

Westinghouse



## Pulse Transducer

For Measuring Speed and Frequency  
 Type VR-842 Transducer  
 Type KR-241 Instrument with Self-  
 Contained Transducer

### Application

The Westinghouse pulse transducer, used in conjunction with a switchboard, panel or recording instrument, provides an ideal method for performing the following measuring functions:

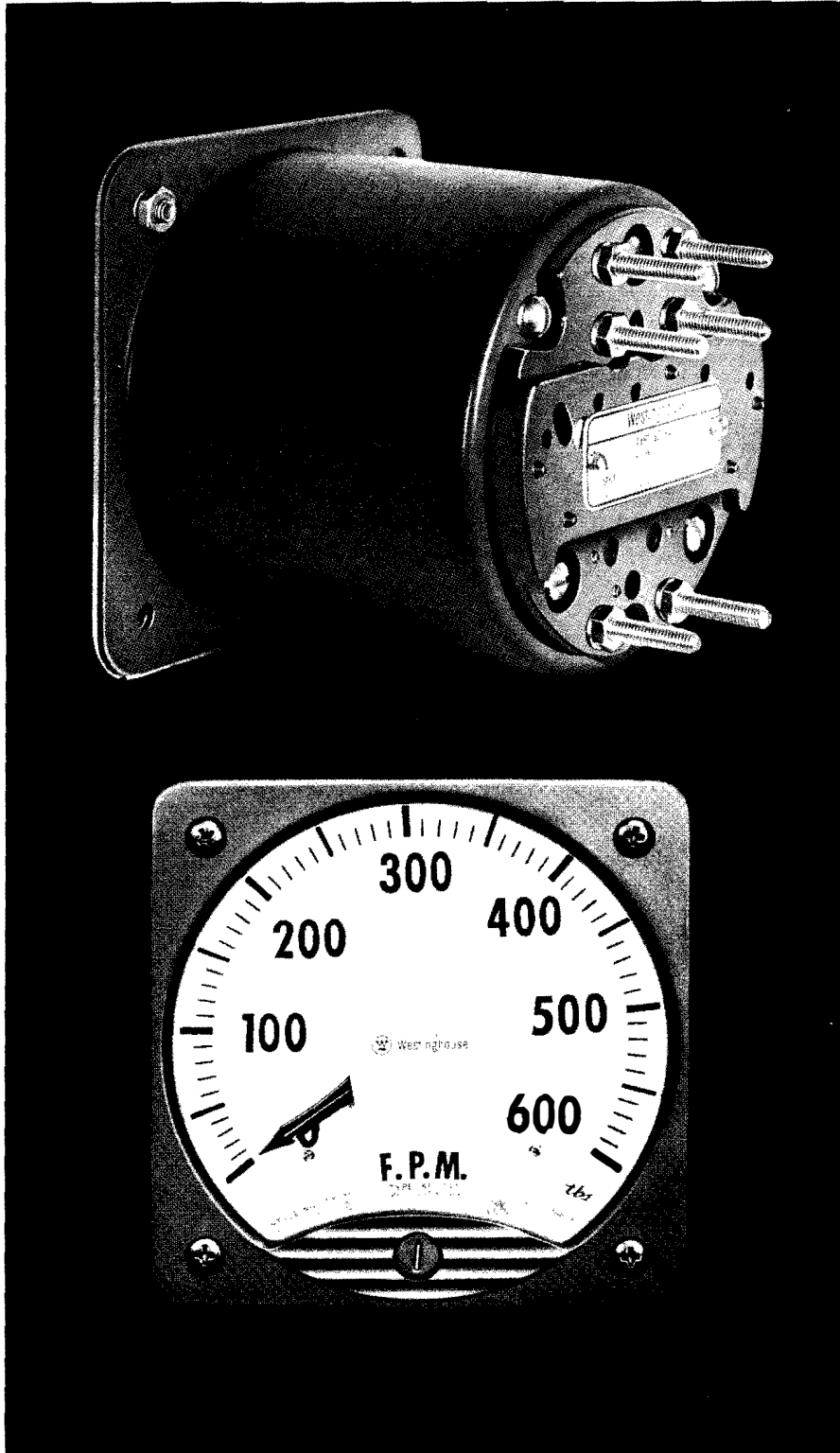
**Speed Measurement:** As illustrated in Fig. 1, speed is easily measured by the pulse-creating action of a notched wheel (mounted on any rotating shaft) as it passes before the pulse tachometer's variable reluctance pickup, as in the type B-801 tachometer. Typical measurements include:

- Motor rpm
- Rate at which paper, textiles, wire, rolled metals, etc., pass over a roller.
- Number of gallons of liquid being pumped during a given interval, when a rotating shaft whose speed is proportional to liquid flow is available.

**Frequency Measurement:** By obtaining "pulses" direct from an ac voltage source, an instrument operating from the pulse transducer's output can be calibrated to read directly in electrical frequency. Inasmuch as "pulse" shape is not critical in this type of application, a standard sine wave can be used without modification to energize the transducer.

### Features

- Transistorized static circuitry
- Simple wiring and installation
- Transducer may be internally mounted in a switchboard instrument or supplied as a separate unit.



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## Operation and Application

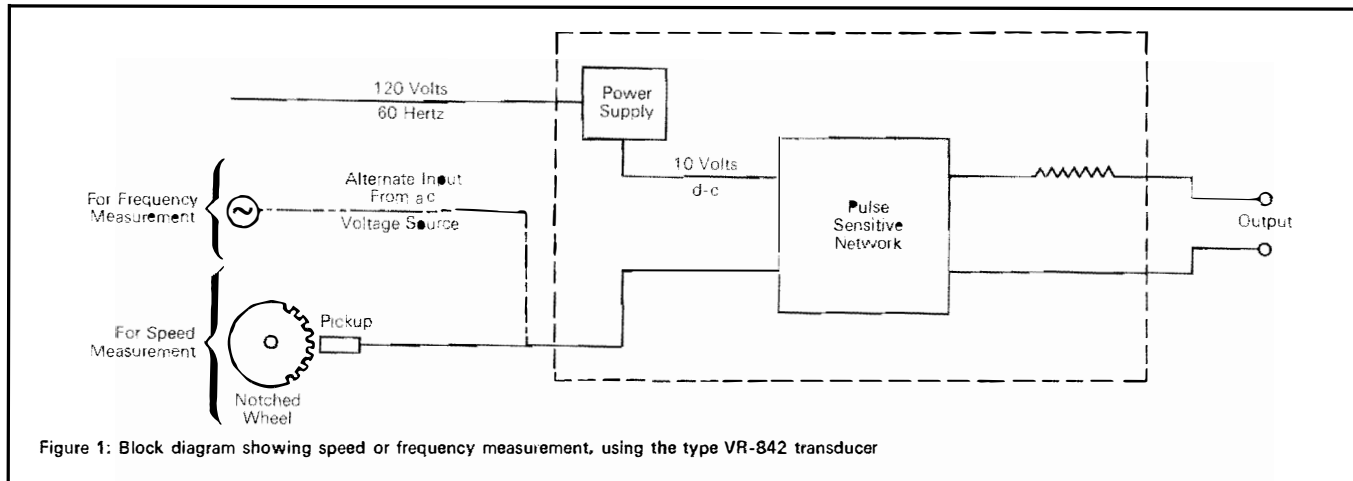


Figure 1: Block diagram showing speed or frequency measurement, using the type VR-842 transducer

## Speed Measurement

In this application, pulse tachometer having a magnetic material notched wheel mounted on a rotating shaft is used in conjunction with a variable reluctance pickup. The pickup contains an electro-magnet. As the notches of the wheel pass the pickup, pulses proportional to the speed of the shaft are generated in the coil of the electro-magnet.

A pulse sensitive network in the transducer generates a dc output proportional to the pulse rate. It is therefore also proportional to the speed of the notched wheel.

This dc output is used to energize an indicating or recording instrument calibrated in rpm or other speed units.

The dc output can also be used to operate telemetering transmitters, computers, and various types of control circuitry. For some of these applications, it may be necessary to filter the output voltage. The type VC-876 Filter Unit is available for this purpose.

The shape of the teeth on the notched wheel in the tachometer is not critical above 100 pulses per second. In fact, a notched wheel as such is not necessary,

as any form of notches or projections of magnetic material on the rotating shaft will provide accurate measurement. It is not even necessary that these notches or projections be evenly spaced. (Consequently, the notched wheel and type B-801 tachometer are not necessary for satisfactory operation when other pulse producing means are available.)

## Frequency Measurement

When the pulse transducer is used to measure frequency, the pulse-sensitive network is energized directly from a variable frequency source, as shown by the dot-dash line in the block diagram.

## Type Designation

When the pulse transducer is incorporated in a circular scale switchboard instrument, it is identified as type KR-241 and dimensions are the same as for the K-241 instruments listed in Descriptive Bulletin 43-240.

When it is supplied as a separate unit, it is identified as type VR-842, with dimensions as shown on page 4 of this bulletin.

## Typical Application Problem

Continuous measurement of the feet per minute speed of wire in a wire drawing process is required. The roller driving the wire is 18 inches in diameter and is driven through a gear reduction unit of 8:1 ratio by a motor with a full load speed of 1750 rpm.

As the roller shaft is inaccessible for mounting the notched wheel and pickup assembly, it is necessary to mount a type B-801 tachometer assembly at the motor with the driving shaft running at 1750 rpm.

$$(1) \text{ Wire speed (f.p.m.) at motor speed of } 1750 \text{ rpm} = \frac{1750}{8} \times 1.5 \times \pi = 1031 \text{ f.p.m.}$$

$$(2) \text{ Pulses per second, using 90 tooth wheel on 1750 rpm shaft:}$$

$$\frac{1750 \times 90}{60} = 2625 \text{ p.p.s. for wire speed of 1031 f.p.m.}$$

A type KX-251 indicator is desired having a scale of 0-1200 f.p.m. The conductor distance from the motor mounted pickup to the switchboard mounted indicator is 35 feet.

$$(3) \text{ Since the transducer output is 1 volt per 1000 p.p.s. (0-401 to 0-5000 range, unit S\# 291B413A11) and the standard calibration is 1 milliampere for full scale deflection, the full scale rating of the instrument will be 1 milliampere at 3.05 volts based on the following ratio:}$$

$$2625 \times \frac{1200}{1031} = 3055 \text{ p.p.s. at 1200 f.p.m.}$$

## Complete Bill of Material for Above Example

Item	Quantity	Description
1	1	Type B-801 tachometer complete, similar to style 186A601A14, except with 35 feet of shielded cable
2	1	Type VR-842 transducer, similar to style 291B413A11, except to have output of 1 milliampere at 3.05 volts
3	1	Type KX-251 switchboard mounting instrument 1 milliampere full scale with dial marked 0-1200 feet per minute, similar to style 291B399A09

Pulse Transducer

For Measuring Speed and Frequency  
Type VR-842 Transducer  
Type KR-241 Instrument with Self-Contained Transducer

Specifications

Range: minimum – 0-25 pulses per second.  
maximum – 0-10,000 pulses per second.

Accuracy (transducer only):  $\pm\frac{1}{2}\%$  for 100-130 volt supply, 25° – 60°C ambient.

Power consumption and supply: 1.3 volt-amperes from 120 volt, 60 Hertz source.

Pulse input: 0.1 to 2 volts.

Frequency input: When used to measure frequency, dropping resistors are included in the transducer input circuit for input voltages between 20 and 150 volts ac.

Output: Proportional to pulse input. If an output proportional to speed difference is desired, negotiate with nearest Westinghouse representative.

Standard calibration provides one milli-ampere output for full scale instrument deflection.

Voltage output for full scale deflection corresponding to one milliampere is:

Range: Pulses Per Second	Volts/1000 Pulses Per Second
0-25 to 0-400	15.0
0-401 to 0-5000	1.0
0-5001 to 0-10000	0.5

Lead resistance between pulse tachometer and transducer: 100 ohms maximum.

Response time (transducer only): 0.01 seconds.

Insulation test: 2600 volts terminals to case.

Weights

Type	Net	Shipping
VR-842	2	4
KR-241	5	7

Basic Units

Description	Range: Pulses Per Second①	Style Number
Type VR-842 transducer only②③	0-25 to 0-400 0-401 to 0-5000 0-5001 to 0-10,000	291B413A10 291B413A11 291B413A12
Type KR-241 switchboard mounting instrument complete with self-contained pulse transducer②③④	0-25 to 0-400 0-401 to 0-5000 0-5001 to 0-10,000	291B351A30 291B351A31 291B351A32

① Full scale value of indicating instrument should be selected to be a decimal multiple of 1, 1.2, 1.5, 2, 2.5, 3, 4, 5, 6, 7.5, or 8.

② Also available on special order with calibrating rheostat, adjustable on base of unit.

③ Transducer may be used with most any type of switchboard, panel or recording instrument having a full scale rating of 1 milliampere and relatively low internal resistance (10-15 ohms). The type KR-241 instrument listed above is the only type available with self-contained pulse transducer.

④ Type KR-241 instrument may be supplied on special order with suppressed zero scale up to 50% suppression.

Accessories

For information on type B-801 tachometers and accessories, refer to Price List 43-500.

When ordering pulse transducer equipment, the following information should be furnished:

- (1) Speed or frequency to be measured
- (2) Full scale dial marking of instrument
- (3) Pulses or Hertz corresponding to full scale dial marking
- (4) Type and style of instrument to be used as display device
- (5) Accessories required including length of shielded cable

It may be desirable to negotiate a complete bill of material to suit a particular application, especially when more than one display device or other than the standard units are to operate from the transducer output.

External Wiring Diagrams

Type VR-842  
Pulse Transducer

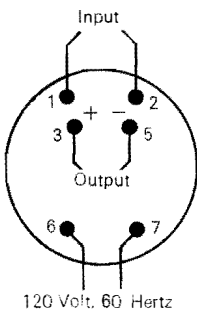


Figure 2

Type KR-241 Indicator  
with Self-Contained Transducer

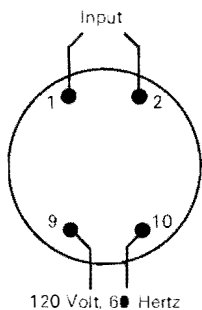


Figure 3

