QX Hawk CCD vs. CMOS Comparison

This document highlights the differences between the CCD and CMOS models of the QX Hawk Imager.

QX Hawk Overview
The QX Hawk imager is the world’s first imager to be fully integrated with liquid lens technology, enabling broad focus flexibility (from 30 mm to 2 m and beyond). The imager features a high resolution modular optical zoom system, aggressive X-Mode decoding, and simple plug-and-play connectivity. The QX Hawk easily reads any linear or 2D symbol, including challenging 2D direct part marks (DPM), in any environment.

Using best-in-class X-Mode decode algorithms, the QX Hawk consistently captures everything from low contrast, damaged, or otherwise challenging direct part marks to a high density 3.3 mil Data Matrix, to very large linear symbols.

The QX Hawk is powered by a dual-core ARM/DSP processor to allow both high-speed image capture and real-time configuration and communication. The embedded processing, combined with three high-speed inputs/outputs directly from the reader, enables the QX Hawk to provide line-level control functions.

Image Size
- CMOS (WVGA): 752 x 480
- CCD (SXGA): 1280 x 960

Pixel Size and Image Quality
The CCD version of the QX Hawk offers a higher-quality image with greater pixel fill factor (the effective area of a pixel cell) and better pixel-per-element performance. However, the CCD QX Hawk has a smaller pixel size, which means the sensor collects less light.
- CMOS pixel size = 6.00um
- CCD pixel size = 3.75um

Default Shutter Speed
- CMOS exposure: 1/2,500
- CCD exposure: 1/1,500

Gain Range
- CMOS: 0 - 33
- CCD: 0 - 64

Shutter Speed Parameters
- CMOS: 60 - 40,000
- CCD: 30 - 150,000

Image Capture Examples
The following images demonstrate the differences between CCD and CMOS image captures at 4 inches, and at varying Gain and Shutter Speed settings.

Shutter Speed = 1/2,500

[Image of QX Hawk CCD and CMOS captures]
Frame Rate – Full Frame

- CMOS: 60 frames per second (27 MHz pixel clock)
- CCD: 20 frames per second (36 MHz pixel clock)

Frame Rate – Window of Interest

- CMOS frame rate increases as row size and column size decrease (until < 660 columns).
- CCD frame rate increases as row offset increases (and row size subsequently decreases).
  Important: Column size has no effect on frame rate.

Trigger Delay

The CCD version of the QX Hawk incurs a 5ms delay from trigger to image capture because of a High Sweep operation. This should be considered before placing the CCD QX Hawk in high-speed applications where there may be variation in speed.