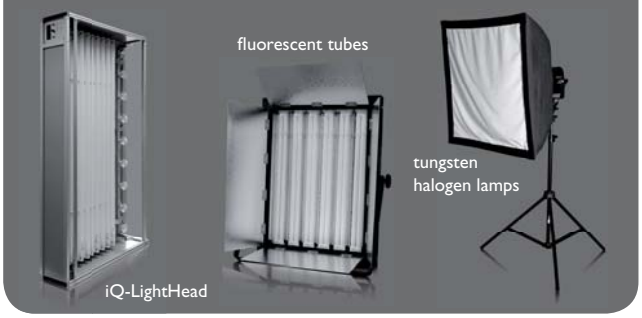
In order to align the camera to the chart in the simplest way, it is best to use a 3-way camera head with micro control. Our motorized iQ-CameraAllignRig can be used for automatic alignment. This device is able to turn the camera around pitch and yaw to align it to the chart. An automatic alignment to the chart can be implemented in combination with a live view output of the camera.

iQ-CameraAlignRig

3 way camera head

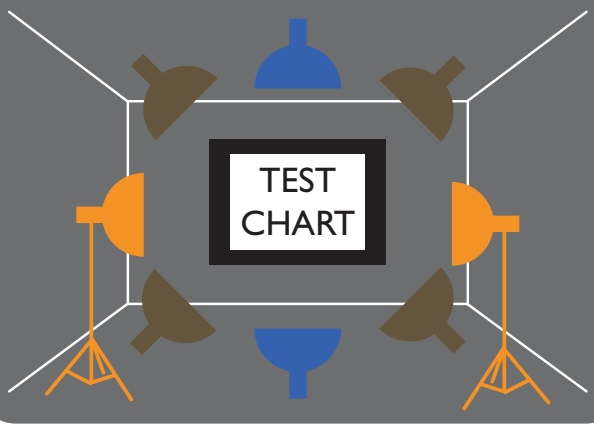
// CHART ILLUMINATION SOURCES

Our program currently includes four types of illumination sources. One is the LE6 / LE7 integrating sphere for illuminating transparent targets. The other three are for reflective targets. They are tungsten halogen lamps that can be filtered to daylight conditions (with a diffusor), fluorescent tubes with daylight characteristics (with diffusor) and our iQ-LightHead with various light sources that can be controlled from a computer using a USB interface. In order to illuminate test charts using the iQ-LightHeads two of these heads are needed, which are mounted on stands to achieve a uniform illumination.



// ILLUMINATION DIRECTIONS

The illumination can be mounted horizontally to illuminate the chart from the left and the right side. Another possibility is to mount the lights below and above the charts to save space. In the latter case the minimum distance of the camera to the chart and the uniformity of the illumination may be restricted by the geometrical limitations of the setup.

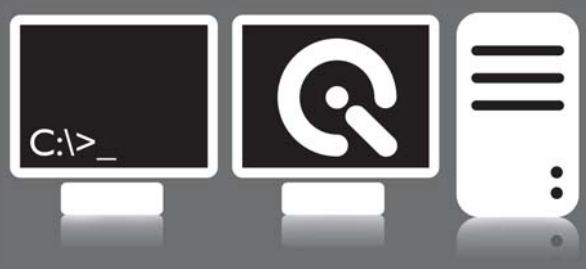


// HOUSING

If the camera test stand is not set up in a special room it is necessary to cover it from stray light and other aspects of the surrounding environment by using a form of housing. This should ideally be decoupled from the stand itself to prevent an impact on the measurement if someone touches the housing. The housing will be constructed individually depending on space requirements and limitations. It can have doors which include an automatic power switch off in case someone opens the door. A simple version of a housing is a framework covered by a tarpaulin.

// SOFTWARE

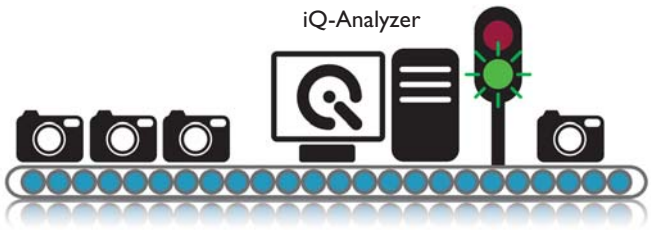
The standard software Image Engineering delivers for camera testing is the iQ-Analyzer. The analysis can also be integrated in custom designed production line software or your own software by using the command line option. Since the automation usually requires interaction of the software with the camera and test stand the software can be individually adapted to each camera. The motorized modules of the test stand are controlled using a USB interface and come with a SDK.



PRODUCTION LINE QA

Quality assurance

Not all production lines use a quantitative evaluation of the camera performance in aspects such as resolution, optical centering, shading etc. in order to differentiate the acceptable from the unacceptable cameras. This sometimes leads to a problem that the quality judgment depends on the individual person on the production line. A problem that can be avoided using an objective method that has been developed by Image Engineering and is currently, and successfully being used in camera production. In one specific project the camera is partly produced by one company and partly by another one. In order to agree on the acceptable tolerances and to minimize failures the two companies use the same production line control system.



MODULAR LIGHTSTUDIO

Test charts are used to test digital cameras and to perform objective measurements. But there are certain aspects in testing a camera that require a real scene. One of these aspects is the correct white balancing for different types of illuminants. Another aspect might be the determination of the visual loss of detail due to noise reduction or the amount of noise in an image. You can do tests with real scenes for yourself, but how to make these tests comparable over time? Or between different work groups when they are located in different parts of the world?

We have developed the lightSTUDIO to make this possible. It provides the standard types of illumination and is large enough to illuminate a whole table top scene. It also allows remote control and the dimming of the lights from a PC using a USB interface. In order to get a worldwide comparison between labs the lightSTUDIO comes with the entire interiour shown on the picture below. Each object was carefully chosen based on our experience in camera testing and can provide you interesting information about your camera system.
In 2012 the lightSTUDIO with its interior objects and the switchable light sources has developed to one of our top selling products. It is well on the way to becoming the industry standard for a camera test scene that can be illuminated with 6 different light sources at adjustable light levels.

BASIC LIGHTSTUDIO	
Supply voltage	220 – 240 V, 50/60 Hz
Outer dimension w x h x d	130 x 80 x 80 cm
Inner dimension bottom plate w x d	125 x 75 cm
Height of the area for a test scene	60 cm
Weight	ca. 45 kg
Power consumption	max. 200 VA
USB interface	USB 1.1


Basic lightSTUDIO

ADDITIONAL FEATURES

Optional LED light head
Now we have gone even further. Starting appr. late summer 2013 the light head can be exchanged for an LED based one that uses 20 narrow band LED channels and 2 white LED channels to spectrally match almost every standard light source. The LEDs are combined to units of 80 LEDs on a 10 x 10 cm area and a multiple of these can be combined to form larger light sources.

Optional moving targets (with rack)
Most devices feature still photography and video functionality nowadays. In order to compare compression technologies, artifacts, motion blur and other aspects in video the lightSTUDIO can be equipped with moving targets. One of these is a horizontally moving frame that can hold a variety of targets including a dead leaves or a slanted edge one. The speed of the motion is adjustable up to 3 m/s.
A second movable section is a rotating plate on the back wall of the box which also allows for adjusting the speed (up to 600 rpm). It can carry a sector chart or any kind of custom chart. In order to stabilize the whole setup with moving parts the option for moving targets also comes with a rack, on which the box is mounted.

HDR option
Another aspect that is important for modern digital cameras is the ability to capture high contrast scenes. In order to really create a high contrast scene it is necessary to add some back illuminated test patterns or images to the box. Two LG2 light boxes with transparent charts are used for this purpose. In order to avoid stray light, which reduces the contrast in the foreground, the light boxes are placed in the back of a surrounding black box. This box is inserted in the center part of the back wall of the lightSTUDIO. That way contrast ratios of more than 10.000:1 can be reached.

BASIC FEATURES OF THE LIGHTSTUDIO


Moving chart in the center


HDR Modul in the center

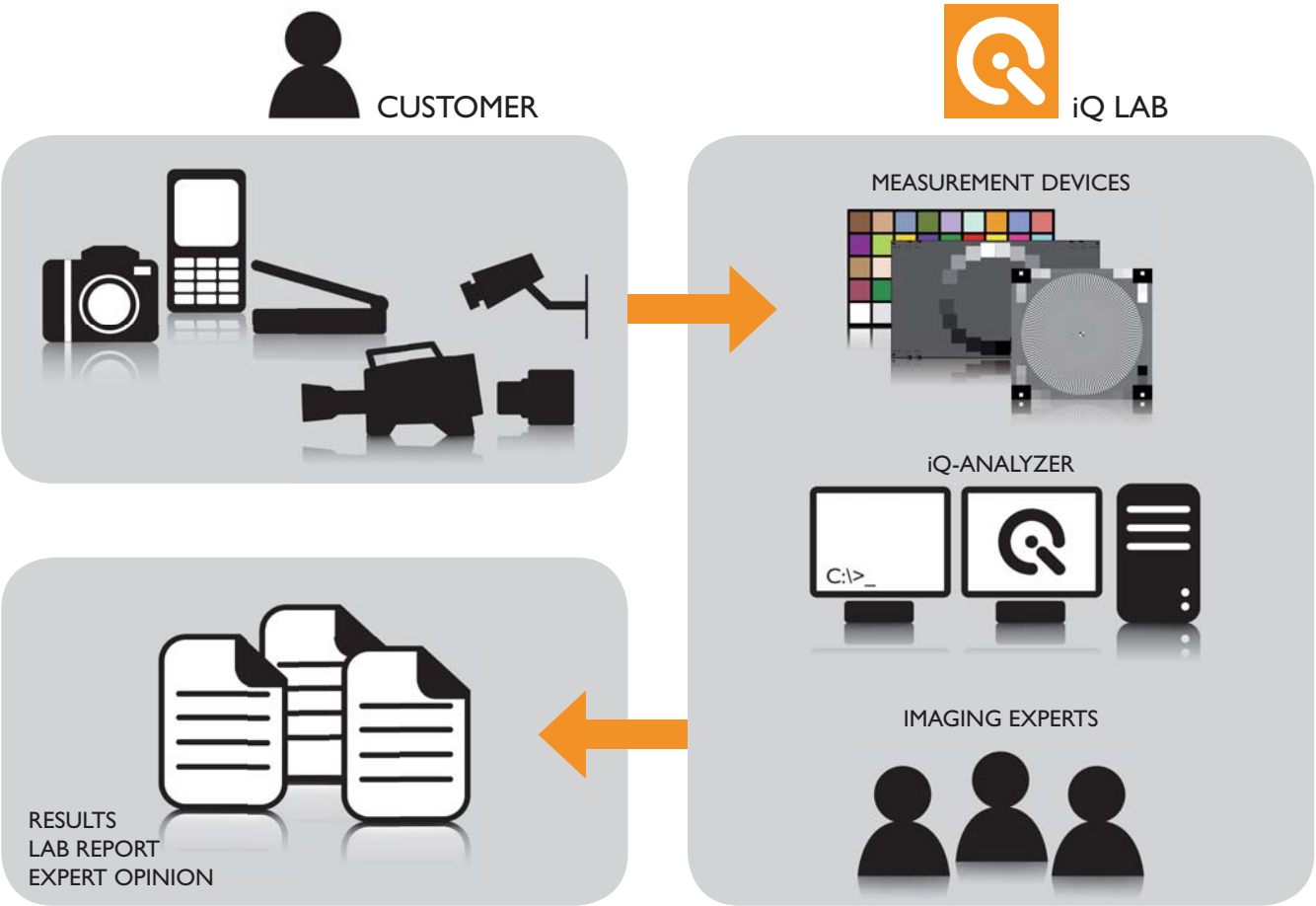
THE iQ LAB

We at Image Engineering produce high quality test equipment for customers worldwide. We do not only produce this equipment, we also use it ourselves. iQ lab is the test lab at our headquarter in Germany, which runs thousands of tests every year. You can also benefit from our experience.

Whatever information is needed about an imaging system – whether resolution, spectral sensitivity, dynamic range, color reproduction, noise or timing – our iQ lab can measure it. We use the latest available international standards and we explain what we do in detail, so that you can retrace the results and can use them to improve your products.

Since 1997, our lab has tested digital imaging devices for reputable international magazines and manufacturers. Over the years our lab has expanded the range of products measured on a regular basis and has developed extensive expertise in testing digital cameras, camera-lenses, broadcast cameras, automotive cameras, surveillance cameras, cellphone cameras, printers and scanners.
Even if you have your own lab, you can imagine the benefits of receiving an external, neutral expert opinion on your latest developments. Because we have so many years of experience and see hundreds of cameras per year, we have the capability to put the results in the right context.

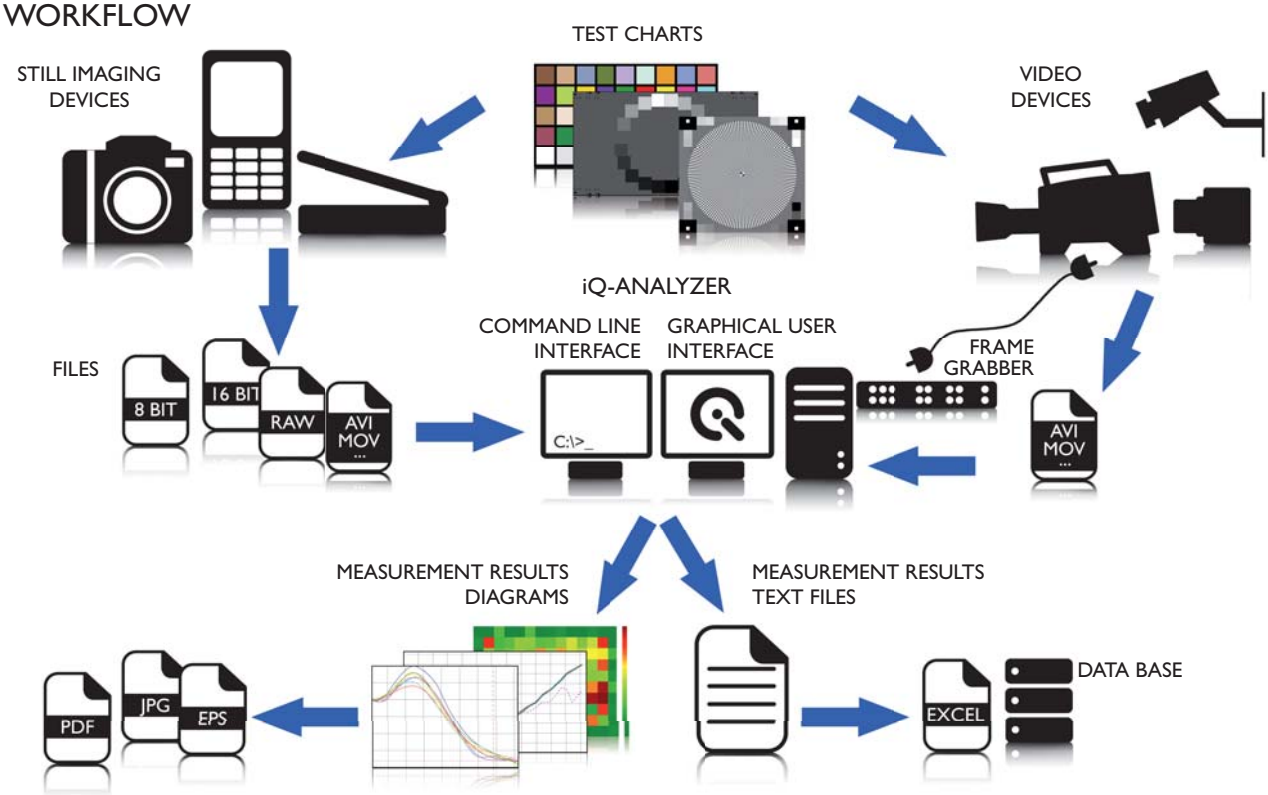
Contact us at iqlab@image-engineering.de and you can receive an individual offer for the tests you need.



iQ-ANALYZER

iQ-Analyzer is the leading market solution in the image quality analysis domain. Especially in combination with high quality test charts and illumination devices by Image Engineering it is a must-have for every camera manufacturer, independent of application area. All over the world, iQ-Analyzer has been widely and successfully used for years by engineers in the imaging world, like broadcasting, cinematography, archiving and photography. It has also proved its value in the development and quality assurance of mobile devices, such as webcams, cell phones, notebooks and tablet computers as well as in automotive, security and machine vision applications.
With the iQ-Analyzer we provide you a versatile tool at the cutting edge of international standards with excellent value for money.

// WORKFLOW



// FEATURES EXTRACT

COMMAND LINE INTERFACE
The Command Line Interface (CMD) allows you to integrate the capabilities of iQ-Analyzer into your individual workflow. iQ-Analyzer comes with a graphical user interface and as a command line version with full support of all features (except of Video module).

RAW FILE SUPPORT
iQ-Analyzer supports RAW image files in all modules and is able to convert and save them with user specific parameters.

BATCH EXPORT OF RESULT GRAPHS
Simply use a right-click context menu on a graph to add it to the export batch list. Save and manage your batch lists.

VIDEO FILE SUPPORT
The video module is able to extract frames from video files (multiple extractions per file in a batch are possible). They are simply passed on to other modules for a comprehensive analysis.

META DATA HANDLING
Image meta data is shown in a separate table for quick overview and is easy to edit.

// MAINTENANCE PROGRAM

Become a member of our **Maintenance Program** and benefit from free upgrade versions of iQ-Analyzer as well as from telephone and e-mail support. On demand, we will also design one custom test chart per year for free, including layout and reference data files for the automatic analysis with our software.

The **Advanced Maintenance Program** includes a two-days training course with customer-specific content, either online, at Image Engineering or on-site at the customer's location*. Includes implementation of up five custom design charts.

The Maintenance Program membership must be ordered directly along with the software purchase or not later than six weeks after delivery of the software. An annual membership fee applies.

// LICENSING

SINGLE USER: You can install the software on as many computers as you wish and use it on the computer with the attached USB dongle.

MULTIPLE USERS: We offer a discount for the second and following single user licenses purchased by the same company.

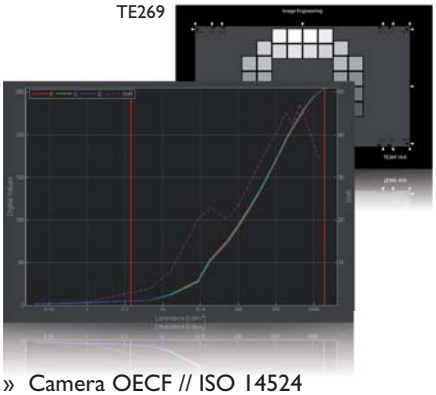
SITE LICENSE: Licenses for up to 10 simultaneous users and licenses for unlimited numbers of simultaneous users are available on request.

*Travel Expenses excluded.

// IMAGE QUALITY PARAMETERS EXTRACT

OECF

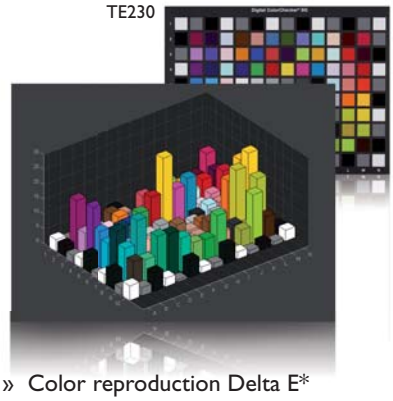
TE269



» Camera OECF // ISO 14524
» ISO Speed // ISO 12232
» **Noise**: fixed pattern noise · total noise temporal noise · visual noise // ISO 15739
» **Dynamic Range** // ISO 15739
» White Balance

COLOR

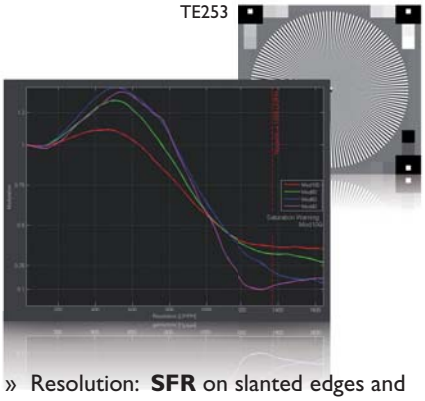
TE230



» Color reproduction Delta E*
» Luminance difference Delta L*
» Chroma difference Delta C*
» Hue difference Delta H*
» Selectable chromatic adaptation and color difference formulas

RESOLUTION

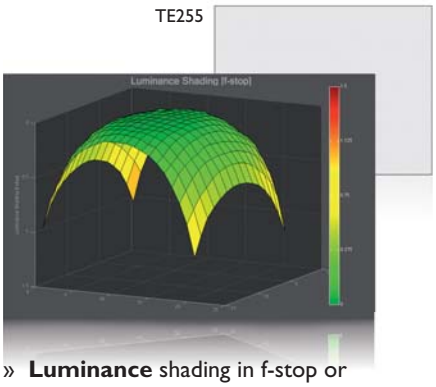
TE253



» Resolution: **SFR** on slanted edges and **MTF** on sinusoidal or bitonal Siemens stars // ISO 12233
» Power spectrum measurement on Dead Leaves and White Noise targets
» Kurtosis

SHADING

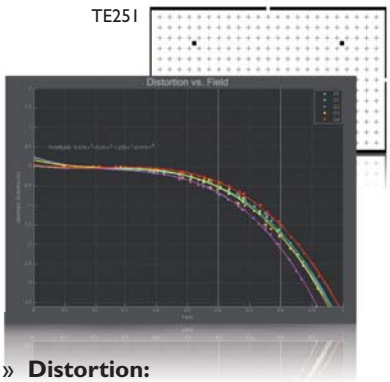
TE255



» **Luminance** shading in f-stop or as a percentage
» **Color** shading
» Noise depending on image field

DISTORTION

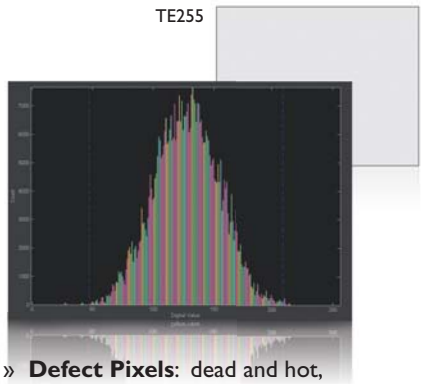
TE251



» **Distortion:**
Lens Geometric Distortion (LGD)
TV Distortion // EBU · SMIA
» **Chromatic Aberration**

HISTOGRAM

TE255



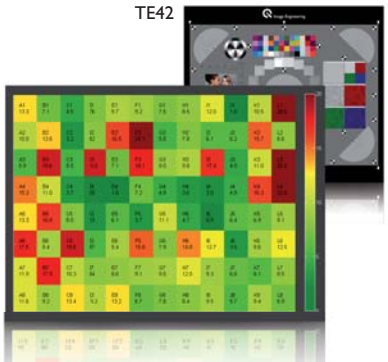
» **Defect Pixels**: dead and hot, single and clusters
» Histogram

VIDEO

» **Live video** signal acquisition
» **Video file** acquisition
» Waveform / Vectorscope
» Histogram analysis
» Color distance analysis
» Color comparison by making one camera a reference
» Capturing single frames and passing them on to other modules for further analysis

42

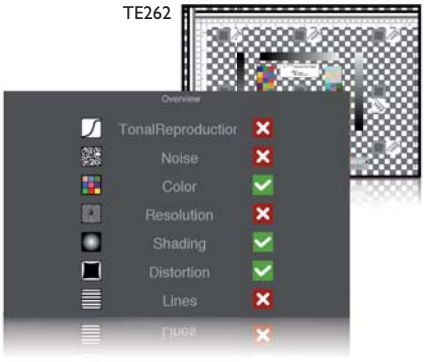
TE42



» Analyze the **TE42 "Forty Two" chart**
» Quick check for cameras, mobile phones and other devices
» Get the most important image quality parameters with one shot of the TE42 and this module

UTT

TE262



» Analysis of the **UTT target** // Metamarfoze Project www.metamorfoze.nl
» Customizable requirements
» Designed for scan / reproduction quality assurance in archiving
» Desigend for archiving domain
» see page 7

iQ-DATA

CAMERA COMPARISON BASED ON ISO STANDARDS

Our data base with image quality measurements of consumer cameras and system cameras, including DSLRs and lenses, grows almost every day. Based on our measurements for magazines it consists of more than 200 consumer cameras, more than 100 SLR and mirrorless system cameras, and more than 350 lens camera combinations (status Feb. 2013). The database is an ideal tool for setting up a side by side quality comparison of various devices. All measurements are based on existing and upcoming ISO standards and other international standards where available. The data measured includes: OECF (ISO 14524), Noise (ISO 15739), Signal to Noise Ratio (ISO 15739), Visual Noise (ISO 15739), Dynamic Range (ISO 15739), White Balancing, Color Reproduction (ΔE, ΔL, ΔC, ΔH, based on CIE 15), MTF (upcoming ISO12233 revision), Resolution (center, corners, upcoming ISO12233 revision), Acutance (contrast weighted with contrast sensitivity function of the human eye, CPIQ). All Parameters are tested at all full ISO sensitivity steps. In addition there is Start-up time (ISO 15781), Shutter-time-lag (ISO 15781), and Shooting-time-lag (1000 lux viewfinder, 1000 lux live view, 30 lux viewfinder, ISO 15781), Frame Rate (frames per second, ISO 15781), Frame Sequence (number of frames in sequence, ISO 15781), Flash Guide Number (ISO 1230). Test images taken of the TE42 target are available.
Included in a yearly free is a subscription to the database und usage of the data for internal analysis or marketing purposes.

IN SITU DATA

IN SITU SPECTRAL RADIANCES

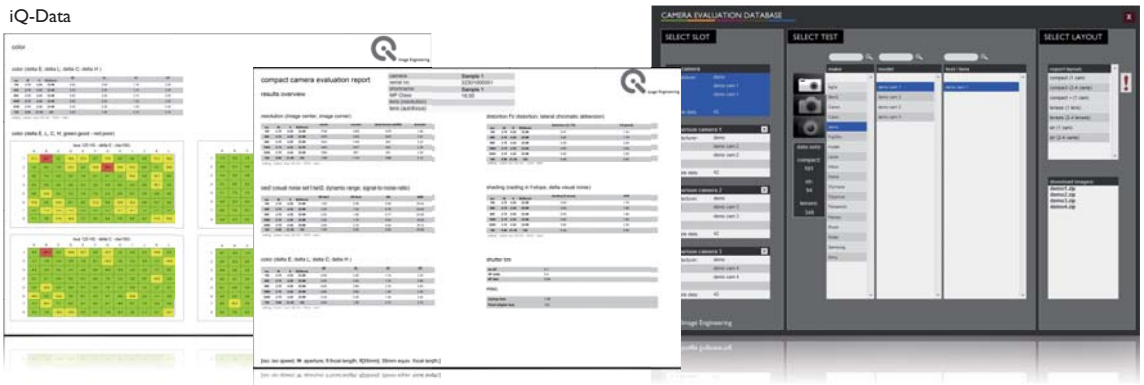
The only commonly known source for some in situ measured spectral radiances until now was ISO 17321-1. It describes the principle of how the color characterization of a digital camera works and provides spectral radiance for 14 common objects. Our in situ spectral radiance data project was started in order to collect several thousand measurements of all different kinds of objects under various illuminations keeping in mind typical scenes and objects that people take pictures of.

Why in situ?
In many cases the spectral radiation of objects is not only that of the reflected light. Some objects like leaves have a transmissive part. In other cases inter reflections between the objects modify the spectral radiance in scenes and some objects, like the human skin, appear totally different in real life compared to the skin tones of a reflective color target.

What for?
The collected data can be used as a scientific data base for different studies related to natural objects. But the main reason for collecting the data was to provide training data for the color characterization of digital cameras in combination with their spectral sensitivities. Currently a total number of app. 2500 measurements are available. With the database, you can optimize your color correction matrix based on real life data, not just a ColorChecker in your lab.

IN SITU DATA

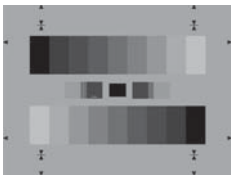
iQ-Data



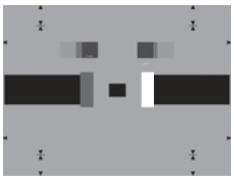
TEST CHARTS SORTED BY NUMBER

OECF/Gamma	Back Focus	Color	Black To White
Resolution/Multiburst	Geometry Grid Registration	Signal Evaluation	Universal Multipurpose

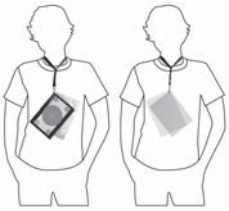
BBC61A
Flesh Tone Reference Test Chart (BBC approved)
The flesh tone test chart is designed for evaluating the flesh tone rendition of electronic cameras. The chart developed by the BBC London is a four color offset print. The spectral remission of the flesh tones approximates the natural flesh tone very well.



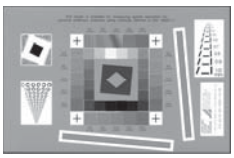
BBC64
Color Camera Gray Scale Test Chart (with super black hole)
The BBC64 is designed for the accurate adjustment of camera flare corrections and the setting of black level. Two 9-graduated counter current gray scales are arranged on a gray background. The gray scales being graduated logarithmically (gamma = 0.45).



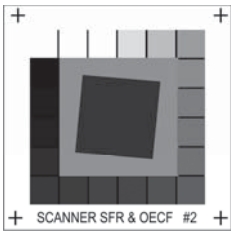
BBC65
Studio Camera Line-Up Test Chart (with super black hole)
The BBC65 is designed to be used in conjunction with the test chart BBC61A Flesh Tone Reference when very close color matching is required. BBC65 was developed to fulfill the need for a simplified studio test chart giving only the necessary information for routine day-to-day camera line-up in the shortest possible time. Black, white, gray fields and black lines with different frequencies are positioned on a gray background.



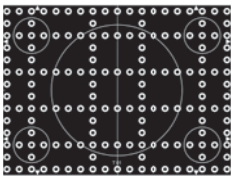
Double-Checker
With the Siemens star TE148 on one side and the white balance sheet TE115 on the other, this target is a practical and essential tool for every cameraman. The neckband is a practical way to use it easily in daily work.



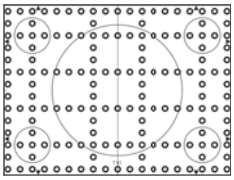
QA-61
Includes a slanted edge, an alphanumeric resolution chart, a Landolt Ring chart, and gray step patches. Horizontal, vertical and slanted Ronchi patterns are provided at 6 to 40 c/mm. Applied Image has also provided (as permitted in section 4.1.2 of the standard) a T-100 Digital Electronic Pixel Target which has horizontal, vertical and slanted bars in widths from 0.1 to 1.0 mm (width to length ratio is 1:5).



QA-62
Includes a dark gray 25 mm square rotated 5 degrees (CW) on a gray field. Surrounding grayscale patches change in discrete steps from white to black. Twenty patches are provided, measuring 9x9 mm each. The four corner-crosses measure 2.625" (66.68 mm) center to center. The upper right grayscale patch is equal in density to the background of the rotated square (0.50 density). The lower left grayscale patch is equal in density to the center rotated square (1.10 density).



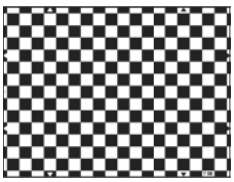
T01B / T01B 16:9
Geometry Test Chart / Ring TB (black surrounding)
The T01 is designed to measure the geometry of cameras and monitors. Circular rings are arranged in a grid in such a way that at ideal geometry their center points are located in the intersection points of a grid raster of lines in an electronic test generator (black surrounding).



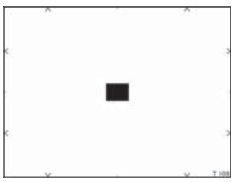
T01W / T01W 16:9
Geometry Test Chart / Ring TB (white surrounding)
The T01 is designed to measure the geometry of cameras and monitors. Circular rings are arranged in a grid in such a way that at ideal geometry their center points are located in the intersection points of a grid raster of lines in an electronic test generator (white surrounding).

T03
Depth Of Modulation 0.5 / 5 MHz
The T03 is designed for evaluating the uniformity of of a TV camera´s modulation depth. Between the line raster rows two white bars of different lengths are arranged on a black background (upper part) resp. two black bars of different lengths are arranged on a white background (bottom part).

T04 / T04 16:9
Bar Test Chart (IEC 61146)
The bar test chart is designed for checking the transmission characteristics of TV cameras at intermediate and deep frequencies. It consists of horizontal bars as a white-on-black and black-on-white background pattern.

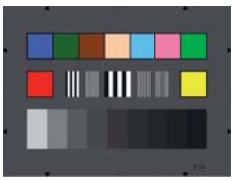


T06
Chess Board Test Chart
The T06 test chart is designed for checking geometry and resolution. It is composed of black and white square fields which are surrounded by rectangular fields at the edges which correspond to the grid raster lines of electronic test generators.

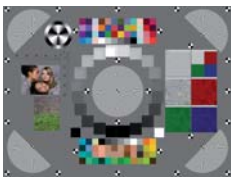


T10B
Scattered Light Test Chart 99% (IEC 84/60B)
The T10B is designed to measure localized flare of camera systems. In the center of the chart is a black area surrounded by a white area in a way that the average picture level is 99%.

OECF/Gamma	Back Focus	Color	Black To White
Resolution/Multiburst	Geometry Grid Registration	Signal Evaluation	Universal Multipurpose



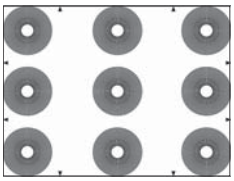
T13 ● ●
EBU Universal Film Test Chart (EBU Tech. 3087 · Pflichtenheft 8/1.1)
The T13 is designed for checking color and neutral gray reproduction, relative modulation depth, gradation and granularity of film material for television. On a neutral gray background three groups of test components (grays, colors, resolution patterns) are arranged within the picture-relevant area.



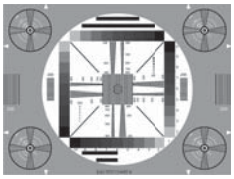
TE42 ● ● ● ● ○
Forty Two · Multi purpose chart for fast camera testing
This chart contains everything you need to measure the OECF, dynamic range (contrast limited to 1000:1), color reproduction quality, white balance, noise, resolution, shading, distortion, kurtosis (see page 7).

TE83 ●
ITE Grayscale Chart I (Gamma = 0.45)
The TE83 is designed for the evaluation of the halftone reproduction of an electronic camera. Two 11-graduated counter current gray scales are arranged on a gray background. The gray scales being graduated logarithmically (gamma = 0.45).

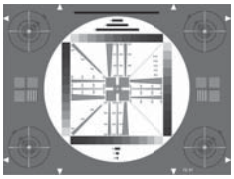
TE84 ●
ITE Grayscale Chart II (Gamma = 1)
The TE84 is designed for the evaluation of the halftone reproduction of an electronic camera. Two 11-graduated counter current gray scales are arranged on a gray background. The gray scales being graduated logarithmically (gamma = 1.0)



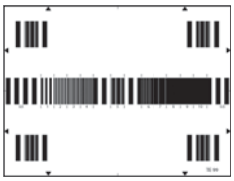
TE94 ●
ITE Radial Resolution Chart
The TE94 is designed for checking resolution over the whole picture area. It consists of nine sector stars of 90 (black and white) sectors each. Resolution measurement with TV lines is independent from TV standard.



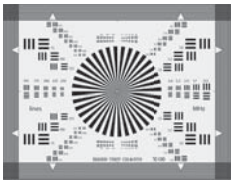
TE95 ○
ITE Resolution Chart / EIAJ Test Chart A
The TE95 test chart is designed for general (visual) appraisal of electronic cameras. It consists of circular figures, multibursts, vertical wedge-sharped rasters, diagonal lines and gray scales.



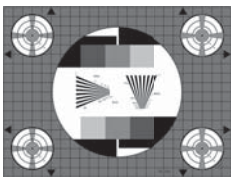
TE97 ○
High Resolution Universal Test Chart 1000 c/ph (= 2000 lines)
The TE97 is designed for the measuring and quick (most visual) appraisal of transmission characteristics of high resolution non-broadcast cameras. In addition to other features, it contains gray scales, multibursts and resolution wedges with different frequencies (vertical and horizontal).



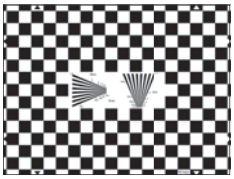
TE99 ●
Multiburst Test Chart (High-Class in Mega Cycle Chart)
The TE99 is designed to measure frequency response of the modulation depth of electronic cameras. A line raster is arranged in the center of the test chart which produces frequencies of 0.5 to 10 MHz in the output of the TV camera. Bar rasters are located in the corners of the test chart and produce frequencies of 0.5 and 5 MHz.



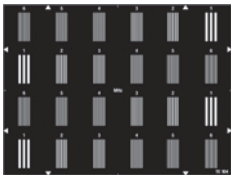
TE100 / TE100 16:9 ●
Lens Focus Test Chart
The TE100 is designed for the adjustment of camera lenses, checking back focal distance and resolution, and establishing cushion and barrel distortion. It consists of a Siemens star, outlined arrows and several black and white line pairs.



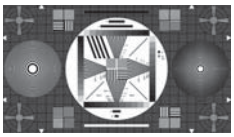
TE101 ○
Standard Test Chart
The TE101 is designed for the general (visual) appraisal of TV cameras. The circular figures and the grid make a rough appraisal of the geometry possible. The wedge-shaped line rasters are used for the visual appraisal of the resolution limit. The gray scales are designed for the evaluation of the halftone reproduction.



TE102 / TE102 16:9 ○ ●
Chess Board Test Chart
The TE102 test chart is designed for checking the geometry, resolution and uniformity of signal generation. It is composed of black and white square fields. Two resolution wedges in the middle of the chart allow for the checking of vertical and horizontal resolution.



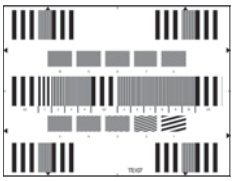
TE104 ●
Multiburst Test Chart 1-6 MHz (negative)
The TE104 is designed for resolution measurements, mainly for visual tests. It consists of four rows, each with six fields of multiburst frequencies (1-6 MHz).



TE105 16:9 ○
Universal Test Chart
The TE105 test chart is designed for the general (visual) appraisal of 16:9 TV cameras. It consists of circular figures, gray scales, wedge-shaped line rasters, zone plates, a grid, diagonal and horizontal lines.

TE106 / TE106 16:9 ●
Color Bar Test Chart
The TE106 is designed for checking the color rendition of TV cameras. The picture area is divided into six color bars showing the three primary colors red, green and blue and the secondary colors cyan, yellow and purple; in addition there is one bar of white and black. The succession corresponds to that of an electronically generated color bar.

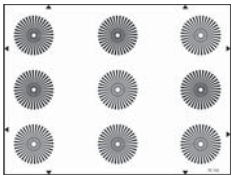
OECF/Gamma	Back Focus	Color	Black To White
Resolution/Multiburst	Geometry Grid Registration	Signal Evaluation	Universal Multipurpose



TE107 / TE107 16:9 (Resolution/Multiburst)
Multiburst Test Chart (0-10 MHz)
The TE107 is designed for checking the frequency response and the uniformity of an electronic camera. A line raster is arranged in the center of the test chart which produces frequencies of 0.5 to 10 MHz in the output of the TV camera.

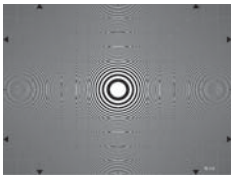
TE108 (OECF/Gamma)
Log. Gray Scale Test Chart (9 steps)
The TE108 is designed for the evaluation of the halftone reproduction of an electronic camera. Two 9-graduated counter current gray scales are arranged on a gray background. The gray scales being graduated logarithmically.

TE109 (OECF/Gamma)
Log. Gray Scale Test Chart (5 steps)
The TE109 is designed for the evaluation of the halftone reproduction of an electronic camera. Two 5-graduated counter current gray scales are arranged on a gray background. The gray scales being graduated logarithmically.

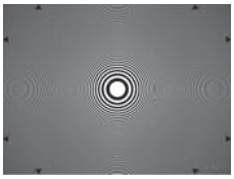


TE110 (Back Focus)
9 Sector Stars Test Chart (36 cycles)
The TE110 is designed for the adjustment of camera lenses, checking back focal distance and checking resolution over the picture area. The test chart consists of nine sector stars. Within the sector stars are two circular lines, which mark a 625 and a 312 line structure (525 / 262 in the NTSC version).

TE111B / TE111B 16:9 (Color)
Critical Flesh Tones Test Chart
The flesh tone test chart is designed for evaluating the flesh tone rendition of electronic cameras. The picture shows the portraits of three women with ideal and critical flesh tones.

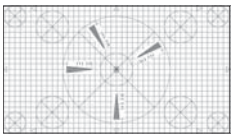


TE113 / TE113 16:9 (Signal Evaluation)
Zone Plate With MHz-Grid
The TE113 is designed for checking the resolution characteristics and "cross color" interferences of TV cameras and TV transmission systems. The test chart shows a zone plate over the whole image area where the spatial frequency of the rings has a linear increase towards the edges. The line grid marks the spatial frequency in vertical and horizontal direction.

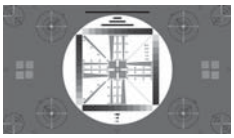


TE114 (Signal Evaluation)
Zone Plate Test Chart
The TE114 is designed for checking the resolution characteristics and "cross color" interferences of TV cameras and TV transmission systems. The test chart shows a zone plate over the whole image area where the spatial frequency of the rings has a linear increase towards the edges.

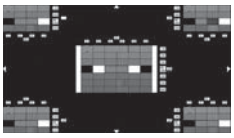
TE115 / TE115 16:9 (OECF/Gamma, Color)
White Balance Chart 70% Reflectance
The TE 115 chart is designed for white balance. The density of the white area is 0.15 (based on BaSO4=0). This corresponds to a remission of 70%.



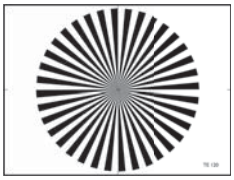
TE116 16:9 (Geometry Grid Registration)
HDTV Grid Test Chart
The TE116 is designed for the operational adjustment and control of HDTV cameras. It consists of circles permitting rough visual appraisal of scan linearity. Lines serve the purpose of adjusting registration and wedges serve the purpose of resolution appraisal.



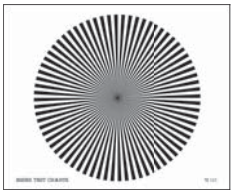
TE117 16:9 (Universal Multipurpose)
HDTV Universal Test Chart
The TE117 is designed for the quick (mainly visual) appraisal of HDTV camera´s transmission characteristics. It consists of a gray background on which circles, gray scales, horizontal and vertical lines are positioned.



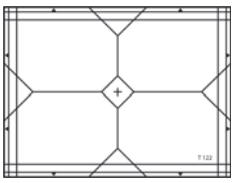
TE118 16:9 (Resolution/Multiburst)
HDTV Resolution Test Chart (100-600 c/ph)
The TE118 is designed for checking the resolution characteristics of HDTV cameras. Five fields with different line grids and black and white reference are arranged on a black background. The line grids are inclined in different angles.



TE120 (Back Focus)
Sector Star Test Chart (36 cycles)
The TE120 test chart is designed for the adjustment of camera lenses and checking back focal distance. It shows a 36 sector Siemens star on a white background.



TE121 (Back Focus)
Sector Star Test Chart (72 cycles)
The TE121 test chart is designed for the adjustment of camera lenses and checking back focal distance. It shows a 72 sector Siemens star on a white background.



TE122 / TE122 16:9 (Geometry Grid Registration)
CCD Registration Test Chart
The TE122 is designed for measuring registration errors in a CCD camera.

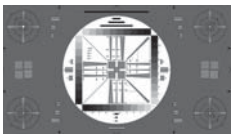
● OECF/Gamma ● Back Focus ● Color ● Black To White
● Resolution/Multiburst ● Geometry Grid Registration ● Signal Evaluation ○ Universal Multipurpose

TE123 ●
100% Red
The TE123 is designed for measuring the behaviour of the chrominance channel expressed as the signal-to-noise ratio.

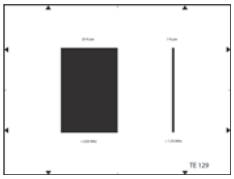
TE124 16:9 ●
HDTV Resolution Test Chart (100- 600 c/ph)
The TE124 is designed for checking the resolution characteristics of HDTV cameras. The test chart with an aspect ratio of 16:9 shows nine blocks containing 42 resolution patterns each in the middle area. The corner fields have 20 resolution patterns.

TE125 16:9 ●
HDTV Zone Plate Test Chart (600 c/ph · asymmetric)
The TE125 zone plate test chart is particularly suited for the visual determination of a high definition camera´s resolution. It shows an asymmetrically arranged one zone plate ranging from 0 to 600 c/ph and two zone plate sectors with their centers located in the left corners. The gore-shaped gaps are gray.

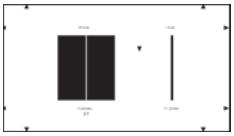
TE127 16:9 ●
Log. Gray Scale Test Chart (9 steps)
The TE127 is designed for the evaluation of the halftone reproduction of a camera with a 16:9 aspect ratio. Two 9-graduated counter-current gray scales are arranged on a gray background. The gray scales being graduated logarithmically.



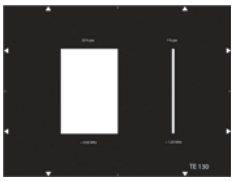
TE128 16:9 ○
ITE High Resolution Chart
The TE128 is designed for the measuring and quick (mostly visual) appraisal of transmission characteristics of high resolution non-broadcast cameras. It consists of a gray background, a white circle, gray scales, multibursts, resolution wedges with different frequencies (vertical + horizontal) and circular rings.



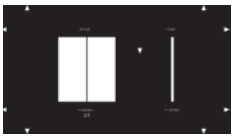
TE129 ●
Black Pulse Bar Test Chart
The TE129 is used to measure the low and intermediate frequency response (streaking) and flare in video systems. A black rectangle (width equal to 25% of picture width; approx. 0.05 MHz) and a narrow black pulse (width equal to 1% picture width; approx. 1.25 MHz) are shown on a white background.



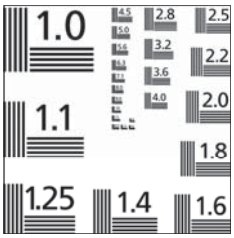
TE129 16:9 S ●
Black Pulse Bar Test Chart (+2T pulse)
The TE129 is a chart with an additional 2T-pulse in the middle of the black 25%-pw-pulse.



TE130 ●
White Pulse Bar Test Chart
The TE130 is used to measure the low and intermediate frequency response (streaking) and flare in video systems. A white rectangle and a narrow white pulse are shown on a black background.

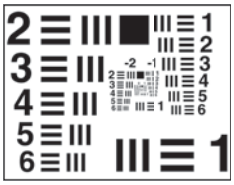


TE130 16:9 S ●
White Pulse Bar Test Chart (+ 2T pulse)
The TE130 is a chart with an additional black 2T-pulse in the middle of the white 25%-pw-pulse.

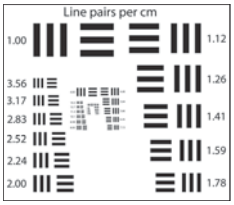


TE132 ● ●
ISO Test pattern No. 2 (1-18 LP/mm · sheet with 12 patterns)
This chart is designed for resolution measurements. Five pairs of lines (black and white) with frequencies from 1-18 line pairs per millimeter are printed on a white background. The patterns are ordered counterclockwise in decreasing resolution on the chart.

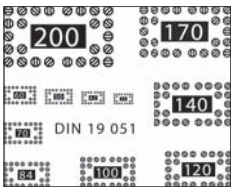
TE135 ●
Multiburst (Megacycle) Test Chart (0.5 · 1 · 1.5 · 2 · 2.5 · 3 · 5 · 6 MHz)
The test chart is designed for measuring the amplitude frequency response of the luminance channel, i.e. the amplitude of the output signal relative to a reference level as a function of frequency. A multiburst with different frequencies is shown on a gray background.



TE136 ●
USAF 1951 Target
The TE136 is designed for resolution measurements. It shows patterns, based on three black bars on white ground, in horizontal and in vertical direction.

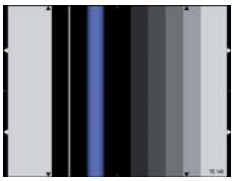


TE138 ●
Line pairs per cm (1-28.5 LP/cm · set of 10 pcs.)
The TE138 is designed for resolution measurements. Frequencies from 1-28.5 line pairs per centimeter are printed on a white background. The patterns are ordered clockwise in decreasing resolution on the chart.



TE143 ●
ISO Test pattern No. 1 (sheet with 20 pattern · DIN 19051)
The TE143 is designed to check the readability of document reproductions. In pattern number 84 the direction of the two lines inside the octagon must be recognized without problems for seven out of eight symbols.

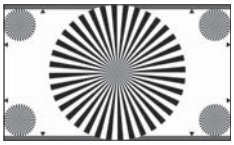
● OECF/Gamma ● Back Focus ● Color ● Black To White
● Resolution/Multiburst ● Geometry Grid Registration ● Signal Evaluation ○ Universal Multipurpose



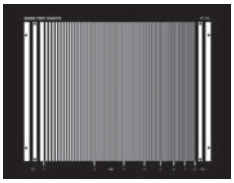
TE145 ●
Test Signal Test Chart · Line 17
The TE145 is designed for measuring several signal parameters according to the definitions set in CCIR Recommendation 569. It consists of a gray scale, a color gradient, gray and black bars of different sizes.

TE146 ●
Test Signal Test Chart · Line 18
The TE146 reproduces the test signal, line 18 as specified in CCIR Recommendation 473. With the aid of measuring instruments test signals can be evaluated in a simple and partially automatic way. It consists of a multiburst with different frequencies.

TE147 ●
Test Signal TC · Line 18 with 0.2 MHz
The TE147 reproduces the test signal, line 18, as specified in CCIR recommendation 473. With the aid of measuring instruments test signals can be evaluated in a simple and partially automatic way. It consists of a multiburst with different frequencies.



TE148 16:9 ●
Sector Star Test Chart (36 Cycles)
The TE148 is designed for adjustment of camera lenses and checking back focal distance. It consists of a large Siemens star in the center and four smaller ones positioned in the corners of the test chart.

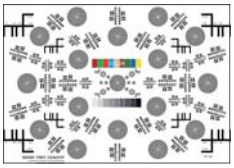


TE152 ●
Frequency Response TC (1-8 MHz continuously)
The TE152 is designed for checking the frequency response of a camera. The test chart shows vertical lines over the whole image area ranging from 1 to 8 MHz.

TE153 ●
Log. Gray Scale Test Chart (11 steps)
The TE153 is designed for evaluation of the halftone reproduction of electronic cameras. Two 11-graduated counter current gray scales are arranged on a gray background. The gray scales being graduated logarithmically. The contrast range of the gray scales is 40:1.

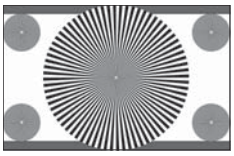
TE155 ●
Window Test Chart 3/10 Picture Height (IEC 61146)
The TE155 is designed for evaluating the degree of the spurious image that remains after removing the still subject being shot. Therefore the black test chart has a transparent square in the center.

TE156 ●
Window Test Chart 1% (IEC 61146)
The TE156 is designed to measure blooming and smearing effects of CCD cameras. The transparency consists of a black area with a white (transparent) area. The transparent area has 1% of the picture area, marked by the white arrows.

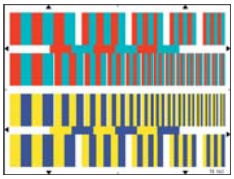


TE158 ○
Cine Test Chart with format markings for 1:1375 (35 mm) · 1:166 (S16) · 16:9 (HDTV) · 1:185 · 1:2. Resolution power is given for three different enlargements
The TE158 is designed for evaluating the image quality of film cameras and can be used for cameras of different formats. It consists of sector stars, several test elements, a linear gray scale, and nine color patches.

TE159 ●
Sinusoidal Multiburst Test Chart (IEC 61146) (0.5 · 1 · 1.5 · 2 · 2.5 · 3 · 4 · 5 · 6 MHz)
The TE159 is designed for measuring the horizontal static resolution. It shows vertical bars, the density variation of which gives a sinusoidal video response.

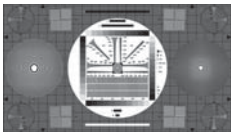


TE161 16:9 ●
Sector Star Test Chart (72 cycles)
The TE161 test chart is designed for the adjustment of camera lenses and checking back focal distance. It consists of a large Siemens star in the center and four smaller ones positioned in the corners of the test chart.

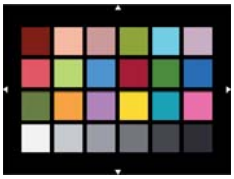


TE162 ●
Chrominance Response Test Chart (IEC 61146)
The TE162 is designed to measure the amplitude frequency response of the chrominance channels. The test chart is a color multiburst pattern, covering a spatial frequency range from 100 kHz to 1.5 MHz.

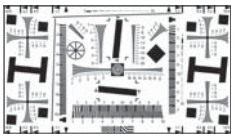
TE165 16:9 ●
Log. Gray Scale Test Chart (11 steps)
The TE165 is designed for evaluation of the halftone reproduction of 16:9 electronic cameras. Two 11-graduated counter current gray scales are arranged on a gray background. The gray scales being graduated logarithmically. The contrast range of the gray scales is 40:1.



TE167 16:9 ○
HDTV Universal Test Chart
The TE167 test chart is designed for the general appraisal of HDTV cameras. It consists of gray scales, circular figures, a grid, sector stars, multibursts and resolution wedges.



TE169 ●
EBU/CAM Test Chart (EBU Tech. 3237)
TE169 is designed to measure color reproduction. The chart consists of 18 color patches and six patches from white to black.



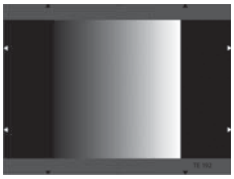
TE170 ●
Electronic Still Picture Resolution Chart (ISO 12233)
The TE170 chart is designed to measure the resolution of still cameras. It contains resolution wedges up to 2000 lines per picture height. In addition, it contains slanted edges for SFR measurements.

OECF/Gamma	Back Focus	Color	Black To White
Resolution/Multiburst	Geometry Grid Registration	Signal Evaluation	Universal Multipurpose

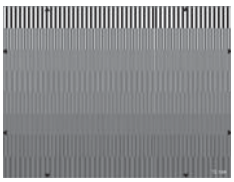
TE175
Streaking Measurement Test Chart
The TE175 is designed for the measurement of the disturbance caused to the video level in black areas to the right of or below the areas. Horizontal white lines are positioned on a black background.

TE182 / TE182 16:9
Neutral Gray 18% remission
The TE182 is an 18% gray test chart.

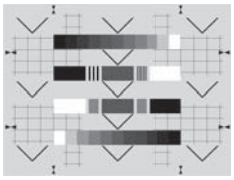
TE188 / TE188 16:9
Color Rendition Chart
(X-Rite ColorChecker)
The TE188 was designed with respect of the well-known 'ColorChecker'. The chart consists of 18 color patches and a 6-step gray scale, and is used in photography, film and TV.



TE192 / TE192 16:9
Saw Tooth Signal Test Chart
The TE192 is designed for cameras without an integrated electronic saw tooth signal. It allows the gamma correction of the camera to be visualized on the oscilloscope. It shows a linear continuous progression from 0% to 100% transmission set on a gray background.

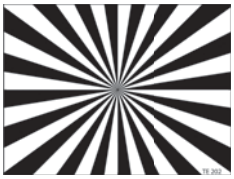


TE194
Aliasing Test Chart
The TE194 is designed for measuring aliasing. The chart consists of eight rows of rectangular bars with the spatial frequencies of 1, 2, 4, 6, 8, 10, 12 and 14 MHz.



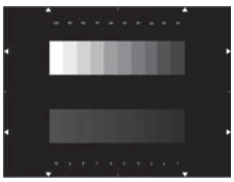
TE195
Ikegami CPU Test Chart
The TE195 is designed for setup of Ikegami cameras.

TE197 16:9
OECF Test Chart (ISO 14524)
Contrast 20:1 · 80:1 · 160:1 · 1000:1 · 4000:1
The TE197 is designed for evaluating the opto electronic conversion function of a camera. The chart consists of a circular ordered 12-step-gray scale on a gray background.

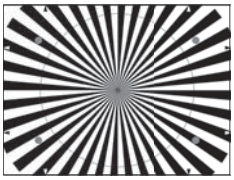


TE202
Sector star 20 Cycles
The TE202 is designed for adjustment of camera lenses and checking back focal distance.

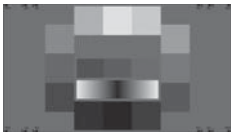
TE203
Double Saw Tooth Test Chart
(digital signal quantisation)
The TE203 is designed to check cameras for quantization errors. It consists of a high and low contrast saw tooth.



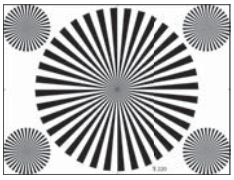
TE205
Gamma Measurement Test Chart
The TE205 is designed to check the gamma setting of the camera. The chart shows ten gray steps from 1-10% transmission and ten gray steps from 10-100% transmission.



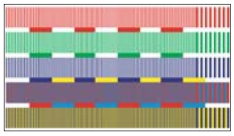
TE218 A + B
Autofocus Test Chart Set (IEC 61146)
The TE218 is designed to check the autofocus system of a camera. It consists of two different sizes of Siemens stars.



TE219 16:9
Noise Measurement Test Chart
(ISO 15739) 20:1 · 80:1 · 160:1 · 1000:1
The TE219 is designed for noise measurement of still images. It consists of circular and horizontal positioned gray fields, one gradient field and one field containing a diagonal multiburst with different frequencies.

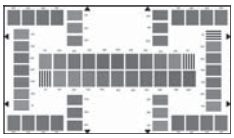


TE220
Back Focus Test Chart
(36 cycles with corner stars)
The TE220 is designed for adjustment of camera lenses and checking back focal distance. It consists of a large Siemens star in the center four smaller ones positioned in the corners of the test chart.



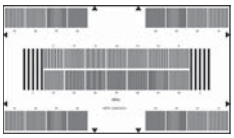
TE222 16:9
HDTV Color Resolution Test Chart
The TE222 is designed to measure color resolution of HD cameras. R, G, B, BY and MC multiburst patterns from 2 MHz to 20 MHz are on the chart.

TE223 16:9
HDTV Log. Gray Scale Test Chart
13 steps · contrast 1:200
The TE223 is designed for evaluation of the halftone reproduction of electronic cameras. Two 13-graduated counter current gray scales are arranged on a gray background. The gray scales are graduated logarithmically.

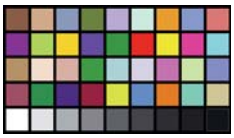


TE224 16:9
HDTV Resolution Test Chart
The TE224 is designed to measure and describe the frequency response of an electronic HDTV camera. The test chart consists of 50 multiburst fields, which are distributed over a 16:9 picture area. The fields are arranged in horizontal and vertical directions in order measure resolution in both directions.

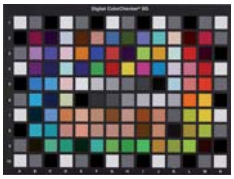
OECF/Gamma	Back Focus	Color	Black To White
Resolution/Multiburst	Geometry Grid Registration	Signal Evaluation	Universal Multipurpose



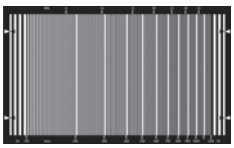
TE225 16:9
HDTV Resolution Test Chart
The TE225 is designed to measure and describe the frequency response of an electronic HDTV camera. The test chart consists of 32 multiburst fields, which are distributed over a 16:9 picture area. The fields are arranged in horizontal and vertical directions in order to measure the resolution in both directions.



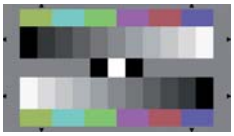
TE226 16:9
HDTV Color Rendition Test Chart
The TE226 is designed for the evaluation of the color rendition of HDTV cameras. The chart consists of 36 color patches and a 9-step gray scale. In addition to the primary and secondary colors the test chart contains mainly the colors, which are critical in reproduction, e.g. dark and light skin tones, foliage, blue sky, orange, violet and others.



TE230
X-Rite ColorChecker SG
The Digital ColorChecker Semi Gloss (SG) is specifically designed to meet the needs of digital photography. It consists of 140 patches, includes standard ColorChecker, skin-tone reference colors and gray scale steps. It is mounted on an aluminium plate.



TE231 16:9
HDTV Sweep Test Chart
The TE231 is designed for checking the frequency response of HDTV cameras. The test chart shows vertical lines over the whole image area ranging from 100 to 1200 lines.

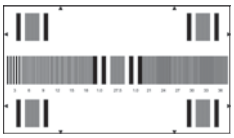


TE232 16:9
Log. Gray Scale / Color Test Chart 16:9 (super black hole in folders)
The TE232 is designed for the evaluation of the halftone and color reproduction of an electronic camera. Two 11-graduated counter current gray scales are arranged on a gray background (graduated logarithmically) and there are two color patches representing the three primary colors as well as the three secondary colors.

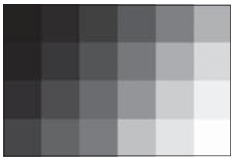
TE233 16:9
Color Chart with 24 colors and 4 skin tones
The TE233 is designed for measuring the color reproduction of HD cameras, for selective color correction and for making color reference shootings for post production. The chart is composed of color patches including the three basic colors, the secondary colors and patches with four skin tones.

TE234 16:9
Color Gradation Test Chart
The TE234 consists of different color grades. It is used to check quantization errors which result in visible steps in the grades.

TE235
Surveillance Camera Test Chart
The TE235 is desigend for the on-site testing of surveillance cameras. The chart roughly corresponds to the size of a person. It consists of different line pairs, a sector star, a gray scale and color fields. It is supplied with a tripod which allows the chart to be tilted and turned by 360°.

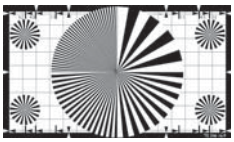


TE239 16:9
HDTV In Mega Cycle Test Chart
The TE239 is designed for checking the frequency response of the modulation depth and the uniformity of modulation depth of HDTV cameras. The test chart consists of multiburst fields, which are distributed over a 16:9 picture area. The fields are arranged in horizontal and vertical directions in order to measure resolution in both directions.

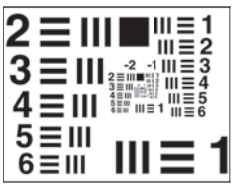


TE240
ISO 21550 Scanner Dynamic Range Chart
The TE240 is designed to check the 35 mm-scanner dynamic range. It has 24 gray-patches with a density range of 4.0 or 6.0. The reflective version consists of a 2.4 density range.

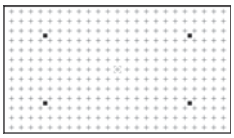
TE241 16:9
OECF / Noise Chart with 20 gray patches 10.000:1
(ISO 14524 · ISO 15739)
The TE241 is designed to measure the characteristic curve of digital cameras. It is an extended OECF chart and has 20 patches and a contrast range of 10.000:1, or if needed 100.000:1.



TE246 16:9
4 Quadrant Sector Star
The special star consists of four segments each with a different number of cycles. So it is possible to focus the wide angle and the tele position for an optimal adjustment of the focusing point. This is essential for positioning the flange focal distance without a special collimator.

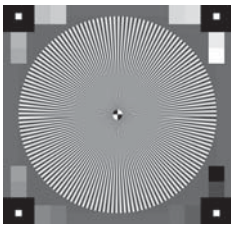


TE250
USAF Resolution Test Chart 35 mm
USAF resolution test chart on film in 35 mm is useable for scanner resolution up to 10.000 ppi.

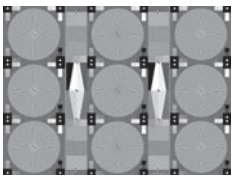


TE251 16:9
Distortion · Chromatic Aberration · Crosses
The TE251 is designed to measure the distortion of digital cameras. It contains black crosses on a white background.

OECF/Gamma	Back Focus	Color	Black To White
Resolution/Multiburst	Geometry Grid Registration	Signal Evaluation	Universal Multipurpose

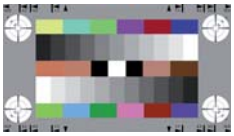


TE253
Modulated Sinusoidal Siemens Star
The TE253 is designed for checking resolution. The chart contains a radially sine modulated Siemens star in the center of the image, gray patches and black squares with a small white square in it.

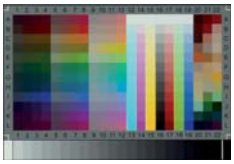


TE253 9x
Modulated Sinusoidal Siemens Star Set of 9 stars arranged in 3 columns
The TE253 is designed for checking resolution. The chart contains nine radially sine modulated Siemens stars, gray patches and black squares with a small white square in it, slanted edges and white noise patches.

TE255
Diffusor Plate To Measure Vignetting
The TE255 is designed to measure shading/ vignetting of a digital camera. It is a very precise milk glass which is used in combination with an integration sphere or a light box.

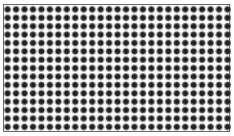


TE256 16:9
Color and Calibration Test Chart revised Version of TE232 (super black hole in folders)
The TE256 is designed to color align HD cameras.



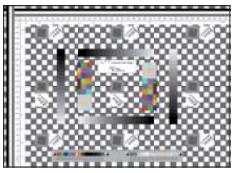
TE258
IT8 Scanner Characterization Chart
The TE258 is designed to characterise slide/ print scanners. It is suitable to create color management profiles for scanners.

TE259 16:9
OECF / Noise Chart with 20 gray patches contrast 10.000:1
The TE259 is designed to check the dynamic range of broadcast cameras on a waveform monitor. It contains a gray step wedge with 20 patches and a contrast range of 10.000:1.



TE260 16:9
Dot Chart
The 'dot' chart consists of two different charts on the front side and on the back side. One of them has 31 lines of dots and the other 15 lines of dots. They can be used to determine distortion and chromatic aberration.

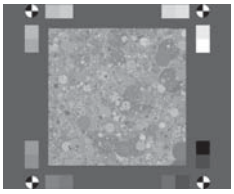
TE261 16:9
Slanted Edges
This target has a tilted checkerboard in the background and five low contrast slanted edges together with surrounding gray patches in the front. It is used to determine the SFR of digital capture devices and is our default chart in combination with the AF-Box and STEVE.



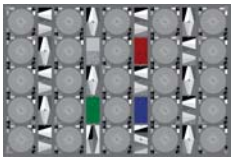
TE262
Universal Test Target (UTT)
The Universal Test Target is designed to evaluate the image quality of scanners and other digital input devices used to create the digital images of documents, photos and other reflective media.

TE263
Scan Reference Chart
The chart consists of gray steps, color patches, a scale and resolution pattern. It allows automatic analysis of each scanned page and, in combination with the right software, provides information for the purpose of showing when a specific page happens to be out of specs.

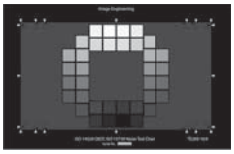
TE264 16:9
OECF 20 ISO 14524 / 15739 revision
The former OECF chart contains 12 or 20 gray patches in a circular order and three different patterns in the center of the chart. The actual version of the OECF chart skips the center patches due to the sometimes occurring straylight. This chart is also offered as TE264X where the 20 gray patches are not rasterized as in the standard version of the chart but done with nearly no structure on a very fine grained film.



TE265
Dead Leaves
This chart contains a so-called dead leaves (in this case circles) structure. The structure is made up of circles in all sizes and gray levels. It is used to determine the Dead Leaves SFR, an approach to describe the loss of low contrast fine details.

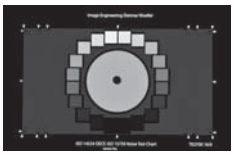
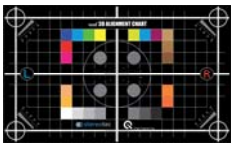


TE268 25x
Lens Resolution Test Chart
The TE268 is designed for resolution and sharpness measurements. 25 sinusoidal modulated Siemens stars, 16 slanted edges at four different contrasts, four colored dead leaves structures and rope structure images are placed on the chart. A very detailed analysis over nine different image heights is possible with this chart. The chart has an aspect ratio of 4:3 and an image size of 800x1200 mm. It is suitable for systems from 3 MP up to 30 MP.



TE269
OECF Chart (following ISO 15739) D280
For high dynamic range cameras, the OECF charts with patches calculated according to ISO 14524 are not that convincing. Densities are calculated according to the cube root formula result in large steps in the high-density patches. Image Engineering's solution for the problem is the TE269, a 36 patch OECF chart which basically follows ISO 14524 but implements additional steps especially at higher density levels.

OECF/Gamma	Back Focus	Color	Black To White
Resolution/Multiburst	Geometry Grid Registration	Signal Evaluation	Universal Multipurpose

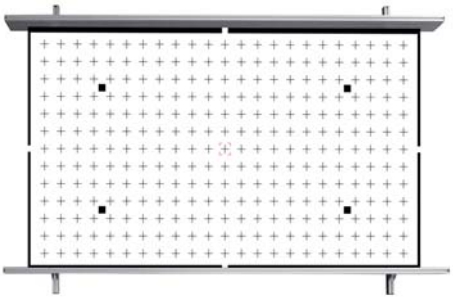
	**TE270X** ● **OECF Chart** The TE270X chart is similar to the TE264 but it is equipped with two polarizing filters in the center of the chart. For cameras that do not allow a manual adjustment of the exposure, the automatic exposure control (AEC) is fooled by modifying the density (transmission) of the central part of the test chart. This feature is needed especially for low-end cameras and camera modules in mobile devices that often do not have a manual exposure adjustment.		**TE271** ● **3D Alignment Chart A1066** The real 3D Alignment Chart is designed to align and adjust cameras for a 3D shooting. A unique combination of 2D and 3D structures allows the easy and straightforward preparation of the stereoscopic camera setup.

TEST CHART ACCESSORIES

Tripod mounting frame for Studio Kits

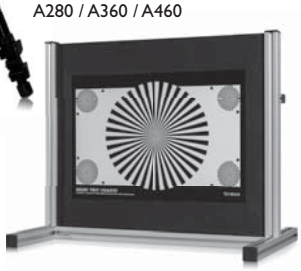
Tripod mounting frame for test charts
A280 / A360 / A460

Wall mounting frames for four reflective test charts from size A280 up to A1066



Cases for storage, protection and transport of transparent and reflective test charts in all available sizes

Table mounts for reflective charts
A280 / A360 / A460



The magnetic tape can be fixed on the backside of all reflective charts. After this modification you can hang the chart on all magnetic surfaces.

Please also see chart amounting systems in section MEASUREMENT DEVICES.

HD STUDIO KITS

HD STUDIO KIT 3 (K360) SUPER BLACK HOLE	
TE148	Sector star (36 cycles)
TE233	Color chart (24 colors + 4 skin tones)
TE256	Color calibration chart

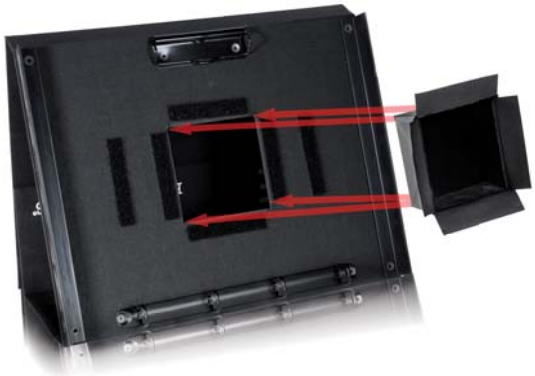
HD STUDIO KIT 4 (K360) SUPER BLACK HOLE	
TE148	Sector star (36 cycles)
TE233	Color chart (24 colors + 4 skin tones)
TE234	Color gradiation test chart
TE256	Color calibration chart

HD TRAVEL KITS

HD TRAVEL KIT (K180) NO SUPER BLACK HOLE	
TE115	White balance chart (70% reflectance)
TE148	Sector star (36 cycles)
TE256	Color calibration chart

HD TRAVEL KIT SB (K180) SUPER BLACK HOLE	
TE115	White balance chart (70% reflectance)
TE148	Sector star (36 cycles)
TE233	Color chart (24 colors + 4 skin tones)
TE256	Color calibration chart

SUPER BLACK HOLE



Both HD STUDIO KIT and HD TRAVEL KIT SB include a fold up super black hole which is easy to handle and increases the contrast of the TE256 between the white patch and the two dark holes to at least 2000 : 1.

GOSSEN MAVO-MONITOR USB

MAVO-MONITOR USB for precise measurement of luminance levels of test charts. The sensor can be placed directly on the patch so that no stray light can reach it.

FEATURES

- precise measurement of the luminance
- classified according to DIN 5032-7 Class B and CIE no. 69
- silicon photo diode, color corrected with spectral response matched to the spectral photopic vision of the human eye V(λ)
- 3½ digit display
- data storage of max. 100 values
- USB 1.1 interface
- CD ROM with software for processing the values measured and regulating the meter
- ever-ready case and USB cable included

RESTAN

Do you need to calibrate your spectroradiometer or do your densitometer for reflective measurements? Or you just need the ultimate white reference for white balancing your camera or checking the exposure?
We have the solution for you. Our PTFE (Polytetrafluoroethylene) based RESTAN diffusely reflects more than 98% of light in the area between 300 nm and 1700 nm. This means the reflection level is higher and more uniform, especially at longer wavelengths than the reflectance of barium sulfate (BaSO4).
The material is stable long-term, temperature consistent, workable, available in various sizes and has a good price/performance ratio.
We offer RESTAN as a reflectance standard in a circular metal case with 50 mm diameter which is suitable for all spectroscopic and densitometric applications. Individual calibration is available on request.

HEDLER TUNGSTEN HALOGEN LIGHT SOURCE

Tungsten halogen light with two independent switchable Tungsten halogen bulbs and a very compact, short and robust metal housing. The light unit suits all digital and analog photographic fields, mainly when a high intensity continuous light is needed. The continuous spectrum makes it particularly suitable for all kinds of color measurement, where fluorescent light sources may cause metamerism problems.

FLUORESCENT TUBE LIGHT SOURCE

Fluorescent tube light source is an economic illumination system for digital imaging. The color temperature is app. 5500 K which exactly fits to the needs of digital still imaging. The six bulbs, each with 55 W, are as bright as usual 2650 W standard illumination but the power consumption is only 330 Watt. The durability of the bulbs is app. 7000 hours.

MANFROTTO 410

Extremely compact, this unique head offers movement in three directions, pan, tilt and side to side tilt. The geared rotation in combination with the bubble spirit level makes this head the ideal platform for testing cameras up to 5 kg. The head incorporates a quick release camera plate system. It is used as a 3 way camera head for our modular camera test stand.

NOVOFLEX PHONE KIT

Testing camera phones requires a universal mounting system for the phones. We have tested the Novoflex phone kit and it does a good job in our lab. So it might be a good option for your lab as well.

NOVOFLEX TABLET PC HOLDER

Even more complicated is the mounting of a tablet computer. For this purpose the phone kit can be extended with a Tablet PC holder.

TECHNOTES

HOW TO ILLUMINATE A TEST CHART

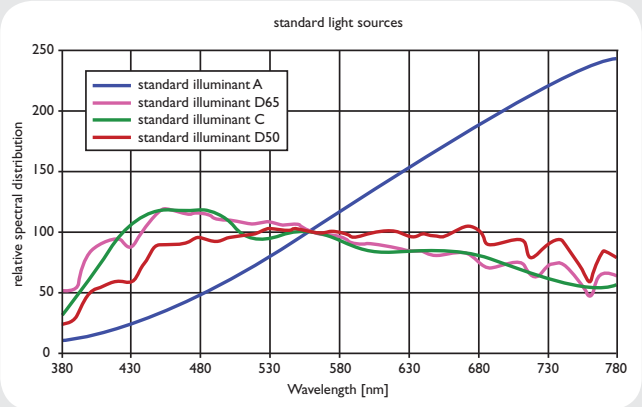
To receive accurate and repeatable results it is important to check the accuracy of your test chart illumination. Such an illumination needs to fulfill three main criteria:

1. UNIFORMITY

To measure aspects like shading or a lens MTF it is important to have a uniform illumination. If a value of 90% can be achieved the uniformity is as good as it can be. However this is not good enough for a camera shading calibration. To reach higher uniformity levels an integrating sphere, in combination with a transmissive target, is required.

2. SPECTRAL DISTRIBUTION

Especially for color and white balancing the spectral distribution of the light source is important. Peaky spectral distributions like fluorescent tubes can produce wrong results. The closer the spectral distribution is to a standard light source, the more accurate the test results will be. Using distributions close to standard sources also increases the comparability between different test labs.

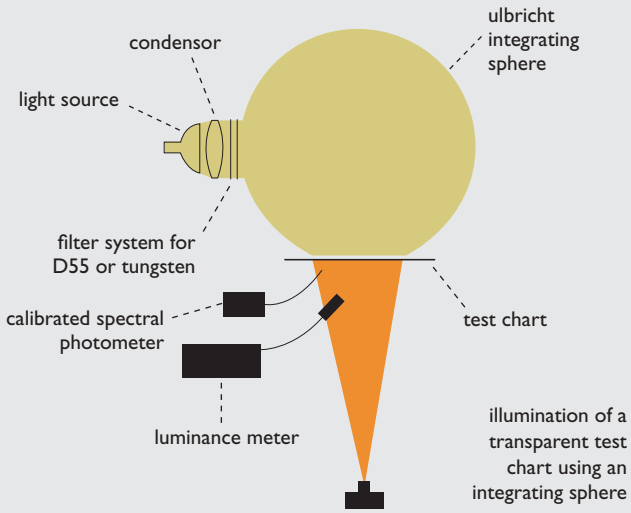


3. ILLUMINATION GEOMETRY

For transmissive charts the ideal illumination is a uniform diffuse one. Therefore the integrating sphere is the solution most users choose.

Reflective charts are usually illuminated using two light sources in a 45° angle because it is the best compromise between uniformity and the prevention of specular reflections. To avoid specular reflections most reflective targets are made of material with a matt surface. Some targets are made of glossy material to increase the contrast of the target or to allow a wider color gamut. With these targets it is important to check the images for potential specular reflections.

To minimize specular reflections it is best to have a diffuser in front of the light sources. By increasing the distance to the target the illumination becomes more uniform and the probability of specular reflections decreases.

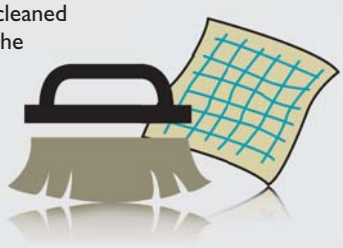


HOW TO CLEAN A TEST CHART

From time to time we do get the question about how to clean a test chart.

The TRANSPARENT CHARTS are usually a film or a foil embedded between glass plates. In this case a simple glass cleaner can be used. Just do not flood the chart with fluid and take care to clean the chart on both sides.

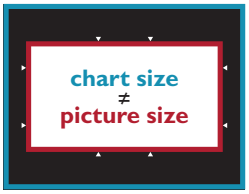
The REFLECTIVE CHARTS are made out of many different materials and cleaning them is a little more difficult due to the fact that the surface is directly accessible. Dust and other little spots should be cleaned by using a brush or a very soft cloth. The surface is sensitive to mechanical processes. Please be very careful when cleaning these charts. Sometimes it is even better to leave the spot on the chart if it is in an area where it does not influence the functionality of the chart.



More TechNotes and information can be found on our website www.image-engineering.de

CHART SIZES

The test charts are available in the sizes listed below.
For technical reasons, some charts cannot be manufactured in all sizes.
Please do not hesitate to ask for additional information or see our website.



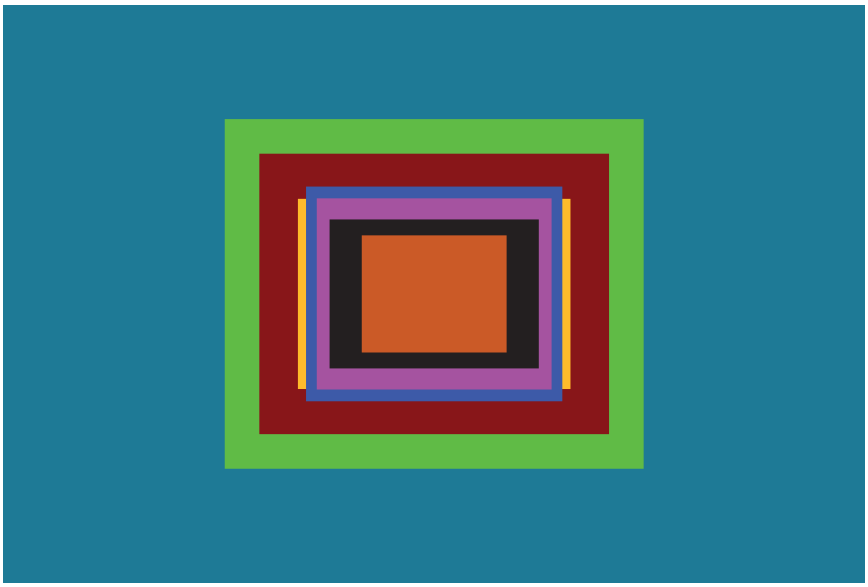
REFLECTIVE			
DESIGNATION	PICTURE SIZE WxH [MM]		CHART SIZE WxHxD [MM]
	4:3	16:9	
A1066	800 x 600	1066 x 600	1245 x 835 x 3.2
A540	540 x 405	460 x 303.8	600 x 500 x 3.2
A460	460 x 345	460 x 258.8	600 x 500 x 3.2
A444	-	444.4 x 250	600 x 500 x 3.2
A360	360 x 270	360 x 202.5	500 x 400 x 3.2
K360	-	360 x 202.5	390 x 271 x 2.1
A280	280 x 210	280 x 157.5	365 x 305 x 3.2
K280	280 x 210	280 x 157.5	334 x 271 x 2.1
K180	-	180 x 101	204 x 164 x 2.1
K160	160 x 120	-	204 x 164 x 2.1

TRANSPARENT			
DESIGNATION	PICTURE SIZE WxH [MM]		CHART SIZE WxHxD [MM]
	4:3	16:9	
D280	280 x 210	280 x 157.5	360 x 280 x 4.6
D240	240 x 180	240 x 135	320 x 290 x 4.6
D240S	240 x 180	240 x 135	360 x 280 x 4.6
D205	205 x 153	205 x 115.3	253 x 202 x 3.5
D120	120 x 90	120 x 67.5	155 x 135 x 4.0
D28	28 x 21	28 x 15.75	50 x 50 x 2.6

K charts (mounted on a plastic plate) are only available in combination with test chart folders.
Size A444 is only available for HDTV charts.
Size D28 is not available for HDTV charts.

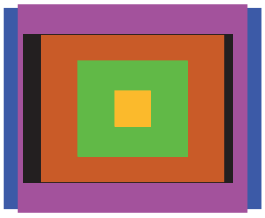
VISUALIZATION OF THE CHART SIZES

REFLECTIVE



A1066
A460
A360
K360
A280
K280
DIN A4
K160

TRANSPARENT



D280
D240S
D240
DIN A4
D205
D120
D28

SUITABLE TRANSPARENT CHARTS FOR THE FOLLOWING ILLUMINATORS

	D280 / D240S	D240	D205
	Spherical transparency illuminator LE6/LE7 Light box illuminator LG2 Sony Pattern Box	DNP standard viewer	Porta Pattern spherical transparency illuminator
With adapter		Spherical transparency illuminator LE6/LE7 Light box illuminator LG2	Spherical transparency illuminator LE6/LE7 Light box illuminator LG2

For further information please visit our website www.image-engineering.de

Image Engineering // imageQuality test equipment made in Germany

Image Engineering GmbH & Co. KG

Augustinusstraße 9d
50226 Frechen / Germany
T +49 2234 995595 0
F +49 2234 995595 10
www.image-engineering.de
info@image-engineering.de