



## Technical Operation Information

Rotech Products

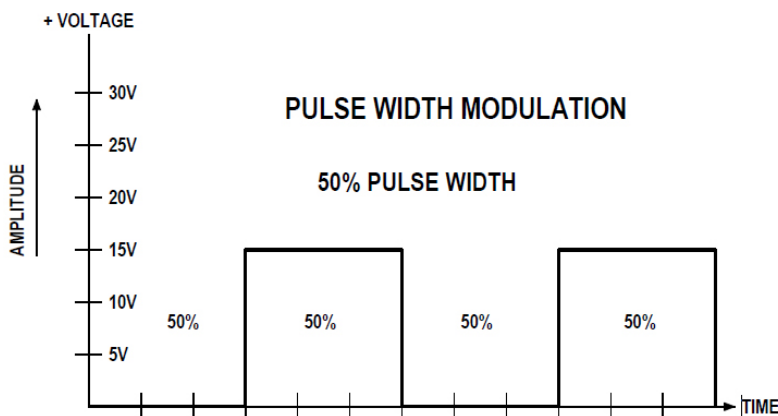
### TECHNICAL OPERATIONAL INFORMATION "ROTECH PRODUCTS".

The "ROTECH" range of motion sensors are used primarily as a speed switch for conveyor interlocking and sequencing and secondarily as a Belt Slip/ Underspeed alarm.

The equipment comprises of two main complimentary items:-

- 1) The Shaft mounted or Wheel Driven Encoder, which is fitted to a driven roller on the conveyor or running on the return belt side..
- 2) The Speed Relay, which is fitted in the conveyor control panel and receives a pulsed signal from the Encoder indicating the status of the conveyor (stopped/start status). This signal is in the form of Pulse Width Modulation as shown in the diagram below:

#### Pulse Width Modulated Signal Output



#### For use with Programmable Controllers/Computers/ Scada control Systems etc

Care must be taken when selecting Encoders for direct input connection to the above systems. The Scanning time of these systems must be capable of reading all the pulses transmitted by the "ROTECH" Encoder. On higher speed drives the number of pulses transmitted by the Encoder may be too fast for the system to read therefore needing careful selection when choosing the Encoder PPR to the required operational speed.

As a general guide a system with a scan time of 30 milli-seconds could read all the pulses from an AE-1-E2-HD running at 1,000 RPM.

(Pulse input rate would be 16.67 pulses per second or 1 pulse every 60 milliseconds)

**Care must also be taken when for low speed drives the detection time could be un-acceptably long. As shown in the following example.**

The response or detection time is approximately 2X the interval between two consecutive pulses.

For in the example above when using the AE-1-E2-HD (1 PPR) @ 100RPM the response time would be  $2 \times 0.6 \text{ seconds} (600 \text{ milliseconds}) = 1.2 \text{ seconds}$ .

Whilst at 100 RPM this response time might be acceptable, the same AE-1-E2-HD running at 10RPM would have a response time of 12 seconds which would **NOT** be acceptable.

Using an AE-60-E2-HD (same Encoder but with 60 PPR disc) would reduce the response time at 1 RPM to a more acceptable 2 seconds.

Speed Frequency Formula:

$$\text{Encoder PPR} \times \text{Speed RPM} = \text{PPM divide by 60} = \text{PPS (Frequency in Hertz)}$$

## THE SHAFT MOUNTED ENCODER-DC Supply Voltage

**Products: - AE1000, AE2000, AE3000, PE4000**

The output signal from the Shaft Encoder is a continuous series of DC square wave pulses, produced at a specific frequency depending on the conveyor drive speed.

Two types of Shaft Encoder are used, the unit in most general use is the type AE-10-E2-HD, which gives 10 pulses for each rotation, some AE-60-E3-HD type units are also installed on very low speed shafts giving 60 pulses per revolution

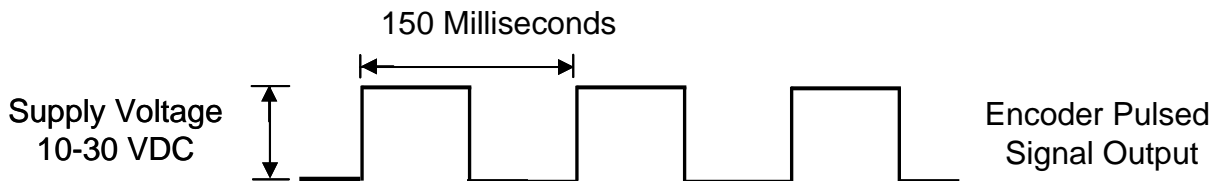
Refer to products codes explanation for details.

### Example 1- Typical conveyor installation.

Consider a shaft revolving at 40 RPM fitted with a Shaft Encoder type AE-10-E2-HD.

With an output of 10 pulses per rev, the unit will give  $10 \times 40$  (RPM)  
= 400 pulses per minute.  
= 6.67 pulses per second. (Frequency)

Or to put it another way: 1 pulse every 150 milliseconds.

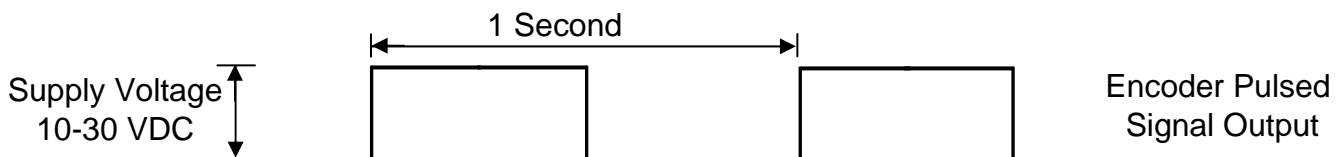


### Example 2.- Slow speed installation.

Consider a shaft revolving a 1 RPM fitted with a Shaft Encoder type AE-60-E3-HD.

With an output of 60 pulses per rev'. The unit will give  $60 \times 1$  (RPM)  
= 60 pulses per minute.  
= 1 pulse per second. (Frequency)

Or to put it another way: 1 pulse every second.



If in either of the above examples the speed of the shaft decreases, the number of pulses will decrease and the time interval between pulses will **INCREASE**.

## **THE SPEED RELAY**

Products; AUE400, SR4000.

As can be seen from the previous examples, it is this increase in the time that is detected by the Speed Relays.

- For use with the Shaft Encoder type AE-10-E2-HD, the standard control module type SR4010 is used.

- For use with the Shaft Encoder type AE-60-E3-HD, the Speed Relay type SR4060 is used. If required for slow drive speeds a start delay option can be incorporated to allow the drive motor to reach running speed.

Speed Relays are calibrated to work with their respective Encoders and for ease of operator use are calibrated directly in R.P.M.

The standard units have three speed ranges:- 1 to 10 RPM, 1 to 100 RPM, 1 to 1000 RPM, with the option to facilitate different speeds if required for the application.

“ROTECH” Speed Relays can be calibrated for drive speeds of less than 1 RPM to 5,000 RPM. The speed range required is selected by fitting wired links to the connection terminals of the Speed Relay.

### **OPERATION OF SPEED RELAYS.**

The principle elements within the Speed Relays are a resettable timer. In Example 1, the internal timer would be set to approximately 160 milliseconds.

With the shaft revolving at its correct speed of 40 RPM, a pulse arrives every 150 millisecond constantly re-setting the timer before it can reach its 160milliseconds- Time out period.

If a situation occurs and the shaft slows down, then the interval between the pulses will increase, at approximately 37 RPM the interval will exceed 160 milliseconds, thus the internal timer will be allowed to time out and de-energise the output relay. Shutting down the plant control equipment to which the Speed Relay is connected.

### **SETTING-UP THE SPEED RELAYS.**

Determination of the exact speed of the shaft to be monitored is not required. By pre-wired links to the appropriate connection terminals the desired approximate operating speed range can be selected.

Turn the potentiometer on the front of the Speed Relay to its minimum setting (Fully anti-clockwise) and start the shaft drive. As the speed of the shaft drive is above this minimum setting, the output relay will energise and the LED will be illuminated.

Now turn the potentiometer slowly clockwise, when the speed of the drive shaft is reached and exceeded, the relay will de-energise and the green LED will extinguish.

Now turn the potentiometer anti-clockwise and set to its position approximately 10% below level at which the relay will de-energise.

The Speed Relay is now set to de-energise if the speed of the shaft decreases below 90% of its normal running speed, thus allowing for fluctuation in the drive speed and nuisance tripping due to drive speed loading

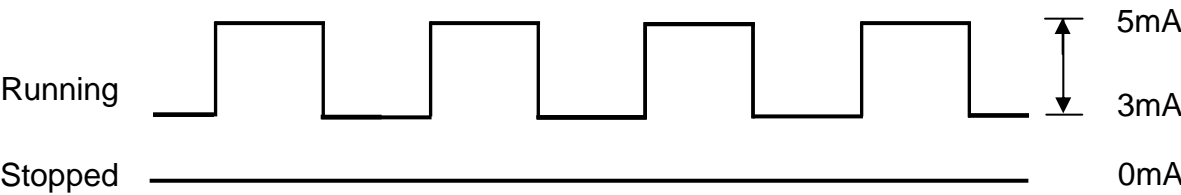
**TESTING**

**All Shaft Encoders**

1) Type AE-16-N-HD.                      Output-Type N-2 wire 5-25VDC    3 to 5mA.

The Type N output operates on the principle of current pulses, it is a two wire device and it is the current flowing through the Encoder that switches from an off state of < 3mA to an on state of >5mA.

To test an Encoder, a milliammeter (preferably an analogue rather than digital) must be connected in series with the unit, and its shaft rotated slowly, for 1 revolution, 16 pulses of < 3mA to > 5mA should be observed.

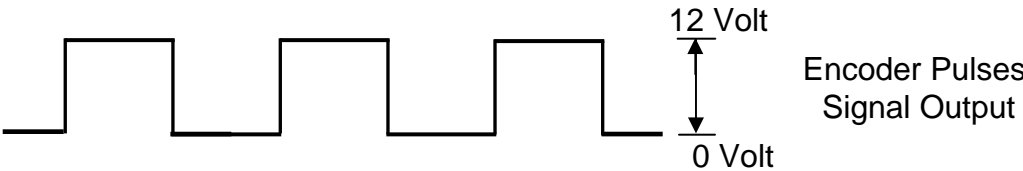


**Note.**  
If tested whilst in operation on a drive, the milliammeter will not respond quickly enough to show the individual pulses and will show an average reading, typically 4 mA.

2) AE-60-E2-HD.                      Output-type E2-3 wire to 30Vdc    max current= 20mA.

The type E2 output is a transistor output that switches between the supply voltage (12Vdc from Speed Relay) and 0Vdc.

To test the Encoder connect a voltmeter between Terminals +12VDC & signal, rotate the Encoder slowly, whilst observing the input switch between 0V/ 12V/0V/ 12V..... Etc confirming the pulsed output from the encoder.



**Connection details.**

3Wire- Shaft Encoders	<u>SR4000</u>		<u>AUE400</u>
	Speed Relay		Speed Relay
	Brown	Terminal 9	14(+12Vdc.)
	Black	Terminal 8	13 (Signal)
	Blue	Terminal 7	12 (0Vdc.)