Specifications:

- Maximum Field of View: 190 degrees
- Nominal Field Diameter: 3.4 mm diameter
- Paraxial focal length: 1.24 mm
- F/number: 2.8
- Focus range: 0.5 inches to infinity
- MTF at Nyquist frequency (65 cy/mm):
  - 71% on symmetrical axis
  - 60% at 0.7 of field
  - 49% at 1.0 field
- Maximum Distortion measured from F-theta condition, at edge of field: 17.3%
- Lens Housing Outer Diameter: 0.943” (23.95mm)
- Lens Length: 1.016”: (25.82mm)
- Lens Mount: Micro 12mm x 0.5mm thread
- Lens end to Image Sensor Dimension 2.25 mm

Introduction:
The ORIFL190-3 is a fisheye lens that provides a 190 degree field of view. The circular image produced is 3.4 mm in diameter allowing 1/3 inch image sensor cameras to capture a symmetrical hemispherical image. Optimized for small size, the anodized aluminum lens body is only 24 mm in diameter, yet the optics have excellent field compression linearity, field luminance and color correctness throughout the field of view. The glass lens construction and coated optics provide a 1.2 mm focal length and F/2.8 speed for good low light capability. The large primary lens uses an O-ring seal to provide water and humidity resistance. Compatibility with most web-cam, circuit board and bullet style cameras is provided with the standard “micro mount” 12mm x 0.5mm pitch mounting thread. Applications include robotics, security, astronomy, and situational awareness monitoring.
Overview

The ORIFL190-3 is a fisheye lens that provides a 190 degree maximum field of view. A high quality 180 degree field of view can be reliably extracted using digital image processing of the digital image, or the entire image can be displayed in its unaltered form. The circular image produced is 3.4 mm in diameter allowing 1/3 inch image sensor cameras to capture a symmetrical hemispherical image. Optimized for small size, the anodized aluminum lens body is only 24 mm in diameter, yet the optics have excellent field compression linearity, field luminance and color correctness throughout the field of view. The glass lens construction and coated optics provide a 1.24 mm focal length and F/2.8 aperture speed for good low light capability. The large primary lens uses an O-ring seal to provide water and humidity resistance. Compatibility with most web-cam, circuit board and bullet style cameras is provided with the standard "micro mount" 12mm x 0.5mm pitch mounting thread. It can also be adapted to most standard C lens mount cameras with an optional adapter. This lens can also be used on 1/4” image sensors, however the entire circular image will not be visible. Similarly, the lens can be used with 1/2” image sensors and the circular image will fall well within the image sensor active area.

The optical resolution of the lens is superior to that of typical 1/3” image sensors (640x480) so resolution limits are governed by the image sensor, not the lens. The lens uses coated glass optics, and has excellent color correction throughout the field of view. An image of a standard Gretag Macbeth color rendition chart taken with this lens in diffuse sun light using a 640x480 CMOS image sensor is shown on the cover of this data sheet illustrating relative color correctness.

Since this lens produces a circular image that is a fraction of the image sensor area, portions of the image sensor are dark as seen in some of the unaltered sample images. This will typically affect the automatic exposure control circuits of the camera, and manual exposure control setting or modification of the automatic exposure control algorithms may be necessary.

When selecting a compatible camera, several factors are important to consider. First, the alignment of the lens and the image sensor is more critical than usual with conventional lenses in order to center the circular image within the image sensors active detection area. The 3.40 mm diameter image produced allows a misalignment of approximately 0.1 mm (0.0039") when using typical 1/3” image sensors (3.60mm x 4.80 mm active region typically). Adjustment of the lens holder with respect to the image sensor may be necessary to center the circular image within the image sensors active area. On PCB format cameras, this is achieved by loosening the fasteners holding the lens mount, then adjusting the lens until a circular image is observed, then tightening the lens mount.

The second factor to consider when selecting a compatible camera is assuring that the lens can be mounted close enough to the image sensor, and that there are no obstructions like image sensor cover glass, filter glass, or lens mount body interferences. Close mounting of the lens element and the image sensor is necessary since the wide field of view requires a very short focal length. The gap between the first glass lens element and the image plane is 2.77 mm when the lens is properly installed and in focus. The gap between the end of the lens housing and the image plane is 2.25 mm when the lens is properly installed and in focus. If the image sensor uses a cover glass or filter, it must be less than this dimension. Figure F4 illustrates nominal mounting dimensions for reference.

A third factor to consider is the electronic shutter capability of the camera, since there is not a mechanical aperture control or shutter on the lens. A fast electronic shutter (exposure time) may be necessary to obtain a proper exposure in bright light conditions. This is possible with most CMOS cameras, but may difficult be with older or high sensitivity CCD cameras and bright lighting conditions.

Figures F5 through F10 show sample images for the ORIFL190-3. Figures F11 and F12 illustrate design curves for nonlinearity of the image compression and relative illumination intensity.
F4: Nominal mounting dimensions for the ORIFL190-3 fisheye lens and a typical PCB camera image sensor

Potential Applications
- Wide Field Of View Robotic Vehicle Image Sensing
- Wide Field Of View Security Cameras
- Wide Field Of View Astronomy Applications: All sky imaging, cloud cover measurement, light pollution measurement.

Ordering Information:
Part number: ORIFL190-3
List Price: $250.00 USD
Discount Schedule:
- 1 - 4 : List Price
- 5 - 9 : 5% discount
- 10 - 24 : 10% discount
- 25 - 49 : 15% discount
- 50 - 99 : 20% discount

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Sample Images

F5: Typical Indoor Image, CMOS 640×480

F6: Digitally Orthorectified Image

F7: Digitally Corrected PSphere Image

F8: Digitally Corrected QTVR Panoramic

F9: Focal Range Example: Nearfield 12 point
Text & Background

F10: Fisheye lens shown on right, next to Omnivision 640×480 CMOS USB camera used to acquire images shown above
F11: NonLinearity of Field Compression as a function of Field Angle

F12: NonLinearity of Illumination as a function of Field Angle