

Theory of operation

RONAN Non Contact WEIGHT Measuring SYSTEM

The Ronan non-contact weight measuring system uses low level gamma radiation to measure loading rates and total weight of material transported by a conveyor system. It is a mass attenuation gauge.

Principles of Operation A low level gamma source emits an energy beam that is reduced by the material on the conveyor. The amount of energy received at the detector is inversely proportional to the conveyor loading in weight-per-unit-length. The measurement is expressed algebraically as:

$$R = R_0 \cdot e^{-\mu L/W}$$

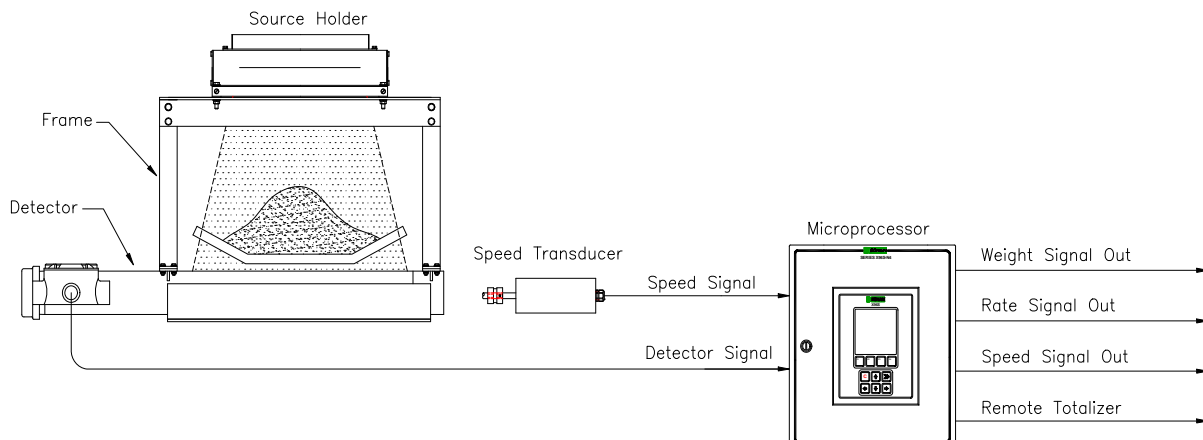
Where:

- R_0 = Radiation transmitted through the empty conveyor
- μ = Mass absorption coefficient, which for Cs-137 approximately equals 0.04 ft²/lb or (0.008 M²/kg)
- L = Material loading on the conveyor in units of lbs/ft (or Kg/m)
- W = Width of the conveyor in units of feet (or meters)
- e = 2.7183 (inverse natural log)

The radiation is measured by a detector, which provides a current directly proportional to the radiation transmitted through the material. The output of the detector is sent to the process computer for output and display.

The material on the conveyor will vary between zero and maximum loading. The systems will provide zero output for no loading and full-scale output for maximum loading.

Below is a simplified diagram of the Ronan weighing system. The system is made up of three



components: a source, detector, and measurement computer. The source and detector are housed in a frame assembly and are mounted external to the conveyor.

Measurement Limitations There are practical min/max limits placed on the belt loading. The maximum belt loading should be greater than 2.5 lbs./ft² and less than 62.5 lbs/ft².

Rate The weighing system has the capability of giving a rate signal and totalizing the weight of the material on the conveyor that has passed through. This is done by multiplying the weight by the belt speed.

Calibration The weighing system is "zeroed" or referenced on an empty belt. In order to average out the thickness variations of the belt, the belt should be running. The weighing system can be spanned by using a static sample or "catch weight" of at least 30 minutes

Accuracy Quoted accuracy is based on a minimum 30 minutes catch weight sample.

Product Density Change does not affect the measurement because the system is simply recording the amount of radiation which is blocked by the material on the conveyor.

Applications: Lime, milled grain, recycled newspaper, wastewater sludge, potatoes, pet food, granular roofing shingles, iron ore, powder, quartz, coal, rock, cement, concrete, wheat stalk, sugar cane, and charcoal.