MODEL MP1A
HIGH-SENSITIVITY MAGNETIC PICKUP

For reliable measurement of flow and rpm, or for other tachometric, counting, or accumulating applications

HOW IT WORKS

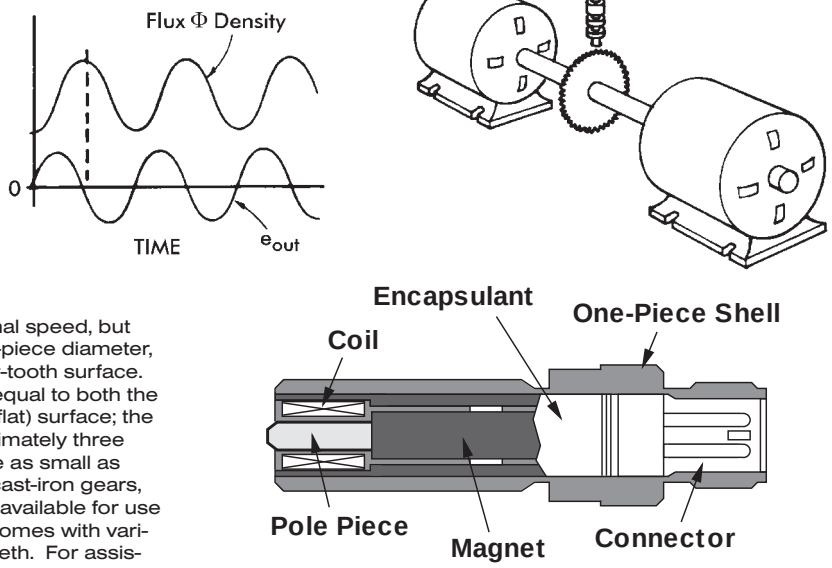
A **magnetic pickup** is essentially a coil wound around a permanently magnetized probe. When discrete ferromagnetic objects—such as gear teeth, turbine rotor blades, slotted discs, or shafts with keyways—are passed through the probe's magnetic field, the flux density is modulated. This induces AC voltages in the coil. One complete cycle of voltage is generated for each object passed. If the objects are evenly spaced on a rotating shaft, the total *number of cycles* will be a measure of the *total rotation*, and the *frequency* of the AC voltage will be directly proportional to the *rotational speed* of the shaft.*

Fig. OT.3 shows a magnetic pickup used in conjunction with a *60-tooth gear* to measure the rpm of a rotating shaft. Such a gear is often selected because the output frequency (in Hz) is numerically equal to *rpm*—a situation that allows frequency meters to be employed without calibration. For very high rotational speeds, a smaller number of teeth may be called for.

Illustrating a similar principle, Fig. OT.4 shows how a turbine flowmeter can measure the *volumetric flow* of a fluid. The fluid flow exerts a force on the turbine blades, causing the meter to rotate. In properly designed flowmeters, the output

(cont'd)

Fig. OT.3
Typical Magnetic Pickup



* Output waveform is a function not only of rotational speed, but also of gear-tooth dimensions and spacing, pole-piece diameter, and the air gap between the pickup and the gear-tooth surface. The pole-piece diameter should be less than or equal to both the gear width and the dimension of the tooth's top (flat) surface; the space between adjacent teeth should be approximately three times this diameter. Ideally, the air gap should be as small as possible—typically 0.005". A number of steel or cast-iron gears, precisely manufactured to AGMA standards, are available for use with the Model MP1A. The standard solid gear comes with various dimensions and with 48, 60, 72, 96, or 120 teeth. For assistance in selecting proper gear type and size, contact the factory.

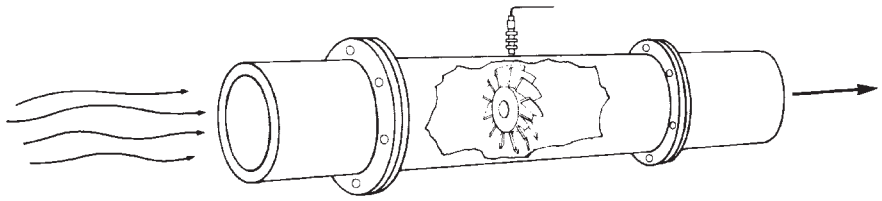
Daytronic Corporation
2211 Arbor Blvd. Dayton, OH 45439 • **(800) 668-4745**
Tel: (937) 293-2566 • Fax: (937) 293-2586 • **www.daytronic.com**

MODEL MP1A HIGH-SENSITIVITY MAGNETIC PICKUP *(cont'd)*

frequency produced by the magnetic pickup is a linear function of the volumetric flow rate. Each output cycle therefore represents the passage of a known volume of fluid, and the flowmeter can be accordingly calibrated in *cycles per gallon* or similar units. This rating is known as the "K factor" of the flowmeter. It will vary somewhat with viscosity and flow rate, but is usually quite predictable, with repeatability to within 0.1% in many units.

A magnetic pickup may also be used as a timing or synchronization device—as, for example, in ignition timing of gasoline engines, angular positioning of rotating parts, or stroboscopic triggering of mechanical motion.

Fig. OT.4
Use of Magnetic Pickup in Flow Measurement



The Model MP1A

The **Model MP1A Magnetic Pickup** is a fast, general-purpose sensor, providing an effective, accurate means of measuring the speed and frequency of mechanical rotary motion without the necessity of mechanical linkage—and the contact, wear, cabling, and alignment problems such linkage entails. It is recommended for *maximum-sensitivity applications with low speed and/or large air gaps.*

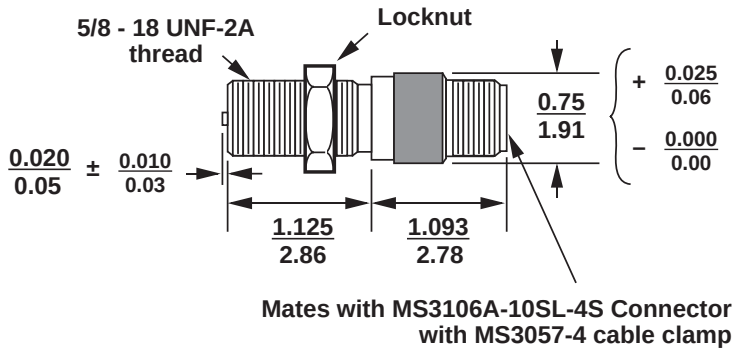
The MP1A is a "passive" or "self-generating" device, requiring no external excitation. When mounted in proximity to the teeth (or blades) of a conventional rotating gear (or turbine), it produces an approximately sinusoidal AC voltage-signal output with a frequency directly proportional to RPM. The amplitude of the voltage is also generally proportional to the speed of rotation (see Fig. OT.6).

Housed in a stainless-steel shell, the MP1A is reliable over a wide temperature range, at repetition rates exceeding one megahertz, and under severe environmental conditions of mechanical shock, vibration, humidity, immersion in water or oil, salt spray, sand and dust, radiation, and pressure. It has a threaded mounting shank and locking nut.

See Model MP1A Specifications.

(cont'd)

Fig. OT.5
Model MP1A Dimensions (in./cm)



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MODEL MP1A HIGH-SENSITIVITY MAGNETIC PICKUP *(cont'd)*

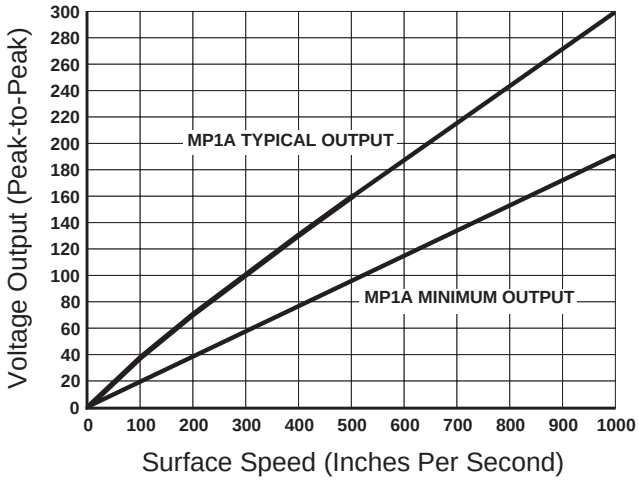

Fig. OT.6
MP1A Performance

MODEL MP1A SPECIFICATIONS*

Dimensions: See Fig. OT.5

Pole-Piece Dimension: 0.106 in. (0.27 cm)

Gear Pitch (optimum): 20 DP**

Gear Pitch Range: 24 DP or coarser

Output Voltage (peak-to-peak): See Fig. OT.6, above; 190 V-AC minimum output at 1000 in/sec, with 20-pitch, 30-tooth gear at 0.005" pole-piece clearance and 100-kΩ load

DC Resistance: 1200 Ω, maximum

Inductance: 450 mH, maximum

Output Polarity: When ferrous metal is introduced into the magnetic field, Pin B will be positive with respect to Pin A

Operating Temperature Range: -100° F to +225° F (-73° C to +107° C)

* At +75° F (+18° C).

** Optimum gear pitch is a compromise between waveform purity and voltage output.

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