

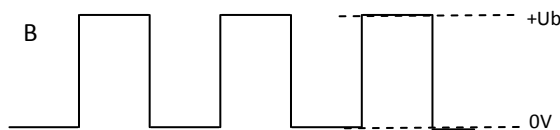
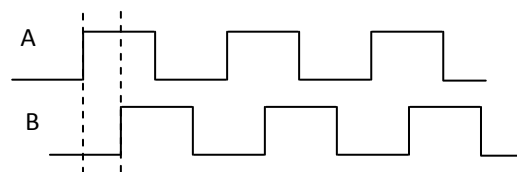
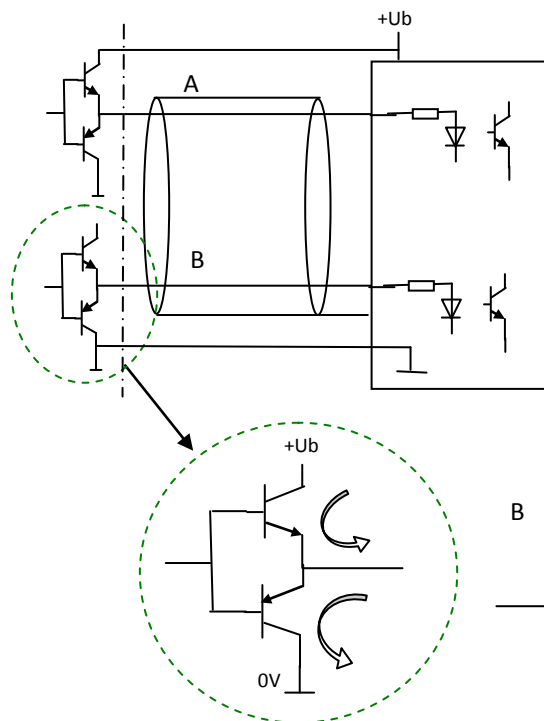
INCREMENTAL ENCODER OUTPUT SIGNAL OVERVIEW

Introduction

The output signals of incremental rotary encoders incorporate two channels to indicate rotation of the encoder shaft plus a zero marker pulse channel. These A and B channels (quadrature) are defined as pulses per revolution (ppr) and define the smallest rotational angular position of the shaft that can be resolved. Since these signals are in quadrature mode, 90-degree phase shift relative to each other, they can also be used to determine the direction of the encoder shaft. The zero marker pulse channel, Z or 0, is a once-per-revolution pulse that can be used to indicate a zero or home position relative to a single revolution of the encoder.

Push-Pull Output

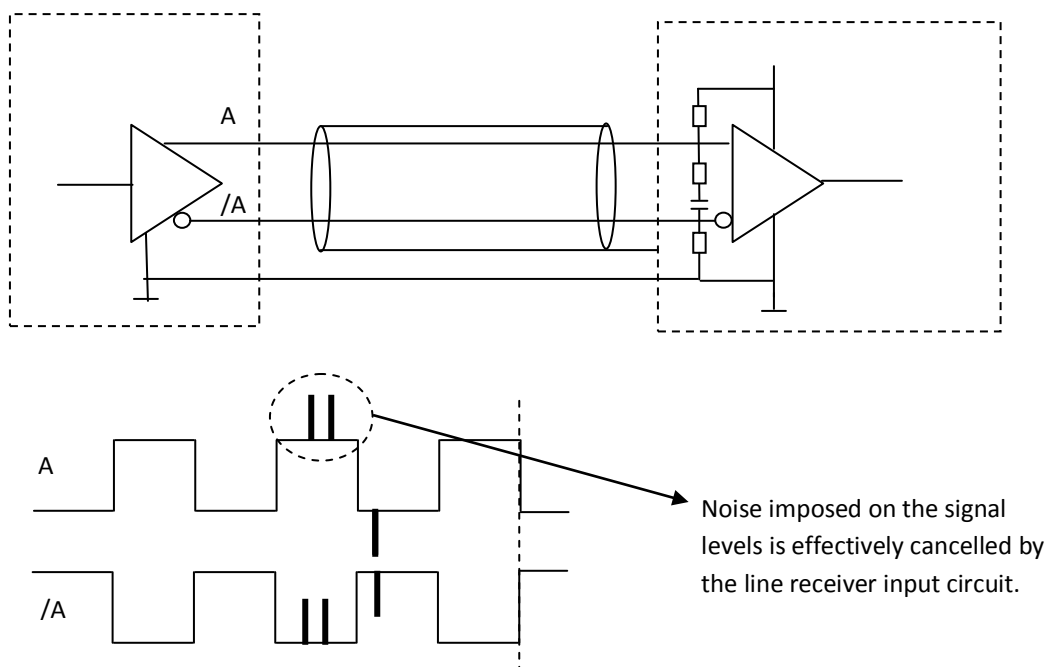
The *Push-Pull* type output is an option that provides encoder output signal levels that are equal to the voltage supply in amplitude and referenced to the power supply common voltage (0V) level. These signals are driven by transistor outputs such that a "high" level output is equal to the power supply level (+Ub), in effect pushing or sourcing the output signal to the load. The "low" level output is equal to the power supply common voltage (0V) level, in effect pulling or sinking the load. The power supply levels for push-pull type encoders are typically in the range of 10 to 30 VDC. The *T-Line* encoder series with push-pull output can be powered in the range of 4.75 to 30 VDC, giving the user further flexibility in powering the encoder device. Push-pull output types can be connected as single ended (A, B, Z) or as differential connections (A /A', B /B', Z /Z').



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RS422 Output

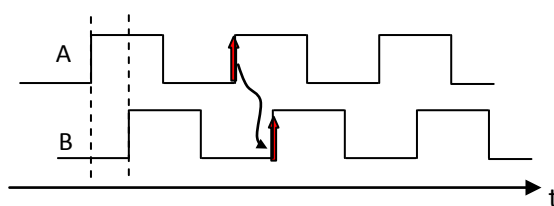
RS422 output types are typically referred to as balanced differential line driver outputs, whose characteristics are determined by the EIA standard that defines the electrical specification and signal characteristics (voltage levels, slew rates, etc.) as well as transmission rates. This signal type is always used as differential pairs of signals (A,/A;) (B,/B;) (Z,/Z) and the encoder output signal is generated by components that conform to the RS422 standard. Differentially RS422 line driver outputs inherently provide a level of noise immunity since the encoder signals are evaluated at the receiver end as differential levels. Therefore, common mode noise imposed on the signals will be cancelled via this differential mode evaluation of the receiving circuitry. Signal levels with this type of interface circuitry are defined as "high" output signal when output is $\geq 2.5\text{ V}$, and "low" output signal, when output is $\leq 0.5\text{ V}$ when referenced to power supply common. Along with the inherent noise immunity of RS422 line driver outputs, these outputs also offer the advantages of higher output frequencies because of the driver/receiver requirements and cabling characteristics.



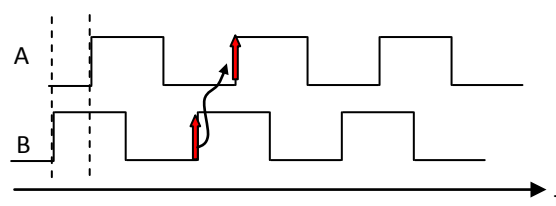
INCREMENTAL ENCODER OUTPUT SIGNAL OVERVIEW

Quadrature Output Signals

The output from incremental rotary encoders is known as a “quadrature” signal. *Quadrature* encoder output signals are defined by the phase shift relationship between the A channel and the B channel signals. This phase relationship (90° phase shift) provides the information required so that the encoder shaft direction as well as the velocity of the encoder shaft can be determined. The direction of the encoder shaft can be determined by evaluation of the A or B signal level. The direction “CW” or “CCW” can be determined by evaluating the signal levels relative to the alternate channel at the time of the rising edge.



Channel A rising edge occurs before Channel B rising edge (Ch B is low value on CH A rising edge)



Channel B rising edge occurs before Channel A rising edge. (Ch A is low value on CH B rising edge)



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