



# How to solve distortion for wide-angle lens

Ultra-Low-Distortion Lens Unit from TOYOTEC : **RDL**

# How to solve distortion for wide-angle lens

Ultra-Low-Distortion Lens Unit from TOYOTEC : RDL



A lens with a focal length close to the human viewing angle is called a "standard lens," while a lens with a focal length closer than that of a standard lens is called a "wide-angle lens". Wide-angle lenses are used in all kinds of optical systems, including cameras, because they can capture a wider range of images than standard lenses.

On the other hand, one of the requirements for wide-angle lenses is "low distortion". Distortion and volume deformation are typical distortions in wide-angle lenses. This is a result of wide-angle lenses being convex lenses. When you use a wide-angle lens to obtain information over a wide area, distortion is an issue that is bound to occur, no matter how small or large the level.

To eliminate this distortion, there are several approaches, such as ;

"physically reducing it through lens specification and configuration"

or

"correcting the image obtained by software".

However, as a lens manufacturer, TOYOTEC decided to solve this problem by offering a solution to the users as a package : a lens unit.

We believe that it is desirable to be able to obtain an image with low distortion without any additional correction by the user.

TOYOTEC's low distortion wide-angle lens unit, RDL, was born from this approach.

# 120° Wide-Angle, Ultra-low Distortion

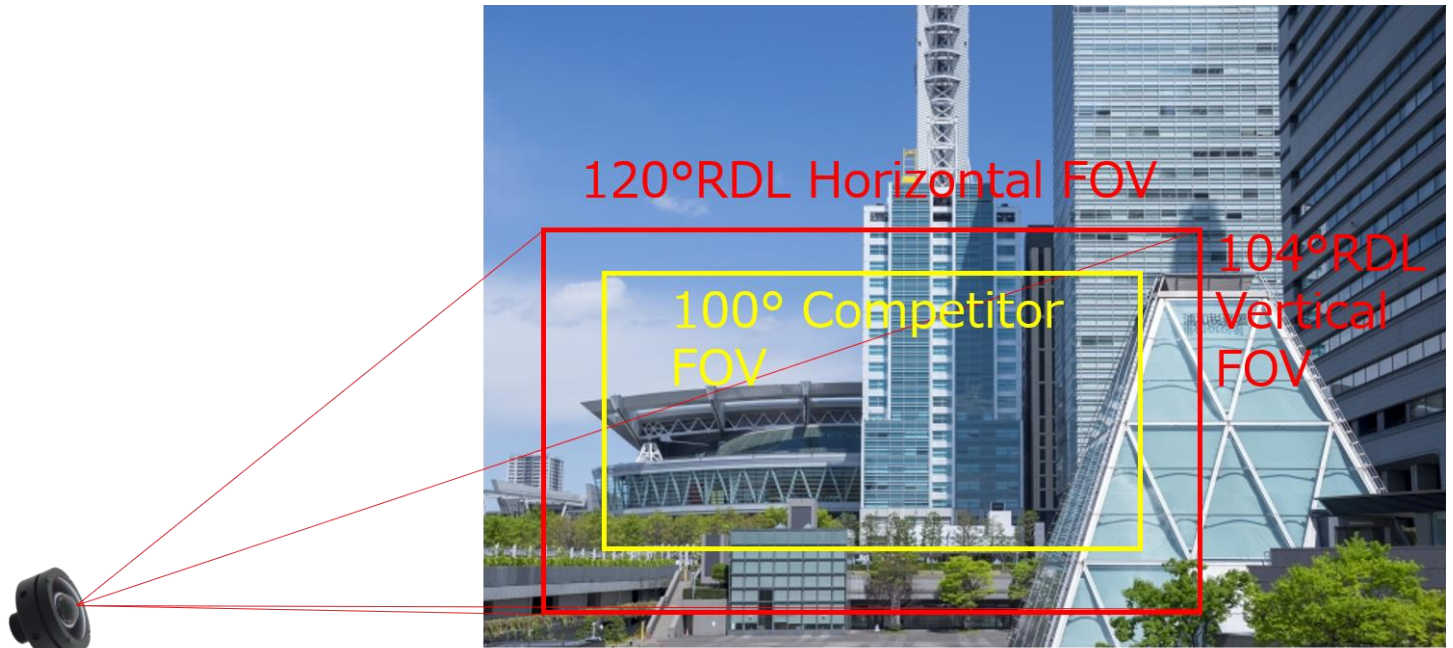


Image of RDL FOV

The wide-angle lens unit RDL developed by TOYOTEC can provide a 120° angle of view. This angle of view is one of the broadest of any wide-angle lens unit that is available on the market today.

The wider the angle of view, the greater the amount of information that can be obtained. This means that information that used to be obtained with multiple camera units or multiple shots can now be obtained with fewer units and fewer shots.

As the distortion in the periphery of the image is also reduced, it is possible to use images without distortion correction, as shown in the photo on the right.

The distortion rate in the RDL is less than 2%, which is an extremely small number for an ultra-wide angle lens. This low distortion is achieved not by the individual optical lens but by the entire system as a lens unit ( international patent pending in part, additional patent pending).



↑ Photo taken with standard wide-angle lens. Distortion correction is required.



↑ Photo taken with RDL lens. Distortion correction is not required.

# “Correct” information at a wide angle

There are two advantages of having a wide angle and low distortion.

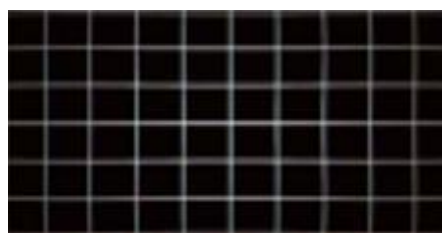
- ① Reduces the CPU burden of distortion processing in image processing
- ② Acquire more information in the periphery

Both of these are major advantages for engineers involved in optical systems, and lead to improvements of the product itself, such as making it more compact, saving energy, reducing costs, and increasing speed.

## Reduces the CPU burden of distortion correction in image processing



Standard wide-angle lens



RDL

As shown in the figure above, on a typical wide-angle lens, distortion occurs as you move toward the wide-angle end. This distortion needs to be corrected as described earlier, but it places some load on the system, such as the CPU of the processing system, especially in the case of QR code reading that requires high-speed processing and surveillance cameras that process and record images in real time. This can cause an increase in product size and cost, so minimizing the load on the image processing system is an important issue.

The image obtained by RDL shows almost no distortion even at the wide angle end. Since this processing is done in the lens unit, the system load received after the lens unit for image information can be greatly reduced.

## Obtain more peripheral (wide-angle end) information.

The less the distortion at the wide-angle end, the more information can be acquired.

This is because with a typical wide-angle lens, at the wide-angle end, there are areas where the image cannot be acquired or used due to image shrinkage. RDL does not cause distortion at the wide-angle end, so information at the wide-angle end can be acquired correctly.

In fact, this advantage is so great that when using an RDL and a standard wide-angle lens, **the RDL can acquire about 1.78 times more information** than standard wide-angle lens when shot from the same distance.



# RDL Specifications and Customization



## RDL Real Distortion-Less Lens Unit

### Standard Specifications

Horizontal FOV	120°
Vertical FOV	104°
Distortion	Below 2%
Imager Size	1/3 inch
Mount	S Mount (M12 x P0.5)
No. of Pixels	1.2M
Unit Size	L28mm x $\Phi$ 32mm
Fno	2
Focal Length	1.386mm
Total Track	32mm
IR-Cut Filter	Optional

※ Application-based customization available

TOYOTEC's RDL has one of the largest angle of view and the lowest distortion rate in the industry.

Our RDLs have been used in agriculture, factory automation, robots, and transportation equipment.

We can flexibly customize our products to meet the needs of our customers, such as changing the size, imaging sensor, or increasing the number of pixels, and we can manufacture and supply products according to the requested specifications.

### Contact for RDL

TOYOTEC Co., Ltd. Sales Department  
2-35 Nishiyutaka, Toyokawa, Aichi 442-0024  
TEL : (0533)85-3000 (代) FAX : (0533)85-6033