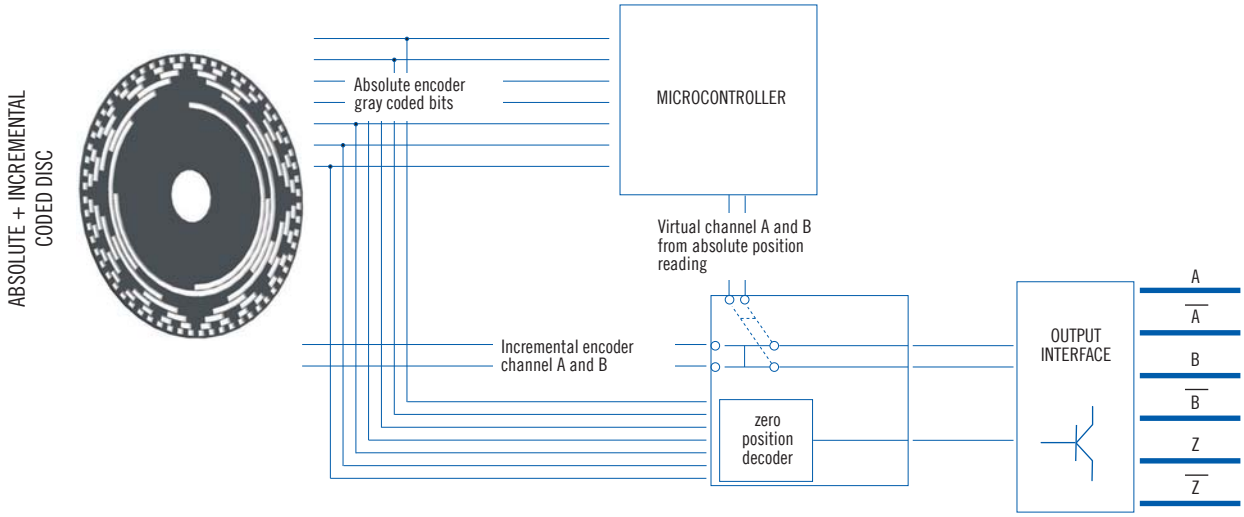
INTRODUCTION

Absolute encoders with Incremental Code Output (ICO) combine, in a single product, advantages of both absolute and incremental encoders. ICOs are absolute encoders (they provide the absolute position within the single revolution) using the same output signals as incremental encoders. Main advantage of ICO encoders is – specially with high resolution – the number of wires because it is the same as an incremental encoder so substantially reduced compared to a standard absolute encoder. Moreover, as with incremental encoders, a simple counter is sufficient for reading the position instead of dedicated boards or multi I/O instruments.

DESCRIPTION

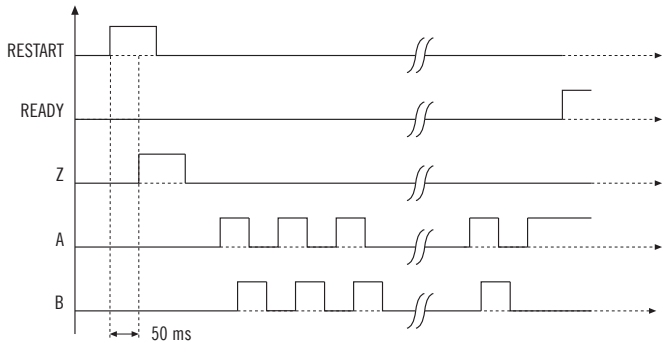
From the reading system point of view, an ICO encoder is exactly made as a standard absolute one. Essentially the light beam is detected by photo-receivers and interrupted by a rotating disc with transparent and opaque windows. However, ICO encoders have a disc etched both with tracks for the absolute bit code and with tracks of an incremental encoder. Incremental output signals are out of 90 electrical grades one from the other and phased with the absolute code. The following figure shows the encoder block diagram:



Please note that a micro-controller handles encoder operations and initialization sequences. It also reads the absolute position and controls the ASIC device. The ASIC integrates a switch for A and B channels and a position decoder for the Z signal generation. Finally, the output interface converts the signals from the ASIC to the final electronic output signals.

WORKING PRINCIPLE

When the encoder is powered up, it goes into a stand-by state where A, B and Z channels are at a low logical level and the READ output is disabled. In this state the encoder does not work and any shaft rotation does not produce any effect on the output channel status. To make the encoder working, it is necessary to activate the RESTART input for at least 50 ms. In this way the microcontroller managing the encoder reads the absolute position and then transmits a number of pulses equal to the absolute position detected by the A and B output channels. A pulse on the Z channel is transmuted before the position pulse sequence allowing in such way a zero setting of the counter.



When that pulse sequence is completed, the READY signal commutes to a high logical level and the counter has the absolute encoder position. Then, the micro-controller releases the control of A, B and Z channel outputs and the system managing the incremental encoder starts working. The described steps are called 'START-UP' sequence: when completed, the encoder is effectively ready to work.

U / D

The U/D (Up-Down) input allows the inversion of the detected rotation direction represented by the increasing or decreasing the output data. By connecting this input to the power supply voltage, the count increases rotating the shaft clockwise. Vice versa, connecting U/D to the 0 V (or not connected), the output data value increases when the shaft rotates counterclockwise.

RESTART

When the RESTART input is activated for at least 50ms the encoder executes the start-up sequence. It can be automatically executed when the power goes on, by permanently connecting the RESTART input to the power supply voltage.

READY

The READY output indicates the encoder working status. When it has a low logical level, it means that the encoder is not functioning and so the RESTART input has to be activated. When the 'START-UP' is completed, the READY signal has a high logical level meaning the encoder is ready to work. The READY output also indicates any encoder malfunctioning due, for instance, to power supply interruptions or to internal faults. If it is continuously monitored, it can be used as a real alarm signal.

SIGNAL TRACKING

If the encoder is moving at the beginning of the 'START-UP' procedure, i.e. due to vibrations or drive offset, the initial read position can be different when the transmission of the data as pulse sequence is completed. In order to avoid this situations, the encoder checks the absolute position value after the pulse sequence has been transmitted. If there is any difference, the encoder transmits again the absolute position until no difference is detected. Then the 'START-UP' stops and the READY output is activated. If variations in the position are quicker than transmissions, READY will not be activated.

RESOLUTION LEVELS

ICO absolute encoders are available with a resolution up to a maximum of 1.024 ppr. The resolution is referred to the incremental output. In fact, a 1.024 ppr ICO encoder has a resolution equal to a 4.096 ppr of a standard absolute encoder. This is thanks to a x4 multiplication factor in the encoder reading device.

OUTPUT CONFIGURATIONS

Push-Pull and Line Driver output electronics are available. READY output is available only with Push-Pull electronic.

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