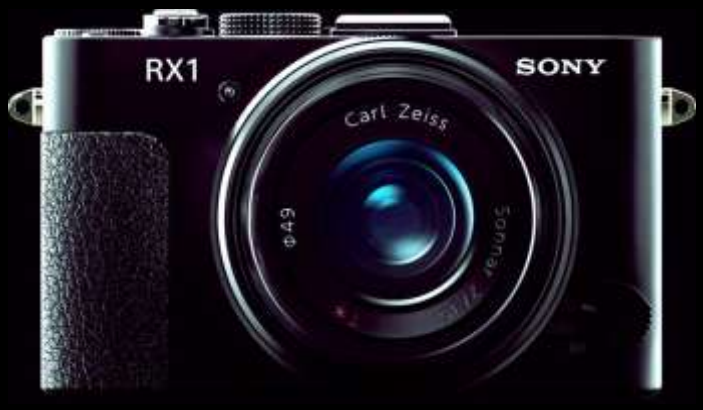


Voice of our engineers

The story behind our palm-sized, full-frame camera

Members of the DSC-RX1 development team reveal how a compact camera with a 35 mm full-frame image sensor came into being.

Superlative image quality from a camera that fits in your palm

PRODUCT CONCEPT

Pushing the limits of optical imaging

LENS

Putting it all together for sharper, cleaner images

INTEGRATED DESIGN

Combining great looks with super usability

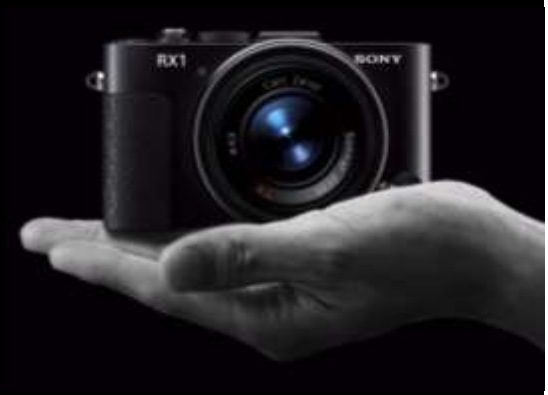
DESIGN

Enhancing performance beyond the basics

ACCESSORIES

Superlative image quality from a camera that fits in your palm

DSC-RX1, a compact camera with a 35 mm full-frame sensor, raised the bar for compact digital camera image quality. Following is an explanation of how the product was conceived and produced.



PRODUCT CONCEPT

Tatsuo Kureishi
Product Planner

Masaaki Oshima
Camera Design Engineer

Achieving optimum image quality

Tatsuo Kureishi (Product Planner)

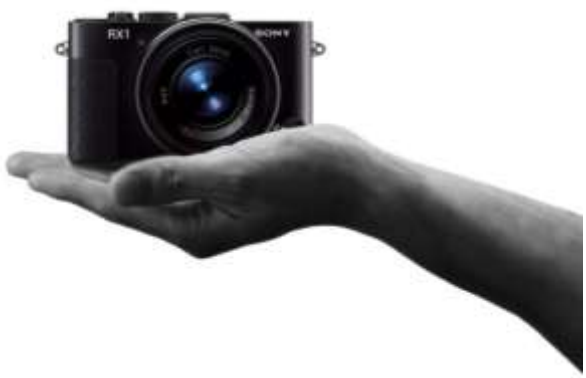
Kureishi: We wanted to produce a camera capable of incredible image quality, one that would epitomise Sony's unique place in the market.

In response to user demand for increasingly higher quality images, the RX1 development team held discussions during which we tried to think outside the box in order to achieve the highest image quality ever.

We eventually realised that only a camera with a non-interchangeable lens could significantly increase image quality, since it would allow us to optimise performance between the lens and image sensor. Moreover, we concluded that the new camera would give users an exciting new way to shoot as compared to standard SLRs. And it was a challenge that only Sony could successfully take on since we make our own image sensors, lenses and key components of image processing engines. Furthermore, we as a company have always been focused on creating increasingly compact products.

In short, development of RX1 — the world's first compact digital camera with a full-frame image sensor — started with the concept of attaining the best image quality possible from a camera that fits in the palm of your hand.

Oshima: RX1 had no precedent. When we began development of the camera, there was no such thing as a compact camera equipped with a full-frame sensor. And because we didn't know how the marketplace would react to it, we focused on creating the ultimate 'second camera' that would primarily attract photo enthusiasts.



SLRs are typically too large and heavy for people who want to have a camera always on hand for grab-shots. And your standard compact camera just can't deliver the high image quality that serious shooters demand. Therefore, we suspected SLR users would really appreciate a full-frame compact camera for everyday use.

We did know, however, that there was an increasing number of users who, after discovering the joy of photography through their smartphones, were interested in stepping up to better cameras. This was clearly demonstrated by the success of small SLR-type cameras such as NEX Series. We thought RX1's superlative image quality and compactness would attract them.

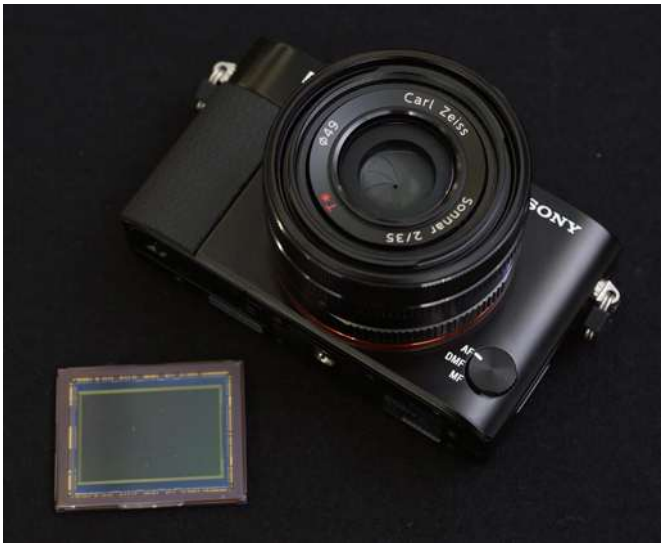
Matching lens with sensor to optimise image quality

Kureishi: How to obtain the best possible image quality from a non-interchangeable lens camera?

With interchangeable lens cameras, some wiggle-room as regards image quality is necessary because the image sensor has to handle different types of lenses.

But because RX1 has a non-interchangeable lens, we could optimise lens and sensor so that each would complement the other. This allowed us to squeeze maximum performance from both devices, which were manufactured to stringent standards.

We achieved breathtaking sharpness even at the edge of the image by using the best lens and image sensor possible, then fine-tuning their relative positions down to the micron level. This is unthinkable with SLRs because it contradicts the core product concept, which is to allow lenses to be changed. But by equipping the camera with a non-interchangeable lens and 35 mm full-frame image sensor, we could set our sights on realising unsurpassed image quality.



Lens and sensor are optimally aligned to provide maximum performance.


Masaki Oshima (Camera Design Engineer)

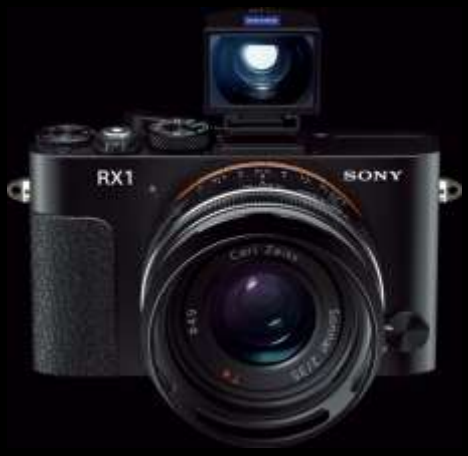
Oshima: In addition to fantastic image quality, we were also determined to keep the camera small. Success in this area would really enhance shooting flexibility.

Since no compact camera with a full-frame sensor existed when we started, we aimed to surprise people into asking, "Is there really a full-frame sensor inside?" As a result, we ended up having to develop every component from scratch, except for the battery, LCD panel and external connection jacks.

Along with maintaining compactness, we wanted the camera to deliver uncompromised image quality. As an engineer, this was an exciting challenge.

Pushing the limits of optical imaging

Why a fixed-focal length lens?
Why a focal length of 35 mm?
Why a Carl Zeiss Sonnar T* lens?
The development team answers these questions while discussing the lens, RX1's eye to the world.



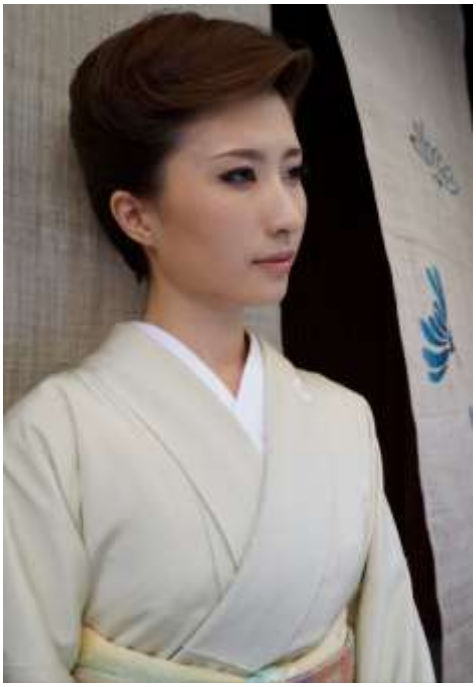
LENS

Tatsuo Kureishi
Product Planner

Fumikazu Kanetaka
Opto designer

Masaaki Oshima
Camera Design Engineer

A well-calculated, 35 mm fixed-focal length lens



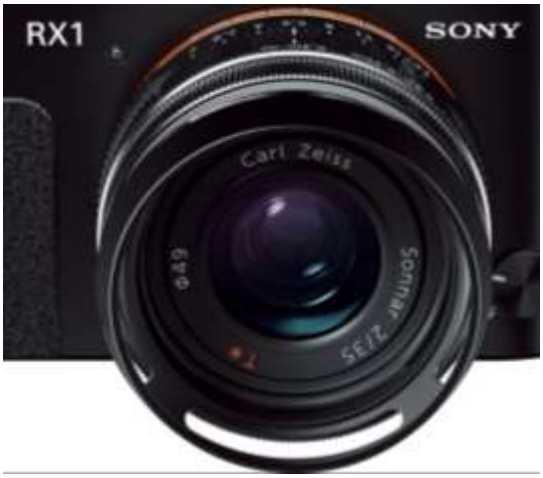
A 35 mm lens was chosen after much discussion.

Kureishi: Our concept of obtaining the highest image quality possible from a camera that fits in the palm of your hand meant pursuing image quality to the max while at the same time maintaining compactness. After giving this a great deal of thought, we decided on a fixed-focal length lens.

Zoom lenses are certainly convenient. And today's models deliver really high performance. But because we aimed for the ultimate in image quality, we thought a fixed-focal length lens was our best choice.

We decided on a focal length of 35 mm after discussing what kinds of photos we supposed users would take. Our conclusion? Photos that only a compact camera could take.

The size of the lens is totally unassuming, making it possible to take portraits close up without alarming the subject. It also makes it easy to carry the camera around for grabbing snaps outside in the city, inside rooms and in lots of other situations. We decided 35 mm would be the ideal focal length for this type of shooting.



Consultations with Carl Zeiss led to selection of a Sonnar T* lens.

Kanetaka: Once we decided on 35 mm, we examined different lenses with an eye toward finding a fast lens that wasn't too long or large in diameter. After consulting with Carl Zeiss, we chose a Sonnar T* lens.

By positioning a newly developed, non-spherical element close to the image sensor, we could keep the lens small as well as ensure excellent edge sharpness. Our efforts paid off in a well-designed, high-performance lens. We purposely omitted image stabilisation so we could keep the lens compact and ensure excellent image quality.

Enhancing image-capture capability and reducing size

Fumikazu Kanetaka (Opto Designer)

Kanetaka: We adopted a floating mechanism to minimise fluctuations in aberrations that occur when focusing at different distances, thus ensuring consistent performance regardless of focus distance.

Oshima: Along with that we made AF fast and accurate so users can fire off shots in rapid succession. The focus elements in the lens are more than 10 times heavier than those found in E-mount fixed-focal length lenses. The lens also has a considerably heavier drive compared to those found in fixed-focal length lenses of other mirrorless cameras. This is because the drive motor controls two focus-lens groups and moves the aperture as well.

This was a real challenge. If the drive motor can't handle the load, the two focus-lens groups sometimes take longer to position, resulting in out-of-focus images. But concentrating only on accelerating drive speed would increase noise from the drive motor, in addition to making it more difficult to have the focus elements stop at their proper positions. To solve this we developed a new drive system specifically for RX1, which keeps noise down while achieving remarkably fast focus speeds. This is a real advantage for users.

Kanetaka: Furthermore, we included a switchable macro mode for shooting close ups and that keeps overall lens size small. The minimum focus distance of 20 cm was made possible by employing a mechanism that allows users to turn the ring to enable macro mode.

Putting it all together for sharper, cleaner images

The development team worked to achieve the highest image quality possible by employing a 35 mm full-frame image sensor and a non-interchangeable lens design. The key to success was precise integration of lens and camera body.

INTEGRATED DESIGN (IMAGE QUALITY)

Masaaki Oshima
Camera Design Engineer

Fumikazu Kanetaka
Opto Designer

Koutaro Amano
Mechanical Engineer

Takayuki Maeda
Camera Design Engineer

Image quality that only integrated-lens design can achieve

Kanetaka: As we noted, the full-frame sensor combined with Sonnar T* lens makes RX1 quite remarkable. To fully leverage the performance of this duo, we employed the concept of "integrated design and adjustment." This is a method of achieving real-world optical performance that closely approaches theoretical limits by reducing variations in the manufacturing process.

Dramatically improving sharpness across the entire image was achieved by adjusting the position of the sensor surface to find the exact point at which image sharpness at the periphery increases without affecting sharpness at the center. These adjustments are in microns.

Amano: After a lot of back and forth regarding the integrated-lens design, we finally got something on paper. But our initial efforts did not come out quite as planned. You see, because components are not perfectly uniform, each camera differs slightly, which means the ideal lens and sensor positions differ from camera to camera.

Given this limitation, we needed to discern sweet spots in terms of lens and sensor positions. This required numerous prototypes and measurements in order to gather data and examine image quality — a process that continued until right before production.

But in the end, there are limits as to what mechanical design can do. So we required close cooperation with the factory during production, making slight adjustments to each part to ensure that the sensor and lens were optimally positioned.

Close cooperation with the factory ensures precise positioning of lens and sensor.

Image quality that only integrated-lens design can achieve

Oshima: We first measure tilt of the light axis for each lens unit, as well as each sensor's surface angle. The positions of the lens and the sensor are then adjusted accordingly for each camera by highly skilled workers inside a clean room. Assembling a camera with lens and sensor improperly aligned results in an inferior product. Therefore we manufacture RX1 one-by-one, making adjustments to ensure maximum sharpness across the entire image. It's a very time consuming and costly manufacturing method but we decided to use it with RX1 to achieve the best image quality possible.

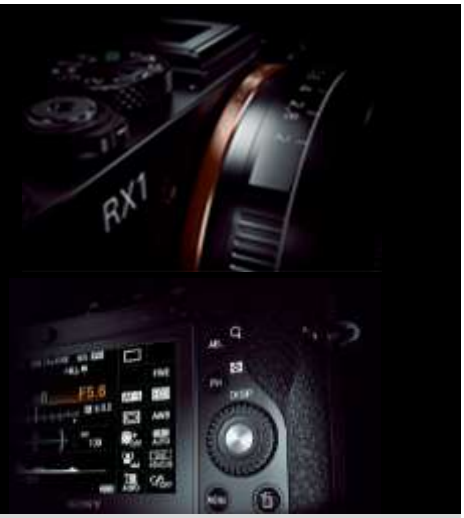
Maeda: In terms of image quality, RX1's full-frame sensor has a dynamic range roughly 2.4 times greater than that of α900. To make the most of this superior performance, we worked toward reproducing highlights and shadows in a way that closely resembles how the human eye discerns light.

At higher sensitivity settings, RX1 delivers very high-quality images with decreased noise. The camera also optimises processing for noise reduction and sharpness depending on the area to which these processes are applied. This is done by examining flat and edge regions of the image and determining subject type. The results are high-sensitivity images with minimal noise and optimal sharpness.

Takayuki Maeda (Camera Design Engineer)

Combining great looks with super usability

DSC-RX1 features an understated, first-class look befitting a camera capable of such high-quality images. The team talked about how they achieved a functional yet highly pleasing aesthetic that makes for a great looking, easy-to-use camera.



DESIGN

Masaaki Oshima
Camera Design Engineer

Koutaro Amano
Mechanical Engineer

Noriaki Takagi
Producer/Senior Designer

Back to basics

Takagi: The initial design wasn't anything like the look we ended up with. True to our tradition of pushing the limits as regards innovative design, we examined numerous possibilities. But even after endless discussions, we couldn't nail down the final look. We finally settled on a fairly basic design befitting such a camera by eliminating unnecessary items. Then, after researching more about the preferences of mirrorless camera users and the history of cameras, we produced numerous prototypes.

Rather than going for a retro look, we designed the camera largely based on its functions. In addition, we worked closely with persons in charge of mechanical design to create the final look.

Noriaki Takagi (Producer/Senior Designer)

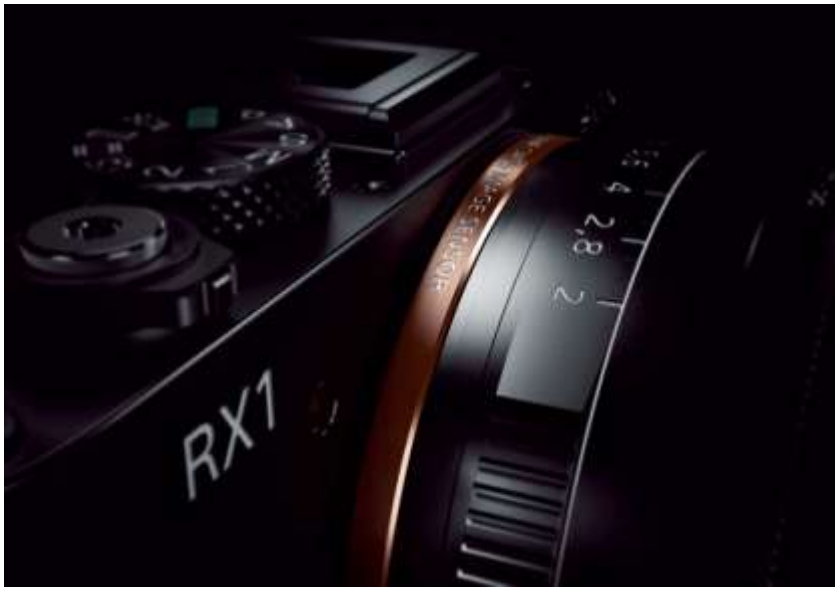
Koutaro Amano (Mechanical Engineer)

Amano: We even reviewed manufacturing processes in order to keep the camera as compact as possible.

The most difficult aspect was fitting a full-frame image sensor inside such a small body. With most compact cameras, the image sensor is attached to the lens barrel, which itself is connected to the camera body. RX1's large image sensor, however, necessitated a large diameter lens. This meant a large hole in the camera body, and naturally a body size to accommodate the sensor.

The new design sandwiches the front body panel between the lens and sensor, with the lens outside and the sensor inside. The complexity of the structure — and the fact that we really wanted to keep the camera compact — dictated that we change the manufacturing process.

Attention to detail creates an object of affection



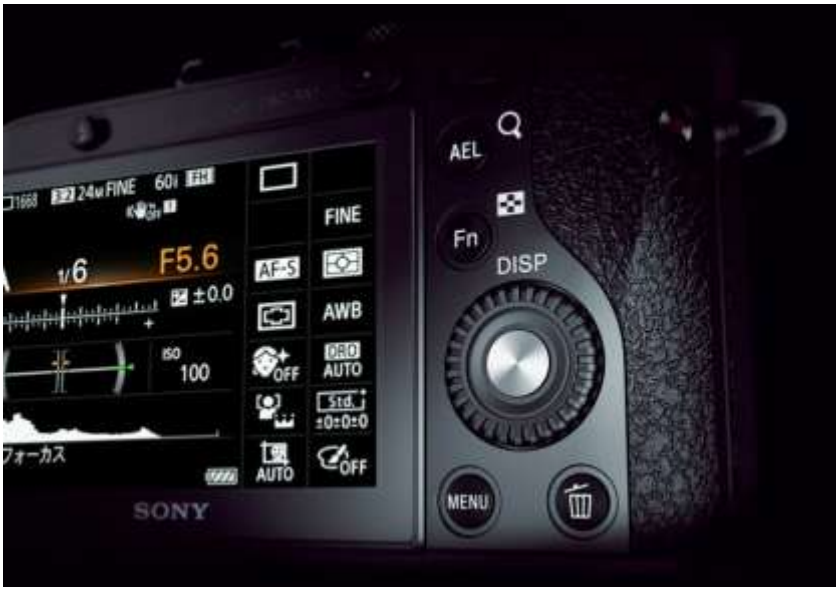
Tactile feel of aperture ring on lens simulates actual aperture movement.

Oshima: We tackled control layout differently than we normally do. The aperture ring, for example, is on the lens. With interchangeable lens cameras, it's often an electronic dial positioned on the upper right of the body. We put the ring on the lens based on the fact that the aperture is part of the lens, and therefore designed it to simulate the feeling of actually closing and opening aperture blades. The positions, diameters and widths of all control rings on the lens — focus, macro switch and aperture — were determined after thorough testing.

Operation was designed to make RX1 easy to use for owners of interchangeable-lens cameras. RX1 also features the same QuickNavi function often found in other mirrorless cameras. This facilitates operation, especially when a viewfinder is mounted because it allows users to check settings at a glance.

Takagi: I wanted users to familiarise themselves with the exposure compensation dial. Generally, information on the dial is printed in a single colour, but we used two colours. Other cameras show compensation levels as dots or other symbols and place numerical information — such as +1 and -1 — next to them. Because RX1's exposure compensation dial is so small, we didn't have enough space to put markings and numbers side by side.

We resolved this by inserting numbers where symbols would be on other cameras. To make it easier for users to distinguish between the symbols and numbers, we coloured symbols grey and numbers white.

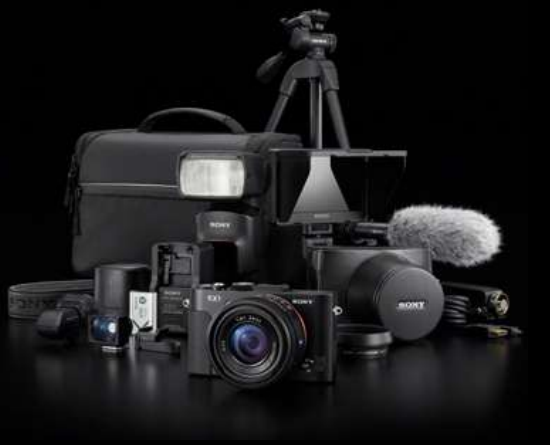


A camera that exudes pride of ownership.

Another little extra we added was the diamond-shaped knurling on the mode dial and shutter button, to which a shutter-release cable can be attached. In fact, our attention to detail went beyond the camera body. We also included an aluminium lens cap. As far as I know, aluminium lens caps are quite rare even among interchangeable lenses. So you see, we went all out to produce a camera that would offer real pride of ownership.

Enhancing performance beyond the basics

Exclusive optional accessories let users maximise camera performance and expand their creative vision. Each accessory was developed with great attention to detail.



ACCESSORIES

Tatsuo Kureishi
Product Planner

Masaaki Oshima
Camera Design Engineer

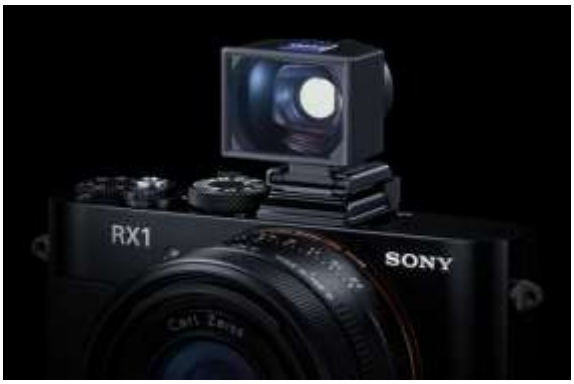
Noriaki Takagi
Producer/Senior Designer

Optional viewfinders

Oshima: Photographers generally have strong feelings as regards viewfinders. Some swear by optical viewfinders while others can't live without their electronic versions. Furthermore, some people like to switch between the two depending on the situation. We could have incorporated a built-in viewfinder, however we were unsure what type would be best. So we decided to let users decide and offer two types of optional viewfinders. Each one has its advantages so I recommend that users try both before choosing.

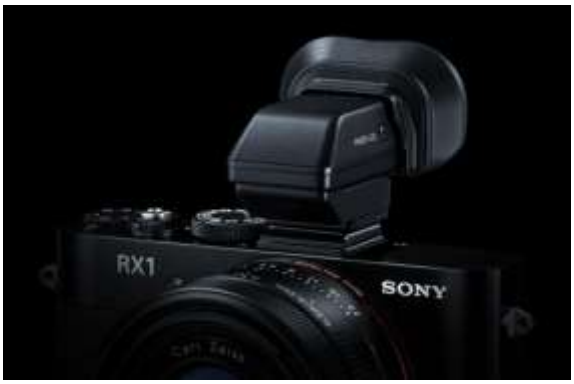
Optical Viewfinder Kit FDA-V1K

Consisting of six elements in six groups, this Albada-type inverted Galileo finder offers a clear, bright field of view with a magnification ratio of approx. 0.58 and a dioptre limit of -1.0 adjustable in ±0.2 steps (viewfinder image).



Electronic Viewfinder Kit FDA-EV1MK

Boasting 100% field of view*, a magnification ratio of 0.71* (35 mm equivalent) and 2.35 megapixels*, this XGA OLED viewfinder delivers excellent contrast in addition to superb resolution.
*Approximate



Thumb grip born of necessity

Thumb Grip TGA-1
The grip can be rotated 180 degrees and doesn't get in the way of the playback button or other controls.

Takagi: Naturally, we wanted RX1 to be easy to hold, but its compactness limited grip size. We solved this problem by developing an optional thumb grip. Once attached, the camera can be held more securely with one hand, providing more freedom when shooting. The thumb grip incorporates a shoe on top for attaching the optical viewfinder and other accessories.

Multi Interface shoe for broadening creative expression

Kureishi: RX1 is equipped with a Multi Interface Shoe, which was developed as a common accessory interface for Sony cameras. The shoe allows users to expand the possibility of expression by adding accessories from both α and Handycam series. For example, users who want to shoot full HD movies can improve the quality of their movies by attaching a microphone or other accessory. In other words, the potential for expression with RX1 expands as the number of accessories increases.