

2-IC circuit decodes quadrature waveforms

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With this simple 2-chip circuit, you can detect the direction of movement of any transducer that produces a quadrature waveform. A shaft equipped with a position encoder is one such device; the encoder provides information that indicates incremental clockwise or counterclockwise rotation or no measurable rotation.

The position encoder's outputs, A and B (Fig 1a), go to Fig 1b's circuit for decoding; each signal enters a 2-bit shift register constructed from a pair of the 74L374's flip flops. A clock signal shifts the information, so the shift registers always contain both old and new samples of A and B. These four samples then specify a 4-bit address to the PROM, via inputs A₀ through A₃, to select a stored byte that indicates direction of movement, no movement or an error condition. A switch on the PROM's fifth address line, A₄, determines whether movement in a particular direction is considered positive or negative.

The 32 bytes of data in the PROM program (Fig 2) contain only four values: 1 to indicate movement in the negative direction, 2 to indicate movement in the

| ADDRESS | DATA | ADDRESS | DATA |
|---------|-------------|---------|-------------|
| 0 | 03 NO COUNT | 10 | 03 NO COUNT |
| 1 | 01 DOWN | 11 | 02 UP |
| 2 | 02 UP | 12 | 01 DOWN |
| 3 | 03 NO COUNT | 13 | 03 NO COUNT |
| 4 | 02 UP | 14 | 01 DOWN |
| 5 | FF ERROR | 15 | FF ERROR |
| 6 | FF ERROR | 16 | FF ERROR |
| 7 | 01 DOWN | 17 | 02 UP |
| 8 | 01 DOWN | 18 | 02 UP |
| 9 | FF ERROR | 19 | FF ERROR |
| A | FF ERROR | 1A | FF ERROR |
| B | 02 UP | 1B | 01 DOWN |
| C | 03 NO COUNT | 1C | 03 NO COUNT |
| D | 02 UP | 1D | 01 DOWN |
| E | 01 DOWN | 1E | 02 UP |
| F | 03 NO COUNT | 1F | 03 NO COUNT |

Fig 2—A 32-byte PROM program contains data values that indicate positive or negative movement, no movement or an error.

positive direction, 3 to indicate no movement and FF_H to indicate an illegal-address condition caused by a problem such as noise or a phase error. Positive movement thus produces a pulse on output D₀, while negative movement puts a pulse on D₁. Lines D₂ through D₇ are LOW unless an error occurs.

By connecting outputs D₀ and D₁ to a counter (such as a 74193), you can use this circuit to track a device's position. You can also implement a second tracker by adding one PROM chip, because the circuit uses only half of the 74L374.

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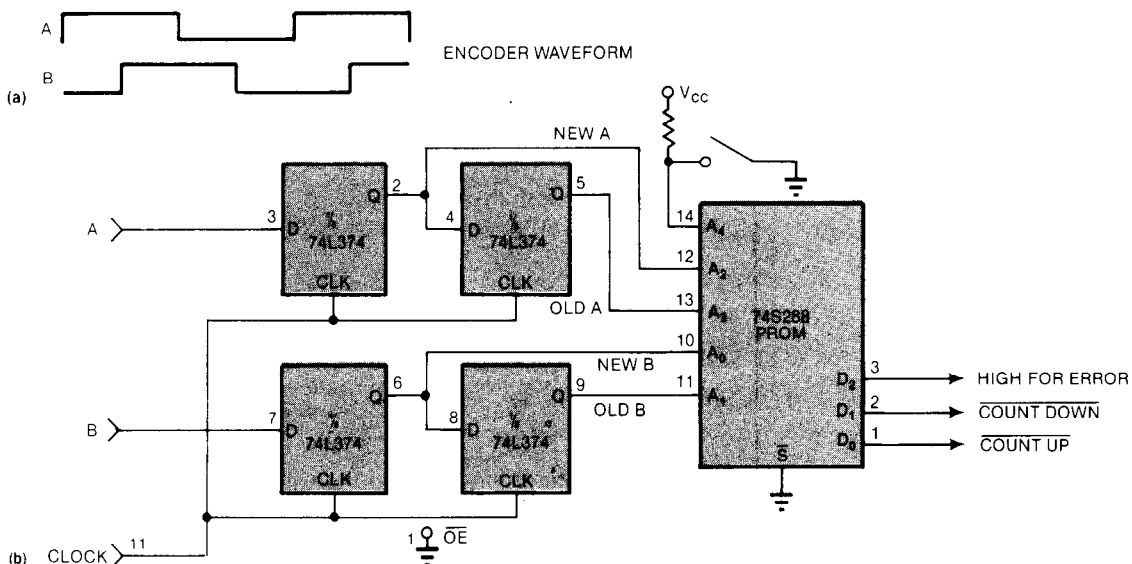


Fig 1—Quadrature waveforms A and B (a) enter a decoding circuit (b), which determines direction of movement of the transducer that generates the waveforms.