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MINOLTA

The CR-400, the latest generation of colorimetry technology

CR evolution

Owners of a Chroma meter of the 200 or 300 series can carry on working with the CR-400 in the usual way – but at a higher level throughout.

Portable colorimetry first saw the light of day in 1981. At that time, the CR-100 instruments from Minolta consigned their predecessors, which were bulky, complex and at least four times as expensive, to the scrapheap almost overnight. The concept proved exceptionally attractive: portable, compact, lightweight, with a freely movable receptor head and simple operation. Colorimeters were suddenly within the reach of small and medium-sized companies too.

The next evolutionary step came in 1984 with the models of the CR-200 series. A minicomputer with storage and statistics functions, an integrated printer and the elimination of the optical-fibre cable by incorporating the measuring cell into the manual unit led to the final breakthrough – which was also reflected in the production figures. The Chroma meters from Minolta opened up new applications in new sectors such as the medical, food and electroplating industries.

CR-100 → 200 → 300 → 400

The next generation (CR-300) were distinguished by improved instrument compatibility. Although competition between portable spectrophotometers became tougher in the nineties, the Chroma meters from Minolta are still practically unchallenged as reference instruments, above all in the basic and luxury foods industry and in the sector of dermatology.

The CR-300 and CR-310 models with their application-specific accessories in particular stole the show with their ergonomic design, reliability and compatibility. The CR-310, with an active measuring area of 50 mm diameter, is still without rivals when it comes to measuring powders, granulates or other coarse bulk materials. The properties of the Chroma meters are almost legendary in terms of long service life and ruggedness even under the toughest conditions.

Evolution, not revolution

The most recent development brings tried-and-tested technology to new easy-to-handle instruments

The brochure on the new Chroma meters may be obtained by quoting code no. 70.

whose ergonomics, user-friendliness and evaluation capabilities are completely state-of-the-art. The CR-400 and CR-410 models retain a compact and ergonomic manual receptor head and a separate evaluation unit. The optics (measurement geometry, measuring areas, standard observation unit and illumination source) were taken over from the CR-300. This means that thousands of former users of the 200 and 300 series now enjoy 100% data compatibility. They can also continue to use accessories such as granulate containers and cell inserts.

Users of a Chroma meter of the 200 or 300 series can operate the CR-400 in their accustomed way – but even more simply and at a higher level throughout! The innovations enhance flexibility, extend the range of applications and ensure cost-effective and efficient use of colorimetry in modern quality assurance. Because the receptor head now also contains batteries, a data display and storage functions, it can also be operated as a stand-alone unit or linked directly to a PC in conjunction with the optional ChromaMagic software.

Perfect ergonomics, simple operation and the latest instrument functions: the CR-400 series successfully continues the tradition of Chroma meters.

Graphics-capable display with extended evaluation functions

The most striking feature of the data processor is its graphics-capable display with optional backlighting. The data memory can now store and statistically evaluate up to 100 references and 2000 measurements. The data is output in the XYZ, Yxy, L*a*b*, LCH, DIN Lab99, HunterLab and Munsell colour systems as well as with the new CIE99 and CIE2000 colour-difference formulas. The CIE WI+Tw, ASTM E313 whiteness indices as well as the yellowness indices to ASTM D1925 and ASTM E313 are additionally available.

The user index allows up to six user- or sector-specific formulas to be implemented. All references can be stored with symmetrical or asymmetrical tolerances and pass/fail tolerance limits. An easy-to-connect thermoprinter prints both numerical data and colour-space graphics. The choice of languages covers English, German, French, Italian, Spanish and Japanese. The permissible operations may be individually restricted to simplify operation as far as possible.

These two CR models of the fourth generation are completely state-of-the-art colorimeters. They combine the reliability of their predecessor series with considerable improvements in terms of flexibility, equipment, ergonomics and convenience of use. They also ensure compatibility and continuity.

Sumika Color – Minolta's partner for on-line colorimetry

Colour on-line

Sumika Color is a wholly owned subsidiary of Japan's Sumitomo Chemical Company specializing in manufacturing plastic master batches used in the production of films and foils. In recent years, Sumika Color has established a complete service chain ranging from raw materials to colour control systems.

Color Judge® is an automated on-line colour control system based on sophisticated application software and high-performance instrumentation. It is simple to install and ideally suited for automating the on-line colour control of plastic extrusion products, films, foils and paper. The product colour is automatically analysed and the result is displayed graphically and unambiguously. The system, which was developed jointly by Minolta and Sumika Color for non-contacting on-line colorimetry, uses the CF-1440 spectrophotometer as its colour detection sensor.

Color Judge monitors colours automatically on the basis of a pre-defined operating plan. The colour data is displayed immediately and an alarm is triggered in the event of excessive deviation. Sumika's many years of experience ensure the system's high adaptability as well as the outstanding control characteristics of its sensors, detectors and displays.

Printed decor products from thermoplastics like this table edge are a speciality of MKT.

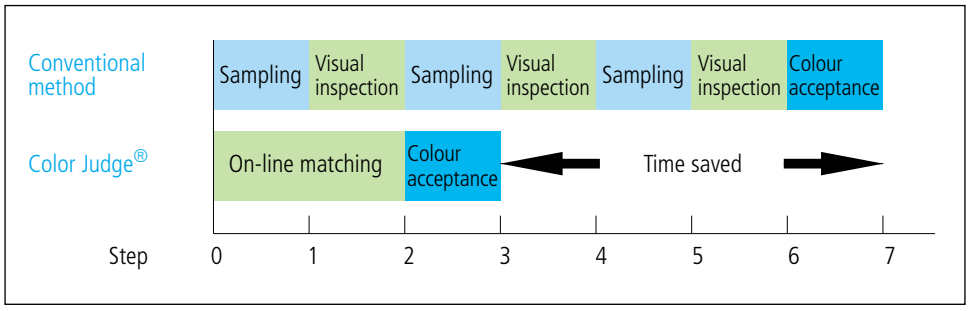
We will be happy to send you further information on the Color Judge® system. Simply quote code no. 71.

On-line colorimetry with Color Judge saves time and reduces rejects.

Color Judge in the production line

Because the target colour is reached much faster at production start-up, material losses can be considerably minimized. The required colour corrections are displayed quickly and continuously, resulting in a shorter response time and higher efficiency in the event of frequent colour changes and small lot sizes.

The pilot customer in Germany for Color Judge was Moderne Kunststofftechnik (MKT) GmbH of Ohrdruf, Thuringia. MKT manufactures special thermoplastics, mainly for the furniture industry. Its wide range of decor products from ABS, PVC and PP include metal, wood and stone imitations. Because colour is the only visible quality parameter of these products, it is vital to minimize the colour tolerances of follow-on orders. Thanks to Minolta's colour matching system for laboratory use and its on-line Color Judge System for in-process application, MKT offers comprehensive quality assurance which gives it a significant competitive edge on the European market.



How white is white?

More detailed information on Polaris may be obtained by quoting code no. 72.

Colour is a natural phenomenon, which helps us acquire an acute awareness of our surroundings. During our lives, we gain experience continuously in order to correctly perceive and interpret our colour impressions. In so doing, we convert colours into sensations and feelings which are just as subjective as the perception of colour itself. Thus, white is only perceived as perfect if it displays a slight bluish tinge in terms of colorimetry.

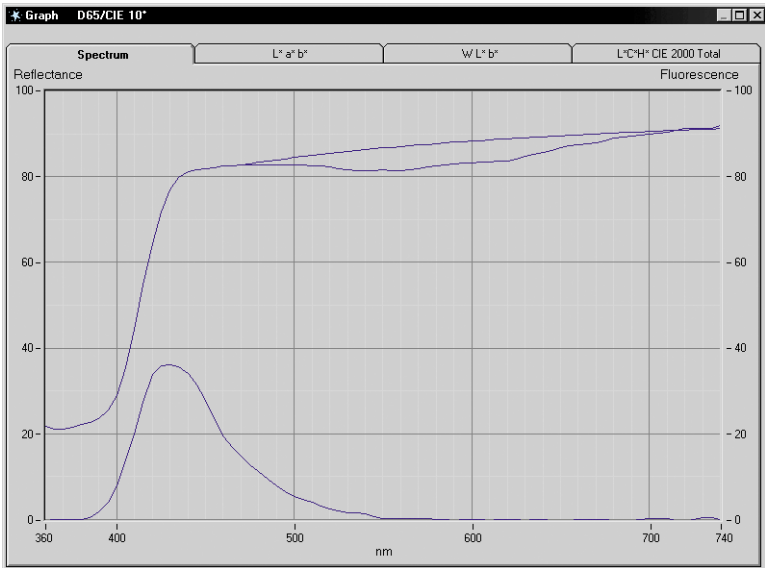
There is no such thing as a white dye. The only technical way of increasing the subjective sensation of white in a substance is by mixing colours. The perception of whiteness is enhanced by a combination of additive and subtractive colour mixing with the inclusion of fluorescent whitening agents. In colour terms, white fluorescent objects are reflecting and self-luminous at the same time. The fluorescence depends on the light source used in the measuring instrument and the quality of the measured results is evaluated on the basis of the closeness with which the light source matches a standardized daylight profile.

Determining whiteness numbers from spectral data

The Polaris White Star System is developed by Axiphos GmbH in Germany in conjunction with Minolta and uses the characteristics of the CM-3600d spectrophotometers. The sample is illuminated in sequence by three xenon flashlights with different filters. After the measurement, which lasts only a few seconds, the fluorescence and passive reflection of the substrate are calculated separately. The colour mixture can then be split up into its additive and subtractive components and the whiteness numbers can be calculated for every type of light or light source with a specific UV signature.

Whiteness can thus be determined from the spectral data at any time for every defined light source independently of the moment in time or a particular measuring instrument. This quality is ideal for whiteness control and management tasks such as measurement of whiteness losses due to decay, matching whiteness of materials or monitoring whiteness and shades during product development.

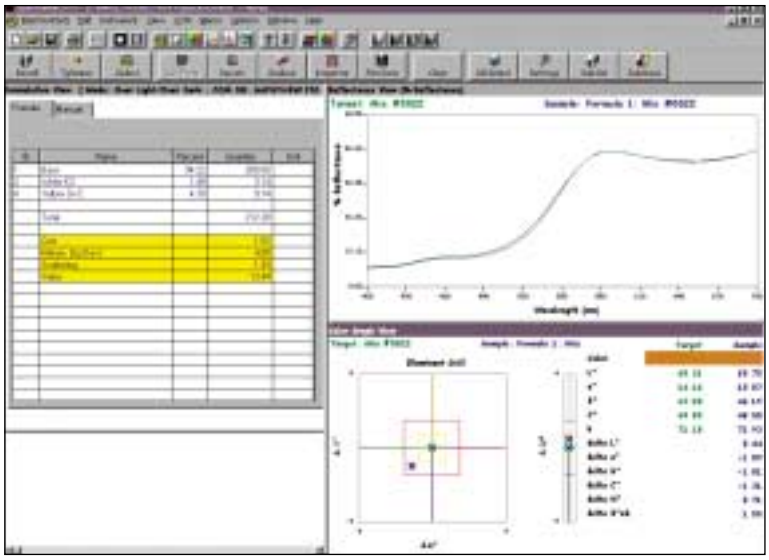
The results can be displayed as spectral curves (passive reflectance and fluorescence separately) or as (a*, b*) and L* or b*L* diagrams. Colour differences (DL*, DC*, DH*) with specified tolerance ellipses can also be graphically displayed and corrected for lightness differences.



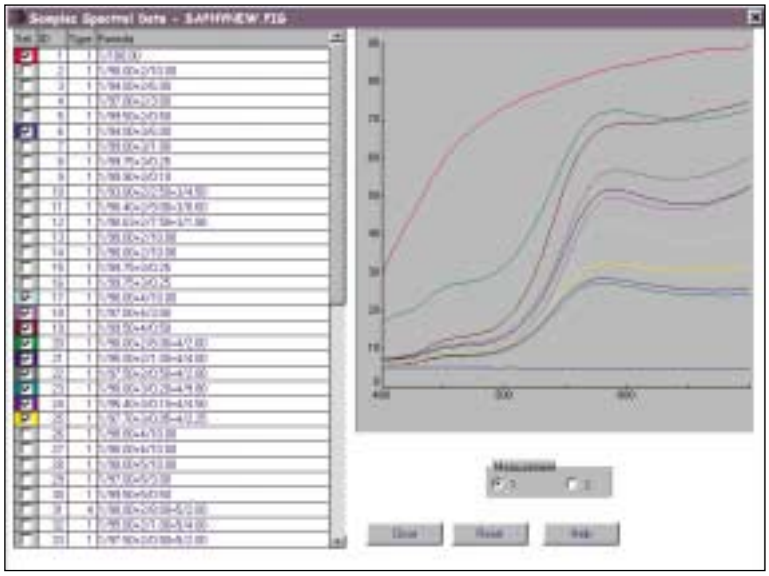
A real innovation: Polaris permits fluorescence, the basic white of the substrate and total reflection to be separately measured and evaluated.

New software with a new colour-matching concept puts an end to over-pigmentation

Cutting costs with SpectraMatch FX



Comprehensive information at a glance: display of the optimum recipe, the reflectance curve and the colorimetric data in digital and graphical form.



Display and control of the measured calibration samples in the database are critical for the quality of every recipe.

Minolta has repeatedly introduced advanced technologies to the colorimeter market. Examples include the first portable spectrophotometers, the still unequalled inter-instrument and inter-model compatibility of its colorimeters as well as the CM-3000 series with numerical gloss and UV control.

Minolta is now setting new standards with its computer colour matching (CCM) software known as SpectraMatch FX.

CCM systems consist of a spectrophotometer, a PC and colour-matching software. This calculates recipes within user-defined limits for a given standard: it matches the reflection curve of the standard and thus includes metamerism in its prediction. Computer-aided colour matching is much faster than the manual version because fewer corrections are required to calculate the recipe.

The colour and opacity of a pigmented layer (paint, plastic or ink) are produced by the absorption and scattering of light. Light is absorbed and/or scattered when it strikes solid particles (e.g. in dyestuffs and pigments) in the layer, but also at the air/layer and layer/background boundaries.

The Kubelka-Munk theory

Standard CCM programs use the Kubelka-Munk two-constant theory to calculate recipes. However, this is useful only for completely opaque applications, i.e. when only the colour needs to be matched. As soon as a specific opacity is also required (translucent plastics, wood glazes, some ink applications) or the minimum amount of pigment must be calculated for a given layer thickness in order to achieve the required opacity, a sophisticated algorithm must be used for the calculation.

Another drawback is that the pigment-specific values for absorption (K) and scattering (S) are both referred to white (calibration samples are principally mixtures with white). This means that dark and highly saturated colours cannot be adequately calculated in advance. In order to reduce the pigment load therefore, additional samples in various layer thicknesses and/or pigment concentrations are often required, but usually only for white. Although this method does not re-

flect the reality, it offers a way of converting the recipe from one layer thickness to another and/or of reducing the pigment load by setting up a relationship between pigment load and opacity.

Multiflux

This is where SpectraMatch FX comes in. This algorithm is based on the multiflux theory: a pigmented layer consists not only of diffuse light fluxes resulting from scattering at the particles, but also of direct beams whose numbers are proportional to the translucency of the layer. The multiflux model can be used to match not only the colour but also the opacity of a layer of specific thickness with great precision. SpectraMatch FX can calculate recipes for opaque applications realistically while minimizing the pigment load.

In practice, this means that the letdowns must be more differentiated than for the Kubelka-Munk method. In addition to white and black letdowns, samples of every pigment must be prepared separately in various concentrations. The number and quality of the letdowns is also the key to predicting recipes with SpectraMatch FX. Production samples may also be used to calibrate the pigment database (calculation of K and S values). In addition, because resins are treated as separate components, various resins may be used without having to prepare a complete set of letdown samples every time.

Opaque layers are basically always overpigmented and thus cost more than they need to. This problem can be solved with SpectraMatch.

Utilizing colour residues (wastes)

Wastes are an expensive aspect of manufacture, as they have to be stored and disposed of. SpectraMatch FX utilizes them in various ways depending on whether the recipe is known or not. The colours in stock are included in the calculation in order to ensure that the quantity suffices for the entire production and not only for laboratory recipes. Several residues may also be used in a recipe, and their priority of use may also be defined (e.g., priority may be given to older residues).

SpectraMatch FX is available in gold and silver versions. The silver version merely dispenses with recording letdowns and calibrating pigment databases. It represents a more cost-effective solution for companies who obtain their letdowns in the form of a pigment database (calibrated with the gold version) from the parent company or from a dyestuffs supplier.

If you want to hear and see more on SpectraMatch FX, simply check code no. 73.

CA-100Plus and CA-210 establish new benchmarks in display measurement

Raising benchmarks

The CA-100Plus CRT Colour Analyzer and the CA-210 Display Colour Analyzer from Minolta highlight the company's global leadership in the manufacture of reference instruments for the whiteness and colour control of monitors as well as LCD and plasma displays. Its predecessors, the CA-100 and CA-110, have established themselves as the industry standard over the last twelve years. This benchmark looks like being raised higher still thanks to the many new and improved features of the upgrade models.

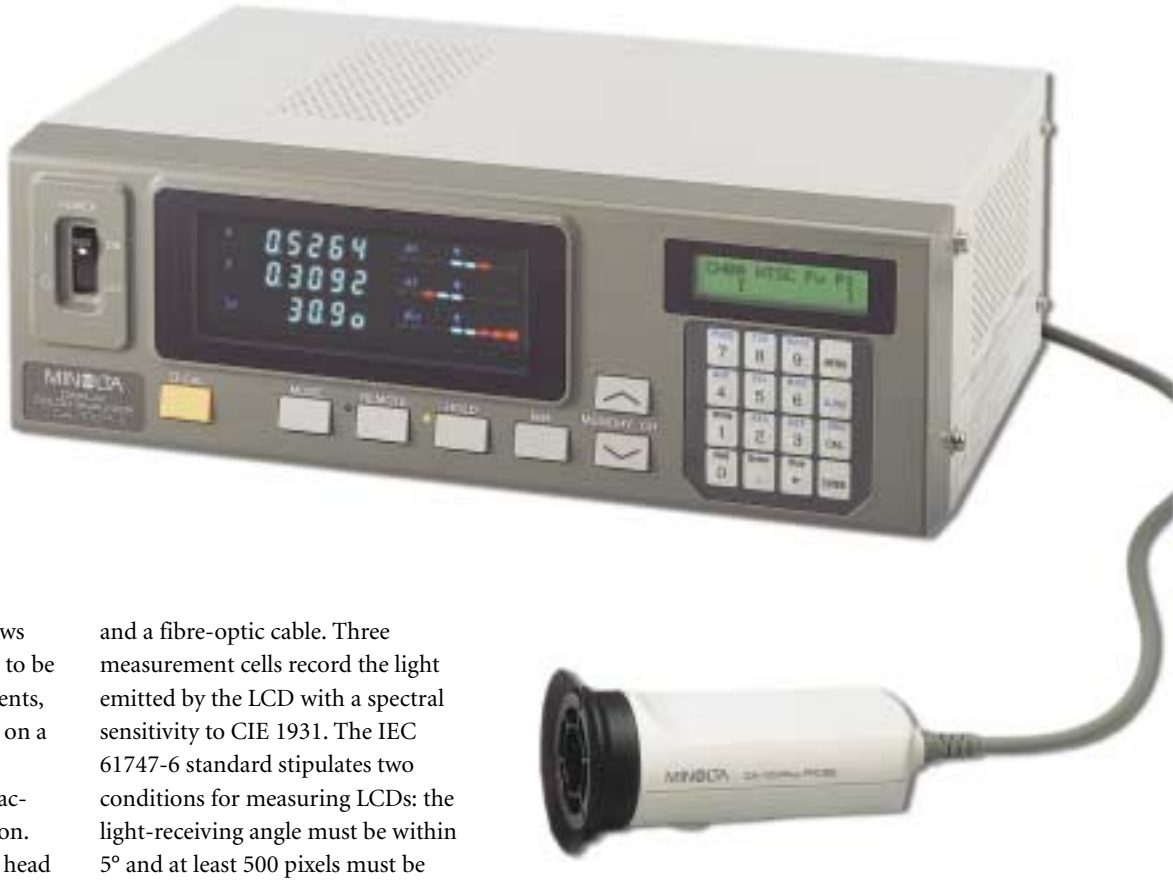
The leading manufacturers of monitors, LCD, TFT and plasma displays use Minolta instruments as a reference for performing white balances, generating gamma curves and monitoring colour linearity during development, production and in the service sector. However, the CA-100 and CA-110 are also among the most widely used calibration tools in TV studios, test laboratories of technical magazines as well as at airports and hospitals. Both are used as a benchmark for testing other instruments. Thus, the IBM Research Center points out: "Use a Minolta CA-100 if you can! They are hard to get, but that is the calibration reference we have here."

The faster measuring speed (20 measurements per second), extended measurement range (0.05–999.9 cd/m²) and broader synchronization range (40–200 Hz) are among the most important innovations of the CA-100Plus. The CA-210 also enhances these three parameters (20 mps, 0.1–999.9 cd/m² and 40–200 Hz respectively). Thanks to its new optics, the CA-210 satisfies the latest IEC standard (±2.5°). A newly integrated flicker measuring function (5–999 cd/m²) extends the application range by new tasks. The optical finder was replaced in the CA-210 by an LED pointer which makes location of the required measuring spot child's play.

Faster, further, higher

In both models, the serial transfer speed was increased to 38,400 Baud and a USB interface was integrated. The patented RGB analyser mode as well as a storage capacity of 100 channels is now already contained in the standard package. A software development kit makes it easier for developers to integrate these instruments into their own software applications. A multiple measurement option continues to be available as an ac-

Further information on the new display meters from Minolta may be obtained by quoting code no. 74.



cessory: an extension card allows four additional receptor heads to be connected up to both instruments, so that the colour distribution on a display can also be recorded.

Both instruments are characterized by their simple operation. Thus, the lightweight receptor head merely needs to be held in front of the display. Anyone familiar with the CA-100 or the CA-110 will also quickly find their way around these two new instruments.

Additional extensions are expected soon: the CA-PH02 and CA-PH05 (2- and 5-meter cables) receptor heads will permit further enlargement of the measuring area (0.05-2000 cd/m^2). This is particularly useful for very high-luminance surfaces such as plasma or rear-projection displays. In addition, Minolta will shortly be bringing out another CA-210 receptor head with a reduced measuring area for analysing small LCD or TFT displays such as those used in mobile phones, palmtops, navigation systems as well as in audio and video systems.

The optics of the CA-210

The optical system of the CA-210 consists of an objective lens and a fibre-optic cable. Three measurement cells record the light emitted by the LCD with a spectral sensitivity to CIE 1931. The IEC 61747-6 standard stipulates two conditions for measuring LCDs: the light-receiving angle must be within 5° and at least 500 pixels must be recorded. With a measuring angle of ±2.5° and a measuring-area diameter of 27 mm, the CA-210 satisfies these conditions easily.

Flicker measurement

The CA-210 offers two modes of flicker measurement. The contrast method can be used directly with the CA-210. For measurement by the Jeita method, the CA-210 is connected to a PC and the Software Development Kit provides the required functions. The contrast method displays the ratio between AC and DC components, whereas the Jeita method specifies the flicker value independently of the frequency.

The CA-100Plus represents a new standard in display measurement and the CA-210 a new benchmark for measuring high-end displays – both instruments demonstrate Minolta's unbroken leadership in display measurement.

The optical finder was replaced in the CA-210 by an LED pointer, which makes location of the desired measuring spot child's play.

CA-210 for flat panels and CA-100Plus for CRT displays: Minolta instruments are the reference worldwide.

The VI-910 for 3D digitizing of objects

High-end in 3D

Find out more about the third dimension with the VI-910 by quoting code no. 75.

Thanks to advances in 3D reception technology, Minolta has succeeded in developing individual solutions for 3D applications in sectors such as industry, medicine, art and historical monuments as well as computer graphics. Minolta is working together with leading universities, research institutes and software partners around the world. Thanks to their highest precision, flexibility and simplest operation, 3D digitizers are already used in numerous industrial sectors such as tool and mould construction, product design and quality control.

Industry, medicine, computer graphics, art and culture

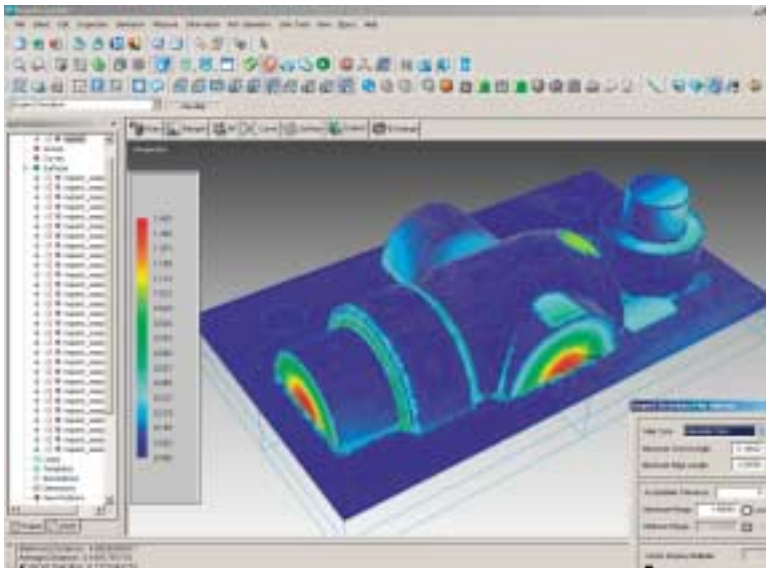
In medicine, 3D laser scanners are used for pre-operative planning in oral and maxillo-facial surgery. Forensic medicine is interested in the 3D analysis of bullet holes, gashes and bone fractures. The production and matching of prosthetic devices with the aid of 3D imaging shortens manufacturing times and improves the well-being of the patients.

3D digitizers are a vital tool for generating realistic web-capable 360° 3D images in computer graphics and film animation. They are used in the domain of architecture and restoration to record the forms and colours of historical sites in order to deepen our understanding of early building methods. Minolta instruments generate high-quality 3D images within the European VIHAP 3D project, which is of immense importance for the preservation of our cultural heritage.

The top-end model: VI-910

The 3D digitizers from Minolta operate on the principle of laser triangulation. Objects, models and irregular areas are scanned by a laser line and thus recorded in a non-contacting and non-destructive way. In addition to the VI-300 entry-level model, the latest high-end development, the VI-910, now complements the 3D product family from Minolta.

The VI-910 records 307,200 measuring points and RGB colour values in 2.5 seconds over a range of 111 x 84 mm with a geometric resolution of 0.008 mm in the Z-axis. In comparison with its predecessor, the VI-900, the VI-910 doubles the resolution and thus satisfies the highest requirements. Three replaceable objective lenses allow larger areas to be scanned. With a weight of only 11 kg and dimensions of approximately 20 x 40 x 30 cm, the portable VI-910 can also be operated on a pedestal. Its integrated LC display and Compact Flash Card drive allow standalone operation even without a PC link.



Thanks to improved measurement accuracy, the new VI-910 digitizer satisfies the highest demands of quality control.

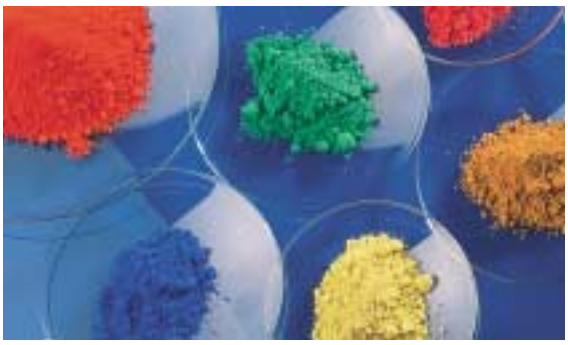
Colorimetry for powder coatings at Thermaset

Reinventing powder

The demand for colour diversity in powder coatings on metal surfaces is also increasing. Despite complex technology and sophisticated processes compared with traditional enamels, powder-coating manufacturers still require an unrestricted colour palette, perfect colour-tone quality and ultra-short delivery times.

In recent years, British manufacturer Thermaset Ltd. of Tamworth, Staffordshire, has made massive investments in R&D and rigorous quality assurance to ensure product quality all along the line, from new orders to the application by the customer. Minolta plays an important part in colour matching and final checking, i.e. in the "creation" of the exact shade required by the customer and in the quality testing of the final powder coating prior to delivery.

In the manufacturing process, the pigments and additives are



mixed, melted and extruded to a solid mass which is cooled and finally ground into a powder of precisely defined particle size (around 40 µ). The customer can then spray this powder electrostatically onto a metal surface. A final burn-in produces a solid coating of highest stability with a typical surface consistency.

Colour tests throughout all process stages

The colour palette at Thermaset comprises more than 4,000 colour standards, including more than 1,000 greys. Moreover, new ones are added every day. This diversity requires a powerful and reliable colour matching and testing system, not least for the incoming inspection of the raw materials originating from numerous suppliers in various countries.

"We produce about 700 tons a year. Our powder coatings are found in bicycles, refrigerators, ovens, warehouse racks and other metal products", says Frank Savage, technical manager at Thermaset. Because the colour impression cannot be tested until the end product, the customer order comprises the entire process inclusive of coating and burn-in in the oven. "This shows the importance of quality tests over the entire process", he explains. Powder coatings are likely to become even more widely used in the next few years: quite apart from their aesthetic advantages, they are much kinder to the environment thanks to lower solvent emissions than classical paints and enamels.

Powder coatings are increasingly being used in a range of industrial sectors, and not only for metal structures.

Customer mirror

Ciba SC (Switzerland)

At the Coatings Effects Division of the world's leading manufacturer of specialist chemicals, everything revolves around colour pigments and additives for plastics, coatings and inks. Minolta's stationary and portable spectrophotometers CM-3600d and CM-2600d are used together with the CGREC colour matching software as reference instruments in the company's laboratories and for customers around the world.

Wella AG (Germany)

The manufacturer of hair-care products relies on the portable spectrophotometer CM-2600d at the incoming inspection of the packaging materials (paper, cardboard, PET bottles, etc.) for its products. Uncompromising quality assurance at Wella extends to its corporate identity and corporate design.

Alcro Beckers (Sweden)

Swedish paint products manufacturer Alcro Beckers has opted for the portable CM-2500d to upgrade its colorimetry capability at the point of sale (POS). Major reasons for this choice were its perfect instrument compatibility and simple operation.

Clariant (Brazil)

This subsidiary of the textile dyestuffs manufacturer of world repute relies on the CM-2600d model for its quality assurance. Today, portable state-of-the-art colorimeters are increasingly replacing much more expensive stationary instruments.

LG Philips (China)

LG Philips Displays is the global leader in display technologies. The company, with operational headquarters in Hong Kong and more than thirty factories worldwide, is a joint venture between the CRT business of LG Electronics of Korea and Royal Philips Electronics of the Netherlands. It uses the Minolta CA-100Plus and CA-210 display analysers as reference instruments to ensure perfect white balance and optimum colour rendering of its CRT and LCD displays.

Barco (Belgium)

Barco is based in Kortrijk, Belgium, and is represented in over a hundred countries throughout the world. The ongoing endeavour of this innovative company is to achieve market and quality leadership in various sectors of image processing. Light and display meters from Minolta, such as the CA-100 and CA-210 Colour Analyzers, the CC-100 convergence meter and the LS-100 luminance meter play a central role in R&D and quality assurance for video projectors and image-data systems used in aviation, medicine, the media and audio-visual applications.

Teijin Twaron (Netherlands)

Teijin Twaron, a member of the Japanese Teijin group, is a global technology-driven company and an important producer of para-aramid polymers, yarns, fibres and pulp under the trade name Twaron®. These materials are used in products such as marine ropes and sails, protective clothing, bullet-proof vests and helmets. Teijin Twaron relies for its colour control on the accuracy of Minolta's colour management systems such as the CM-3610d and CM-3600d bench-top spectrophotometers with their unrivalled MiOS technology.

Masthead

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