

## Resolution measurements on the Nikon P1000

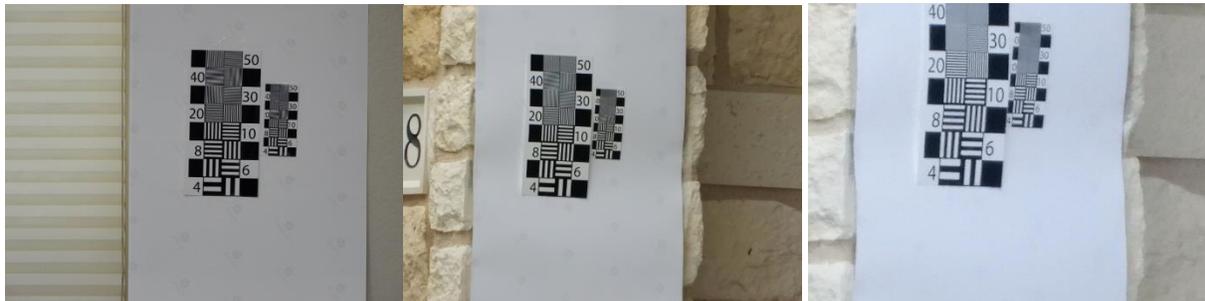
Michael P.C. Watts

I am enthusiastic bird photographer and long term “super zoom” fan. I have just received my Nikon p1000, here are my first impressions – hint – if you are a bird nerd it’s amazing. The cliff notes version is;

- From 24-700 mm the lens resolves close to the sensor pixel.
- At 3000 mm the lens resolves at roughly a HDTV image.
- At 12,000 mm the lens resolves at roughly a VGA image.
- All the resolutions are for a tripod mounted camera with 3 second delay to damp vibration. To reduce vibration, I mounted the camera to a plate and attached the plate to the tripod at the center of balance of the camera at max. zoom. The tripod mount has “gear head” that allows small adjustments to aim the camera at a target at max. zoom.
- Hand held vibration control worked well up to 400 mm. Beyond that, there was often some loss of resolution 1.5-2x. I like to use continuous or burst mode and often find one image that is really sharp. A high shutter (bright light) @ 1/2500 really helps.
- The manual focus feature is excellent and really helps for birds hidden in bushes and with low light.

### Details

- 1) I printed a standard resolution test pattern, at full size and 50% reduction and mounted them to a 480 mm (19”) long piece of paper. I positioned the camera so that the 480 mm paper filled the vertical frame, at each focal length. The pattern was identified in lines per inch, which was converted to mm and ratioed to the 480 mm that filled the vertical frame. The camera has a sensor resolution of 3456 pixels, so the minimum resolved feature could be expressed in sensor pixels. The smallest pattern of 100 lines per inch (2x reduced 50) corresponded to 1.7 sensor pixels. The images show resolution at 24, 700, 3000, and 12,000 mm. The 12,000 mm was taken at 150 meters from the target, I added a 150 mm shot from the same spot which is roughly to life size. Finally, I graphed the measured resolutions as a function of focal length.



*Focal length 50 mm*

*Focal Length 3000 mm*

*Focal Length 12,000 mm*

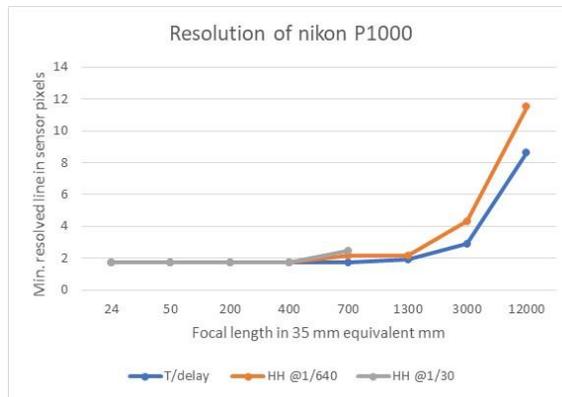
*(3000 mm optical 4x digital)*



Resolution target

Photo from site of the 12,000 mm photo, taken with a 150 mm zoom setting – roughly life size

- 2) The resolution is summarized in the graph below. From 24-700mm the lens resolved at the sensor pixel size, and the images look excellent. At 1300mm, the resolution is slightly compromised at 2 sensor pixels. At 3000mm, the lens resolved down to 2.8 sensor pixels, so the image quality was roughly equivalent to HDTV – good looking images just not quite as crisp. At an eye watering 12,000 mm (4x digital zoom), the lens resolved down to 7 sensor pixels, roughly equivalent to a VGA quality image - certainly good enough to identify a bird. If you took a fixed focal 700 mm lens and just cropped it to an equivalent 12,000 mm image you would see 2x poorer resolution.



- 3) I compared this to my Canon SX60 HS, at it's maximum optical zoom of 1350 mm it also resolved at HDTV levels. The P1000 for 2.1x the weight and 2x the price delivers 2.3x the resolution.
- 4) All the resolution tests were run on a tripod with 3 sec delay. I mounted the camera to a plate and attached the plate to the tripod just behind the focus ring, which is the center of balance at full zoom extension. This really reduced vibration compared to mounting the camera directly to the tripod. I could not see any negative effect from using "vibration reduction" on a tripod.
- 5) At 3,000 - 12,000 mm zoom it is almost impossible to aim the camera at a target using conventional tripod head with a screw lock. I have a Manfrotto "MXPRO -3WG Geared head"

which has a coarse locking adjustment, and then a micrometer screw to do the fine adjust – this worked really well.

- 6) Hand held with vibration reduction on, produced resolution similar to the tripod from 24-400 mm even at a shutter speed of 1/30. Above 400mm, I used a shutter speed of 1/800, and typically saw a 1.5-2x loss of resolution. However, if I use burst mode I can often find one image that is as good as the tripod shot. Stabilizing the camera with a monopod, tree trunk, or rock really helps. I could not detect any difference from the two vibration isolation settings.
- 7) An unsung feature of the P1000, is the manual focus ring. Birds have an annoying habit of hiding in trees which defeats auto focus, plus low light causes problems. The manual focus implementation on the P1000 is excellent.

My conclusion – every optical system is a resolution/low light/size/cost compromise, the Nikon P1000 offers a unique solution for the wildlife enthusiast that is very cost effective.