

AxF

➔ Appearance eXchange Format ➔

The inability to capture and manage complex visual appearance data in a single, editable file has been an obstacle to improving the virtualization process. X-Rite's new AxF digital file format is the first file format exclusively designed for system-independent storage of measured digital appearance. AxF is:

- ▶ The foundation of the Total Appearance Capture (TAC) Ecosystem
- ▶ Produced by TAC7 Scanners measuring physical material samples under specific or multiple lighting conditions
- ▶ Imported and used by newer CAD rendering systems including Autodesk VRED™ and Nvidia Iray® - more planned
- ▶ An enabler for designers, 3D artists, material specifiers and marketers to visualize their designs with unmatched realism
- ▶ Built on HDF5 (a versatile and complex data model, library and file format for storing and managing data)
- ▶ The AxF SDK enables access to Maps, Components and metadata
- ▶ Payload and metadata can be encrypted separately

To date, digital appearance representations have been highly system dependent. The materials or shaders represent the surface appearance and reflection properties of 3D objects but are created using system-specific shaders and shading languages. Almost every available commercial system comes with its own proprietary models and specifications which cannot be exchanged or converted easily. In practice many complex production workflows rely on different software packages, and different formats must be used in parallel. This poses serious problems when consistency such as color, image or gloss measurement needs to be achieved.

To solve this, a standardized representation for storing and communicating complex visual appearance is required. Before AxF, no such format existed for appearance, in contrast to color measurements or images. As a result, materials and surface finishes were communicated and controlled using small physical samples and/or standards with all the associated problems regarding availability, applicability, generality, etc.

AxF is a binary digital file format that delivers a standardized appearance representation with the following characteristics:

- ▶ Not restricted to a specific device or measurement geometry - From a single spectrum up to full BSSRDF
- ▶ Supports continuous appearance representations - like parametric BRDF models but also discrete samples like BTF measurements
- ▶ **Scalable** - ensures efficient access for large data volumes of gigabytes or more
- ▶ **Extensible** - Extensions can be defined without harming existing support in third-party applications
- ▶ **Portable** - SDK available for Windows and Linux Operating Systems (Mac planned) to support existing workflows and enable simple integration into existing applications
- ▶ **Compatible** - comes with a built-in set of material representations designed for compatibility with existing SVBRDF based workflows

AxF is the foundational component of X-Rite's Total Appearance Capture (TAC) Ecosystem. The AxF files are used to define, store and transfer digital materials between other components of the TAC Ecosystem which create, store, edit, communicate or present visualizations.

The typical workflow follows:

- ▶ Physical material samples are scanned (TAC7 Scanner or X-Rite Scanning Service) to measure and create highly realistic and accurate digital materials specifications in AxF.
- ▶ Alternatively, existing AxF files can be accessed from digital material catalogs such as the PantoneLIVE Cloud or Pantone® Silk (a mobile Digital Material catalog for iOS).
- ▶ AxF files are stored and managed in the Pantora Digital Material Hub and can be distributed from there to Digital Material rendering cores, plug-in integrations with third-party 3D rendering systems including Autodesk VRED™ and Nvidia Iray® or X-Rite's Virtual Light Booth.

Supported AxF representations:

- ▶ CPA (car paint)
- ▶ SVBRDF
- ▶ Diffuse albedo map (RGB and spectral)
- ▶ Specular color map (RGB and spectral)
- ▶ Specular roughness map
- ▶ Normal map (replaces need for a Bump map)
- ▶ Surface orientation map (to capture anisotropy)
- ▶ Height map (also known as Displacement map)
- ▶ Fresnel map
- ▶ Alpha map (-> Backlight Option)
- ▶ Clear coat maps (Clear coat IOR & normal map)

X-Rite and ISO Standards

CxF, developed by X-Rite Pantone, is based on XML and can include spectral color values, named colors such as PANTONE®, color spaces and appearance effects (specific lighting conditions, type of substrate, type of ink, density, opacity, transparency of the color, gloss, texture, position and shape of color patches), as well as commercial aspects, mathematical, optical conditions, etc. CxF was adopted as an ISO standard in 2015.



ISO17972 Graphic technology – Colour data exchange format (CxF/X).

In contrast to CxF, AxF information is stored as binary data to accommodate the significantly larger data volume needed to describe the total appearance of a material. AxF was developed as a complement to the CxF format. It is able to store CxF-based color information for materials. AxF is a container that encapsulates metadata which identifies the material and describes its properties, as well as the payload which is either a Bidirectional Texture Function (BTF) or Spatially Varying Bidirectional Reflectance Distribution Function (SVBRDF), and other data which describes the appearance of the digital material.

Thanks to the binary Hierarchical Data Format (HDF5) metadata in the AxF file is quickly accessible, as well as readable and editable independently from loading and writing the entire payload data. The payload data itself is optimized for size and speed and can be protected against unauthorized access.

X-Rite is a world leader in color measurement, management, and communication technology for industries and applications that reach around the globe. We provide the expertise and know-how to make the most of your color and appearance opportunities...right the first time, right every time.