Westinghouse Electric Corporation
Relay-Instrument Division
Newark, N. J. 07101

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New Information
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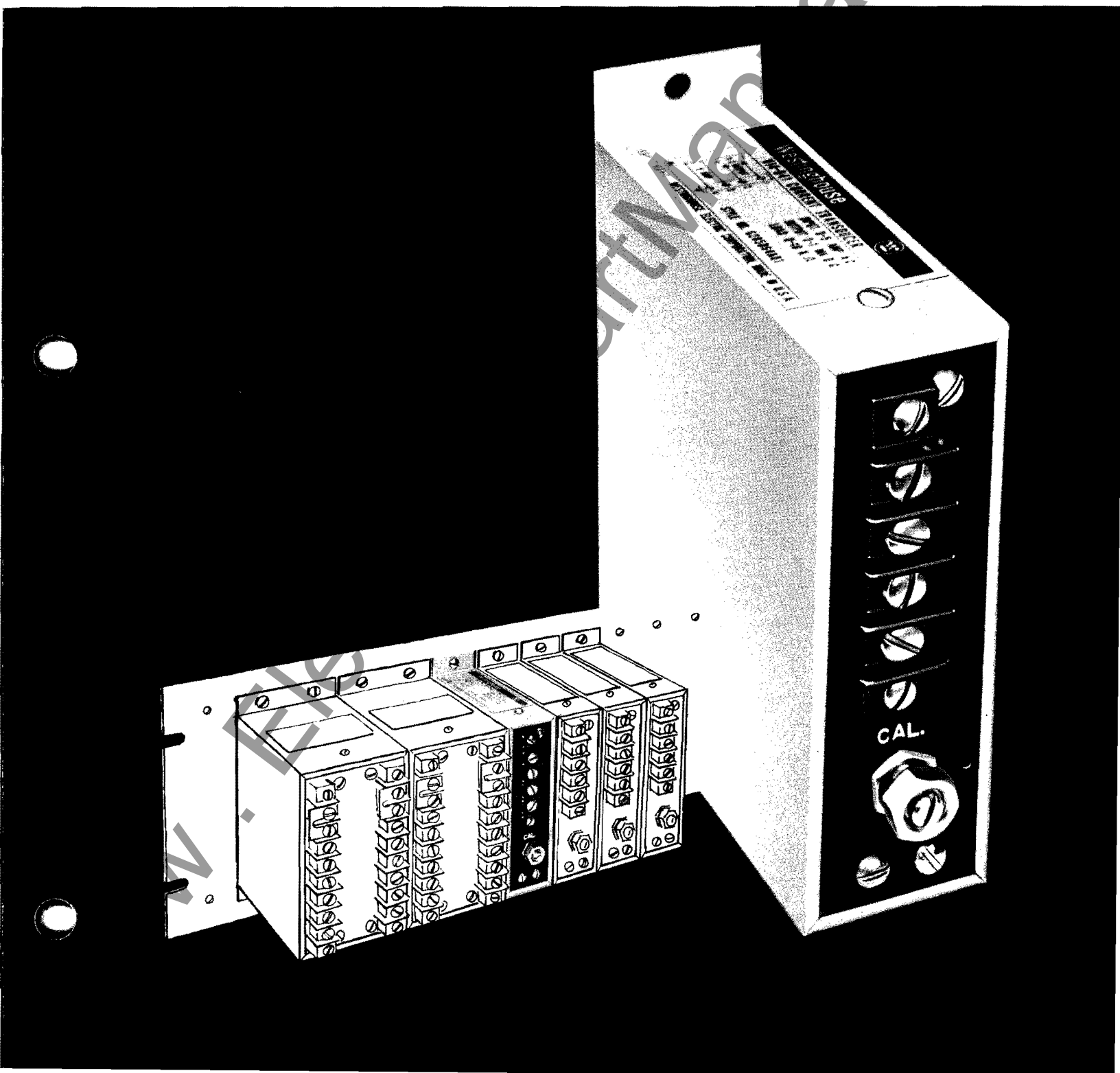
Load-independent (Constant Current) Output
½% Accuracy Class

Type V-4 Voltage and Current Transducers



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Application
Type V-4 voltage and current transducers convert the output of potential transformers and current transformers to proportional dc signals. The output can be utilized directly by computers, control and data systems or by analog or digital instruments.

The type V-4 voltage and current transducers replace "Teleductor®" transducers which were introduced by Westinghouse in 1952 to yield higher output levels than available from the then-used thermal converters. Like the Teleductor the VI-4 and the VE-4 transducers are average responding devices. Electrical power measurements are made on an rms basis, so the transducers are calibrated, assuming a perfect sine wave input, for a form factor of 1.11. Deviations from pure sine wave, resulting from harmonics or chopped waves will result in deviation from rms output.

The load-independent feature makes these transducers particularly suitable for remote instrumentation service where the circuit resistance either is unknown or subject to change. It permits long, small-gauge leads between transducer and readout.

Operation
Each transducer consists of an input transformer to provide isolation from the measured circuit, and a full-wave diode bridge to rectify the ac signal. The signal is amplified in a "constant current" amplifier to the output level of 0-1 mA into 0-10,000 ohms. There is a potentiometer in the amplifier circuit to permit a range adjustment of +10%.

Features
Westinghouse is a major supplier of the apparatus and the systems which control electrical power systems. They are consequently, especially knowledgeable of the actual needs in the accessories for such systems. This is reflected in the design features of the V-4 transducers.

Proven Components
The basic transformers and rectifiers have evolved since 1952 with the Teleductor as better components became available. Amplifier circuitry has been in general use in transducers since 1967, with several stages of improvement.

Printed Circuit Construction
All components are mounted on printed circuit boards of glass-epoxy. This material possesses great strength; it does not support fungus growth, it has a high resistance to damage due to re-soldering of parts during repair or modification under field conditions. The circuit board is readily accessible when the cover has been removed.

Surge Withstand Capability (SWC)
Experience in the application of solid-state devices to power system control circuits has shown the need for integral surge protection circuitry. The major concern has been in the protection of solid-state protective relays from damage or malfunction under transient surge conditions. IEEE Standard 472-1974 (ANSI C39.90a 1974) covers the surge testing of protective relays.

In designing the V-4 transducers Westinghouse was able to draw upon the advanced knowledge of its static relay design and application engineers. In so doing it became apparent that the relay SWC specification was not completely adequate as a standard for transducers. (Relays terminate in a switching circuit while transducers terminate in a precision amplifier of much lower capacity.)

The IEEE standard defines the test wave and locates the test points on a relay. Westinghouse has adopted the same test wave but has defined the application points in terms of a transducer, making certain that all critical areas are tested and that the tests, as performed, are valid.

The Surge Withstand Test which all Westinghouse V-4, 60 Hz transducers will meet is:

1. SWC Test Wave: An oscillatory wave, 1.0 to 1.5MHz, 2.5 to 3.0 KV crest value of the first half-cycle peak decaying to 50% of the initial crest value in 6.0 microseconds or longer. Surge generator terminal impedance 150 ohms. Test waves are applied at the rate of not less than 50 tests per second for not less than 2.0 seconds.

2. Test Procedure: The transducer is terminated into a resistor with a value equal to the maximum rated load resistance. The power supply is energized through an isolating transformer so that the transducer is in operating condition. Surge voltage is then applied:

a) Between case and each ac input terminal including power supply.

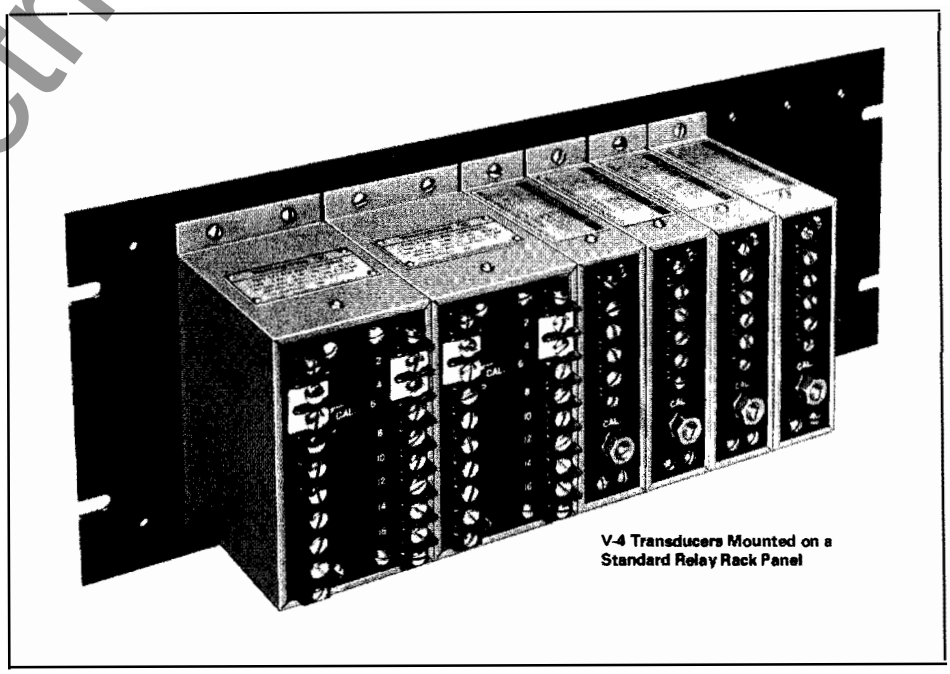
b) Between case and each dc output terminal.

c) Between each ac input terminal and each dc output terminal.

d) Between each ac circuit element and every other ac circuit element.

e) Across the dc output.

The transducer is considered to have passed the test if it continues to operate normally with no change in calibration.



V-4 Transducers Mounted on a Standard Relay Rack Panel

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Amplifier Protective Circuit
The output amplifier is protected from damage due to inadvertently applied voltages or induced surges on the output leads. The amplifier can withstand the application across its terminals of a surge equivalent to the SWC test, and the short time (approximately 5 minutes) application of 120 volts ac in the event of miswiring.

Radio Frequency Interference (RFI) Immunity
The transducers, by the nature of their circuit design, are not affected by stray radio frequency energy.

Current Amplifier
The amplifier uses the variation of the emitter-follower circuit commonly known as a "current pump". This configuration allows the amplifier to be independent of load resistance. The amplifier is self-powered (from the source being measured).

Modular Design
The case represents the best possible compromise between the requirements of the various mounting methods normally uses:

a) Unistrut® channel.

b) Standard relay rack panels.

c) Standard rack unit mounting strip.

d) Pre-drilled channel.

e) Pre-drilled panel.

® Trade mark of UNISTRUT Corp.

The basic module for the V-4 transducer line is 3 inches wide and uses the 5¼ inch vertical distance between mounting holes as suggested by an IEEE proposed standard. Current and voltage transducers are made in half-modules (1½ inch) with the same 5¼ inch mounting dimension. The horizontal holes are arranged so that any array of transducers can be mounted side-by-side with pre-drilled mounting holes on 1½ inch centers. If rack unit mounting strip is used there will be a ¼ or ½ inch space between units. A 19-inch rack will mount a full set of watt, var, voltage and current transducers for a three-phase line. There is no interaction between transducers regardless of mounting space.

Terminal Blocks
Molded terminal blocks with #8-32 screws to accept wire sizes up to #12 in lugs to ⅜" width.

Repairability
Westinghouse has never potted its transducers. Accessibility for repair or modification has been a feature of Westinghouse transducers since 1959. The V-4 transducers continue the tradition of ease of parts replacement. Current and voltage transducers utilize only discrete components soldered in place.

Specifications

	Voltage Transducer Type VE4-841	Current Transducer Type VI4-841
Full Scale Input	150V	5A
Intrinsic Accuracy	+0.5% at 23°C, 60 Hz	+0.5% at 23°C, 60 Hz
Linearity	0.5%	0.5%
Overload	180V continuous	10A continuous 100A 1 sec.
Full Scale Output	1mA dc	1mA dc
Output Load	0-10,000 ohms	0-10,000 ohms
Maximum Ripple	1%	1%
Frequency	50-70 Hz	50-70 Hz
Amplifier Power	Self-powered	Self-powered
Loss (Burden)	2.5VA	1.0VA
Temperature Range	−20°C to +60°C	−20°C to +60°C
Temperature Influence	+1% over maximum Temperature range	+1% over maximum Temperature
Response Time	Less than 400ms	Less than 400ms
Calibration Adjustment	+10%	+10%
Dielectric Test	1500V rms	1500V rms
Surge Withstand Capability	IEEE 472-1974 ANSI C39.9a	IEEE 472-1974 ANSI C39.9a
Weight		
Net	1⅛ lbs. (.5 kg)	2 lbs. (.9 kg)
Shipping	1⅛ lbs. (.5 kg)	2 lbs. (.9 kg)

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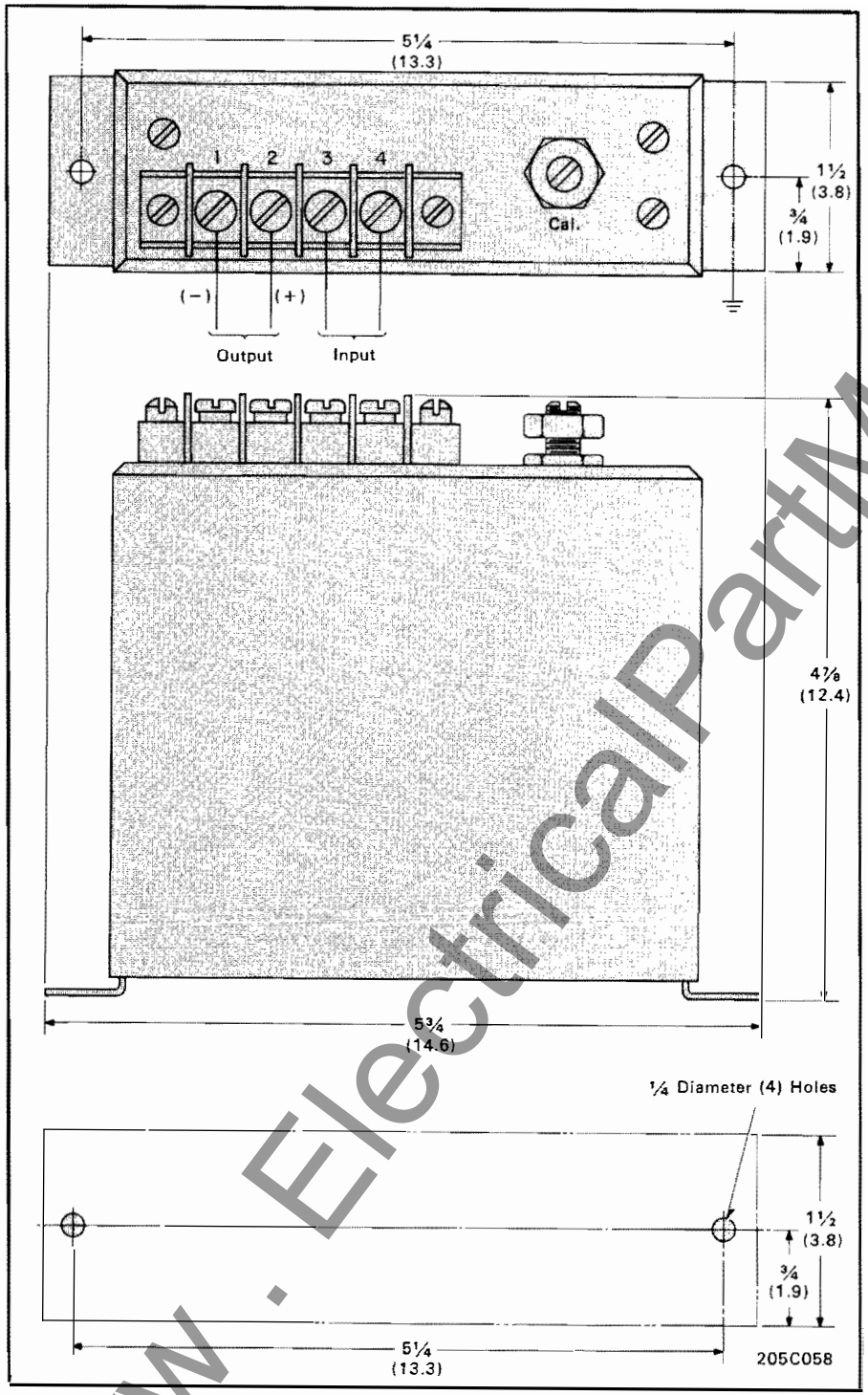
External Wiring and Dimensions in Inches (Centimeters)



Further Information
Prices: Price List 43-870
Instructions: IL 43-841.9
Watt and Var
Transducers
(Constant Current): Descriptive Bulletin 43-871

Other Transducers
1% Low Output:
Descriptive Bulletin 43-861
½% Watt Low Output:
Descriptive Bulletin 43-840
½% Frequency: Descriptive Bulletin 43-841
½% Pulse: Descriptive Bulletin 43-842
Current and Voltage Teleductor:
Descriptive Bulletin 43-844

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