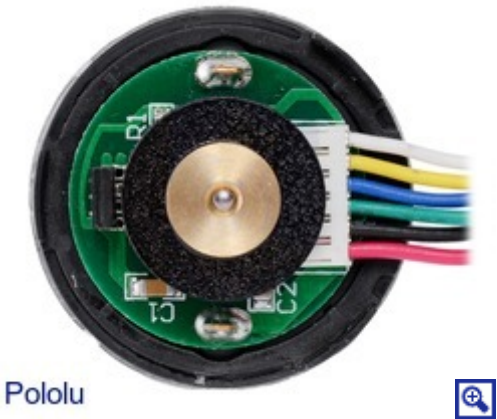## Using the Encoder

A two-channel Hall effect encoder is used to sense the rotation of a magnetic disk on a rear protrusion of the motor shaft. The quadrature encoder provides a resolution of 64 counts per revolution of the motor shaft when counting both edges of both channels. To compute the counts per revolution of the gearbox output, multiply the gear ratio by 64. The motor/encoder has six color-coded, 11" (28 cm) leads terminated by a 1×6 female header with a 0.1″ pitch, as shown in the main product picture. This header works with standard **0.1″ male headers** and our male **jumper** and **precrimped wires**. If this header is not convenient for your application, you can pull the crimped wires out of the header or cut the header off. The following table describes the wire functions:



**37D mm metal gearmotor with 64 CPR encoder (with end cap removed).**

| Color  | Function                                         |
|--------|--------------------------------------------------|
| Red    | motor power (connects to one motor terminal)     |
| Black  | motor power (connects to the other motor terminal) |
| Green  | encoder GND                                      |
| Blue   | encoder Vcc (3.5 – 20 V)                         |
| Yellow | encoder A output                                 |

| White | encoder B output |
|-------|------------------|

The Hall sensor requires an input voltage, Vcc, between 3.5 and 20 V and draws a maximum of 10 mA. The A and B outputs are square waves from 0 V to Vcc approximately 90° out of phase. The frequency of the transitions tells you the speed of the motor, and the order of the transitions tells you the direction. The following oscilloscope capture shows the A and B (yellow and white) encoder outputs using a motor voltage of 12 V and a Hall sensor Vcc of 5 V:



**Encoder A and B outputs for 37D mm metal gearmotor with 64 CPR encoder (motor running at 12 V).**

By counting both the rising and falling edges of both the A and B outputs, it is possible to get 64 counts per revolution of the motor shaft. Using just a single edge of one channel results in 16 counts per revolution of the motor shaft, so the frequency of the A output in the above oscilloscope capture is 16 times the motor rotation frequency.