



# Industrial Magnetic Pickup Sensor

**A6012**

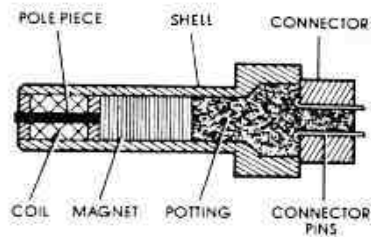
## General Operation Manual

### **Windrock, Inc.**

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# TECHNICAL APPLICATION DATA

## GENERAL DESCRIPTION



Cut-A-Way View of VRS Magnetic Sensor

Completely self-powered, VRS (magnetic) sensor, rugged devices that do not require an external voltage source for operation. They are generally used to provide speed, timing or synchronization data to a display (or control circuitry) in the form of a pulse train.

## PRINCIPLE OF OPERATION

The output signal of a VRS sensor is an AC voltage that varies in amplitude and wave shape as the speed of the monitored device changes, and is usually expressed in peak to peak voltage (V P-P). One complete waveform (cycle) occurs as each actuator passes the sensing area (pole piece) of the sensor. The most commonly used actuator is a metal gear, but also appropriate are bolt heads (cap screws are not recommended), keys, keyways, magnets, holes in a metal disc, and turbine blades. In all cases, the target material must be a ferrous metal, preferably unhardened.

A permanent magnet is the heart of a VRS sensor and establishes a fixed magnetic field. An output signal is generated by changing the strength of this field. This is caused by the approach and passing of a ferrous metal target near the sensing area (pole piece). The alternating presence and absence of ferrous metal (gear tooth) varies the reluctance, or “resistance of flow” of the magnetic field, which dynamically changes the magnetic field strength. This change in magnetic field strength induces a current into a coil winding which is attached to the output terminals. If a standard gear is used as an actuator, this output signal would resemble a sine wave if viewed on an oscilloscope.

## APPLICATION CONSIDERATIONS

VRS sensors are not designed for sensing extremely low speeds. The target passing the pole piece of the sensor must be traveling at a minimum velocity, or surface speed, to provide an adequate output voltage. Typical minimum surface speeds for each sensor type can be found in the specifications section. The bottom line in proper VRS sensor selection is to choose one that will meet the following two conditions:

- 1) Provide the required peak to peak voltage at the minimum speed of interest.
- 2) Will still function properly at the maximum operating frequency of the application.

To choose an appropriate sensor, the following data must be obtained:

- 1) Minimum and maximum speed of interest.
- 2) Diameter of gear (or shaft) and number of teeth (or actuators) per revolution.
- 3) Load resistance & the input resistance of the device being driven.
- 4) Air gap setting (pole piece clearance) & distance between sensor face (pole piece) and top of gear tooth (or other actuator).
- 5) Minimum acceptable peak to peak voltage level (V P-P) of the device being driven & typically a display or frequency to DC convertor.

# USE OF MAGNETIC PICKUP WITH WINDROCK INSTRUMENTATION

When using the magnetic pickup for TDC (top dead center) triggering in reciprocating machine analysis, it is extremely important that the pickup triggers data acquisition exactly at TDC. Errors of only 2 degrees can produce measurement errors of up to 5% in horsepower and throughput calculations.

For the magnetic pickup to operate properly with Windrock analyzers, several issues must be addressed.

## PICKUP DISTANCE FROM TARGET

Often, the magnetic pickup is placed too close to the target. When this happens, the pickup can trigger data acquisition on scratches, nicks, or magnetic deformities in the flywheel or shaft. Usually, a gap of about 1/4 inch sufficient.

## TARGET TYPE

Some sort of target must be placed on the flywheel or shaft to trigger the magnetic pickup. The target must be of a ferrous material. It may be a hole drilled into the flywheel or shaft, or may be a protruding object such as a bolt head. Either way, the target must produce the largest magnetic interference of any other scratch, hole, or deformity in the flywheel or shaft. The center of the hole or bolt head must be placed at TDC of the machine. A hole is preferred because it is always round, and the center of the hole is the magnetic center of the target. A good choice for hole size is 1/4" diameter, 1/4" deep. Sometimes when using a bolt head, the flats of the bolt causes the magnetic center to be other than the geometric center of the bolt.

Sometimes, we have seen a sharp edge used as a target. This is OK, but due to the small magnetic interference, the gap must be smaller in order to get a sufficient signal.

## SIGNAL POLARITY

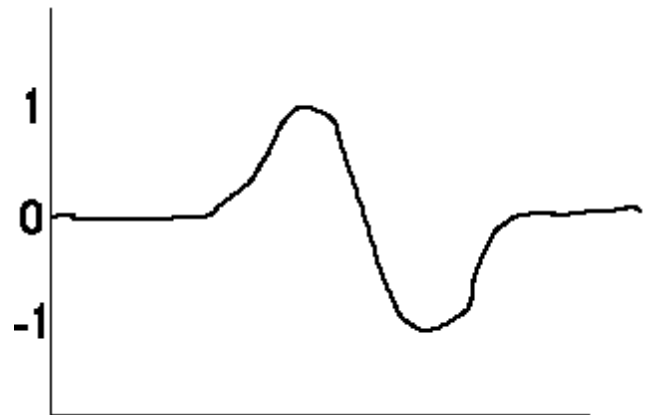
This is where many problems occur when using a magnetic pickup. The circuit in the Windrock analyzers arms itself on a POSITIVE going signal. The actual trigger occurs upon ZERO-CROSSING after the circuit is armed. Zero-crossing occurs at the magnetic center of the magnetic pickup or when the magnetic pickup is centered on the target.

When using a hole as a target, pin A of the magnetic pickup is the signal.

When using a protruding object as a target, pin B of the magnetic pickup is the signal.

If in doubt, use the analyzer in o-scope mode, or an oscilloscope to view the signal. The signal should look like the figure below. If the polarity is reversed from this, swap

the signal lead and ground leads in the connector.



## SIZE OF SIGNAL

The magnetic pickup contains a permanent magnet with a coil. When the magnetic field changes due to the pickup going over a hole or object, a voltage is generated in the coil. The size of the signal is proportional to the magnetic field change. Several factors determine the field change : permanent magnet strength, number of turns in the coil, gap from pickup to target, material of target, and size of target.

The bottom line is that you want a signal of about 1V peak, and it must be at least 10 times the size of any other noise or spurious signals in the output of the pickup. If the polarity of the signal is reversed, the trigger point will be much later than actual TDC.

# SPECIFICATIONS

## ENVIRONMENTAL

**Temperature Range:**

Operating: -65EF to +250EF

**Shock Limit:**

5,000g pk

**Conditions:**

Mild oil/fluid splash

## ELECTRICAL

**Output:**

30 V P-P minimum

**Frequency Response:**

DC to 40KHz

**Power:**

Self Generating

**Excitation Voltage:**

Not required

**Case Isolation:**

$>10^8$  ohms

**Coil Resistance:**

150 ohms typical

## MECHANICAL

**Size(hex x height):**

0.75in dia x 2.5in long

**Weight:**

2.5 oz

**Mounting Thread:**

5/8-18 UNF-2A

**Mounting Torque:**

Maximum 15 ft-lb

**Case Material:**

303 Stainless Steel

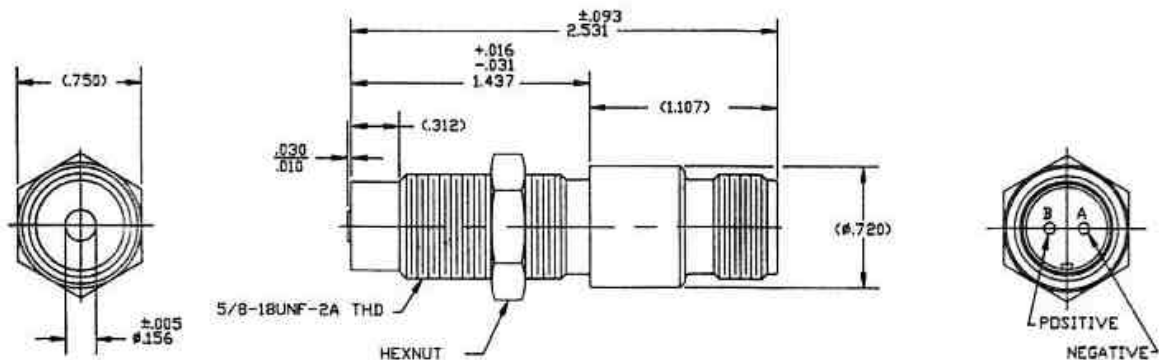
**Connector Type:**

MS3106A/Top

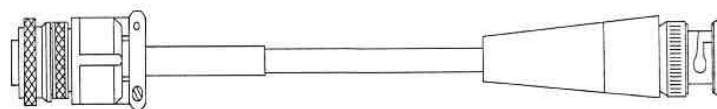
## APPROVALS

**Rating:**

Class 1, Groups ABCD



Physical Dimensions



Interconnect Cable (A6015-00-06)

Optional