

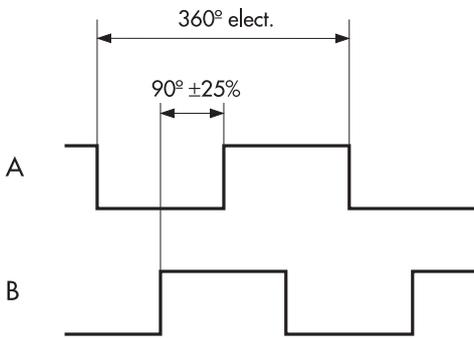
# INCREMENTAL ENCODERS

Incremental encoders are probably the most common type of encoder employed in industry because of the wide variety of applications in which they can be used.

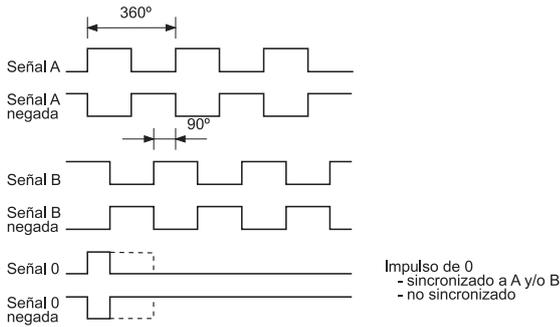
Incremental encoders generate pulses when the shaft is rotated, where the number of pulses per turn can determine a measurement of speed, length or position.

They can be classified, according to function, into unidirectional (a single output channel A), employed whenever it is not necessary to detect the direction of rotation, such as addition and subtraction in counters or tachometers, and bi-directional (with two output channels A and B), which allows the detection of rotation direction, with channel B being 90° out of phase with channel A.

## DIGITAL SIGNALS



A third reference or zero signal (0 output channel) can be made available, which provides a pulse for each full turn of the shaft that, for example, permits a position reference to be determined and this signal can be synchronised with respect to channel A or B, or to both, and it can also be non-synchronised. All these signals are also available in inverted form, usually employed in environments where there is noise and/or long wiring runs.



## Maximum frequency response

This is the maximum frequency at which the encoder can electrically respond, it refers to the number of output pulses the encoder can produce per second. This frequency is related to the encoder shaft rotation speed and the number of pulses, so that:

$$\text{Frequency (Hz)} = \frac{\text{No of shaft turns per minute}}{60} \times \text{No of encoder pulses}$$

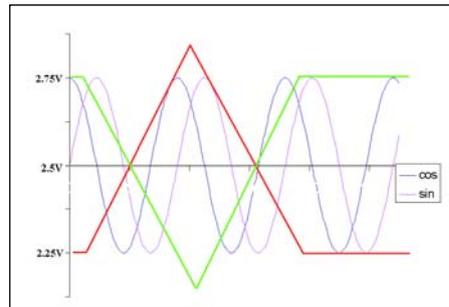
## Precision

The unit of measure that defines the encoder precision is the "electrical degree". This is:

$$360^\circ \text{ electrical} = \frac{360^\circ \text{ mechanical}}{\text{No of encoder pulses}}$$

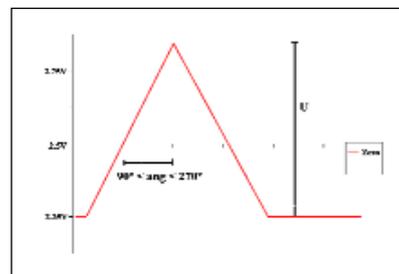
The error of a rotating encoder is not accumulative, it does not increment when the shaft rotates more than a full turn.

## SIN COS signals



## Rotation direction

The rotation direction criterion of the sine encoder is that shown in the figure. Therefore A goes before B if the shaft turns clockwise when observed from its own shaft.



## Signals A Ainv, B Binv and Z Zinv

Signal A (cos) goes before B (sen) 90 degrees. The median value of signals A and B is 2,5V DC. Both signals can be obtained in their negative form Ainv and Binv as well as Zinv (Fig 1). The reference signal is Z (zero). The distance from zero mode to the peak value of Z is within a 90 to 270° electronics interval, as shown in figure 2. The tool component U is maintained between 0,2 < U < 1 V.