SARGENT & LUNDY ENGINEERS CHICAGO	Calcs. For Non-Class 1E Resistors Used With Westinghouse V-4 Transducers	Calc. No. 19-BD-17
	X Safety-Related / Non-Safety-Related	Rev. 0 Date 4-16-85
		Page 1 of 15

Client	Illinois Power Company	Prepared by A S Caruso	Date 4-15-85
Project	Clinton Power Station - Unit 1	Reviewed by [illegible]	Date 4-15-85
Proj. No. 4536-00	Equip No. VARIOUS	Approved by Mark F. [illegible]	Date 4-16-85

RESPONSIBLE DIVISION - EPED FILE NO. 19-BD

REVISION STATUS

Revision 0, Dated 4-16-85, Pages 1 thru 15 (original Issue)

FOR REFERENCE ONLY

REVIEW METHOD

Revision 0 - Detail review of the entire analysis.

UNCONTROLLED COPY

PURPOSE

The purpose of this calculation is to show that the use of Non-Class 1E resistors in the output circuits of Westinghouse Type V-4 transducers which are connected to optical isolators is acceptable.

ASSUMPTION

Since the output of the transducer is only wired to an optical isolator which provides a Non-Class 1E output, the inaccuracy or loss of the transducer output signal will have no effect on safety.

Form GQ 3.08.1 Rev. 2

ANALYSIS

The sketch on page 4 shows the typical connection of a Westinghouse Type V-4 transducer to analog optical isolators furnished in panels 1H13-P822, 1H13-P851 and 1H13-P861. The Non-Class 1E resistor is used to develop a voltage signal for the isolator since the output of the transducer is 0-1MADC while the optical isolator requires a 0-10VDC input. The resistor is assumed to fail by shorting, opening, or shorting to ground. The effect of the resistor failure on Class 1E circuitry on the input side of the transducer must be considered as well as the effect on the Class 1E wiring contiguous to the wiring between the transducer and the isolator.

See attached telecon memo between Mr. E. Horn and J. S. Paniagas dated March 18, 1982 concerning open and short circuits on the transducer output side. An open or short circuit on the output side will have no effect on the transducer input side. Also, see the attached descriptive catalog excerpts describing the amplifiers. Specifically, note the description under "Operation". The signal from the pulse generators passes through an amplifier to convert it to a "load-independent" (constant current) output. Therefore, there is no effect on the input from open or short circuits on the output side. Also note "Amplifier Protective Circuit" and "Surge Withstand Capability".

The wiring between the resistor and the optical isolator would not be affected by the 1) shorting out of the resistor since the transducers are rated to handle 0 to 10,000 ohms output load nor by the 2) open circuiting of the resistor since the output of the transducer would see a 200,000 ohm input impedance of the optical isolator (see attached FPR No. 147) which would limit the voltage across the optical isolator input to 200 volts (1×10^{-3}amp x 200 x 10^3ohms = 200 volt). The safety-related panel wiring is rated 300 volts and

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		Page 3 of 15

Client	Illinois Power Company	Prepared by	Date
Project	Clinton Power Station - Unit 1	Reviewed by	Date
Proj. No.	4536-00 Equip. No. VARIOUS	Approved by	Date

ANALYSIS (CONTINUED)

therefore, the 200 volts imposed on the transducer to isolator wiring will present no hazard to contiguous safety-related wiring.

CONCLUSION

The use of a Non-Class 1E resistor in Westinghouse V-4 transducer-to-optical isolator circuits is acceptable.

Form GQ 3.08.1 Rev. 2

SARGENT & LUNDY ENGINEERS CHICAGO	Calcs. For Non-Class 1E Resistors Used With Westinghouse V-4 Transducers	Calc. No. IM-ED-17
	X Safety-Related / Non-Safety-Related	Rev. 0 Date 4-16-85
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Client	Illinois Power Company	Prepared by	Date
Project	Clinton Power Station - Unit 1	Reviewed by	Date
Proj. No.	4536-00 Equip. No. VARIOUS	Approved by	Date

PANEL 1H13-P851 (TYPICAL)

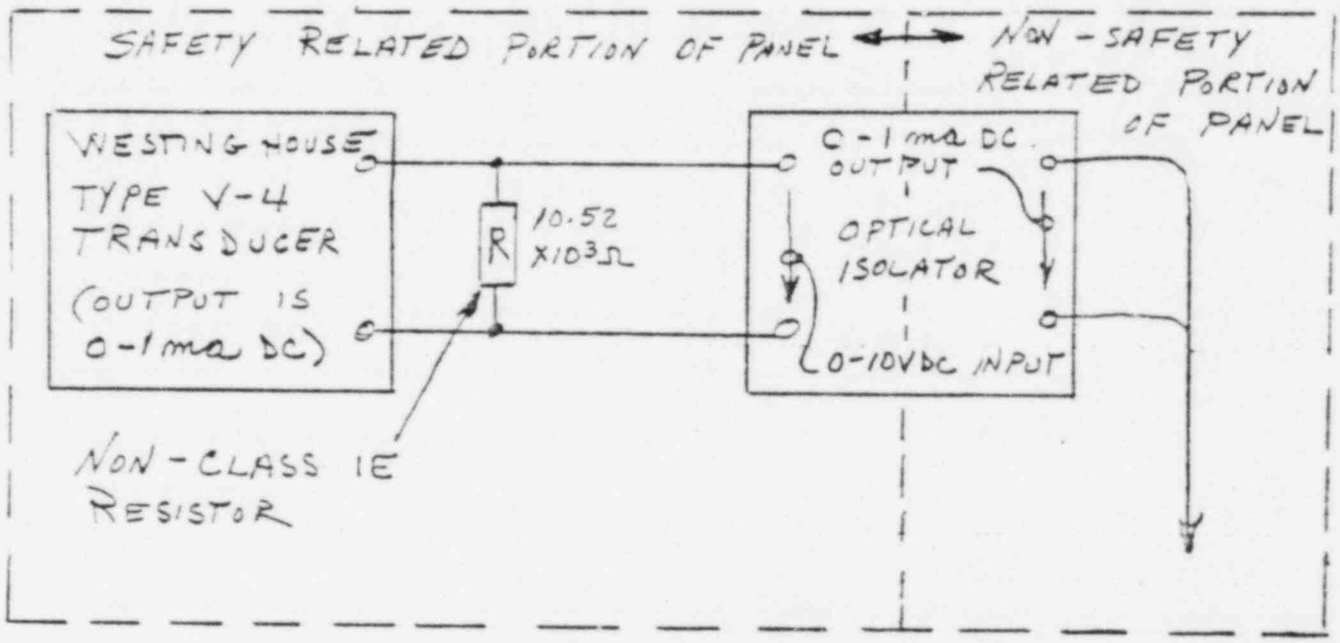

FIGURE 1

Form GQ 3.08.1 Rev. 2

MS#/DAS

SARGENT & LUNDY

MEMORANDUM OF
TELEPHONE CONVERSATION

Proj No 4536-00
Page 5 of 15
Calc. No. 19BD-17
REVISION 0

Illinois Power Company 4-16-85
Clinton - Unit 1
Safety - Related

Date: March 18, 1982

Time: A.M.

Person Called: Ed Horn (Name) of Westinghouse (Company)

Person Calling: J. S. Paniaguas (Name) of Sargent & Lundy (Company)

Project: Clinton Project No. 4536-00

Subject Discussed: Westinghouse V-4 Transducers

Summary of Discussion, Decisions and Commitments:

Ed advised that if output side of V-4 transducers are open or short-circuited, there will be no effect on primary.

Action;

c: J. M. Buckman - 24

J. S. Paniaguas
Signature

File: 19BD

Westinghouse Electric Corporation
Relay-Instrument Division
Newark, New Jersey 07101

43-871 D WE A
Descriptive Bulletin

Page 1

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Illinois Power Company
Clinton - Unit 1
Safety-Related

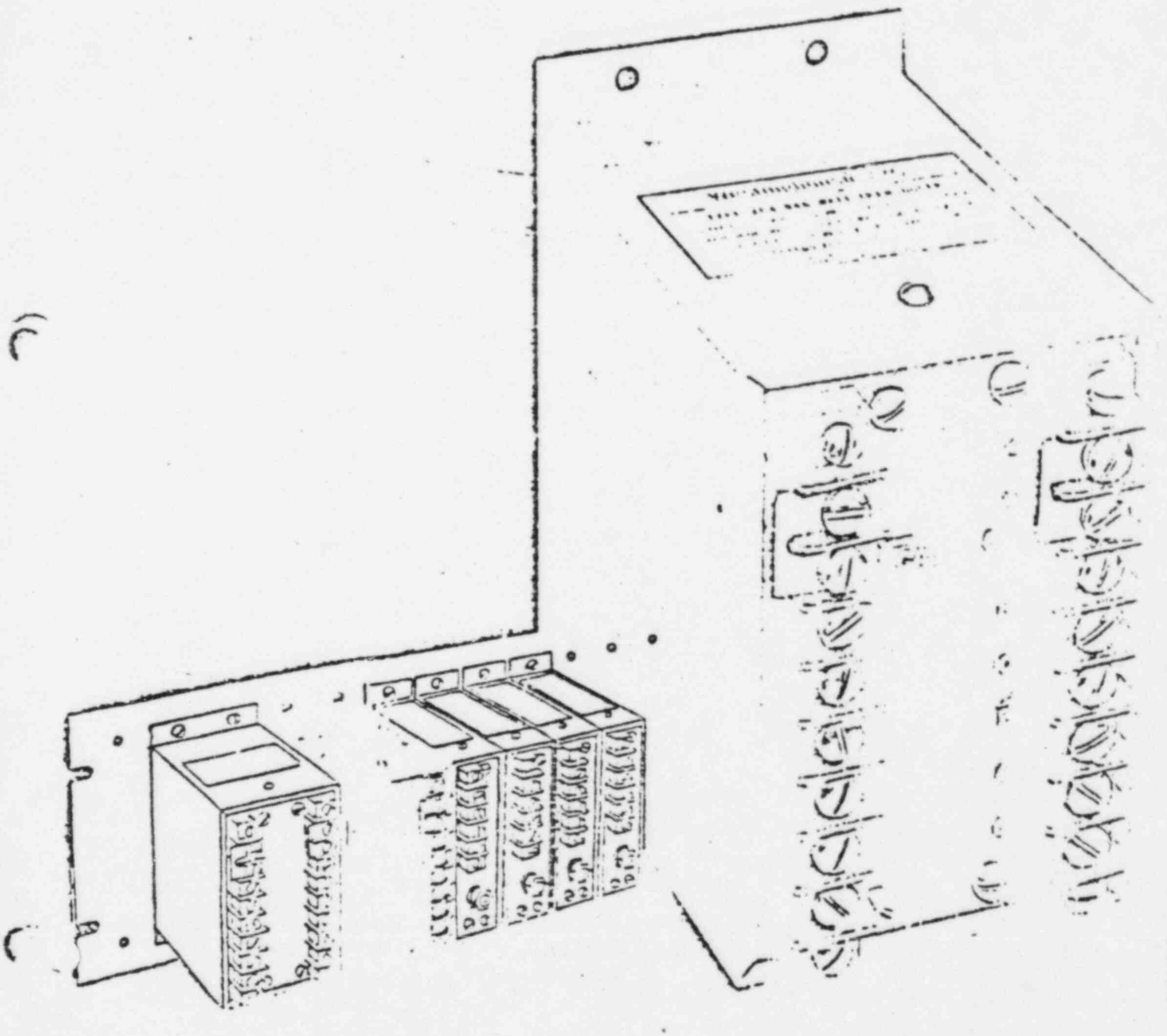
REVISION 0
4-16-85

Calc. No.
19ED-17
Proj No 4536-00

April, 1975
New Information
E. D. C/2043 DB

Load-independent (constant current)
Output ½% Accuracy Class

Type V-4 Watt and Var Transducers



Illinois Power Co.
Clinton - Unit 1
Safety-Related

Westinghouse Electric

43-371 D WE A
Descriptive Bulletin

REVISION 0
1-16-85

Pg 7 of 15
Calc. No. 19BD-17
Proj. No. 4536-00

Application
Type V-4 watt and var transducers convert current and voltage input signals from a power system into dc output signals proportional to the true power or the reactive power on that system. Output polarity changes with direction of power flow. The outputs can be utilized by computers, control and data systems or by analog or digital instruments.

The watt transducers are identified as type VP4-845 and the var transducers as type VV4-846.

Operation
These transducers employ the time-division multiplication principle. The measuring circuitry generates a train of pulses whose height is proportional to current and whose length is proportional to voltage. The area of each pulse is proportional to the power flowing within the duration of each pulse. There are many pulses per cycle. Integrating these pulses, therefore, yields a rate of flow of power. The circuitry presents this in the form of a proportional dc signal.

The signal is passed through an amplifier to convert it to a load-independent (constant-current) output.

...sducers are similar to the watt trans... except that the potentials are shifted ... by means of an internal R-C network.

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.

Time-Division Multiplier
This circuitry employs complementary MOS digital integrated circuits for superior accuracy, linearity and stability.

Printed Circuit Construction
All components are mounted on printed circuit boards of a glass-epoxy. This material possesses great strength; it does not support fungus growth; it has a high resistance to damage due to a re-soldering of parts during repair or modification under field conditions. All circuit boards are accessible for repair. This is especially important in the case of the power supply and amplifier board which is exposed to externally-caused damage from accidental misconnection to sources beyond the level of the inherent protective circuitry.

Plug-in Integrated Circuits
All amplifiers and multipliers are IC's for consistency in performance with plug-in mounting for convenience in servicing.

Convertible Power Supply
Jumpers are supplied on the terminal block of each transducer to connect the power supply source to the measured potential transformer circuit. With jumpers removed the transducer may be operated from a separate control power source. Thus, only one style transducer need be used to serve both functional requirements.

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 By-Pass
Each transducer contains by-pass circuitry to give the device a relatively high immunity to radio frequency interference (RFI).

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

a) Unistrut© channel.
b) Standard relay rack panels.
c) Standard rack unit mounting strip.
d) Pre-drilled channel.
e) Pre-drilled panel.

The basic module is 1½ inches wide and uses 5¼ inch vertical distance between mounting holes as suggested by an IEEE proposed standard. Watt and Var transducers are made in modules (3 inches) 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 (see Page 1). There is no interaction between transducers regardless of mounting space.

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

Temperature Stability
Low temperature coefficient resistors and zener diodes are used to obtain a low temperature influence without resorting to the resistor-thermistor compensation schemes which were needed on the Hall generator transducers. Good temperature performance is designed in, and not compensated in.

Adjustments
Models are available with both a ±10% and a 0–110% output adjustment capability. Because of the grade of amplifier used it has not been necessary to limit the adjustment range in order to maintain a reasonable accuracy at the low end. The calibration control is a 20-turn potentiometer accessible from the top of the case. Any element trimming and phase shifting adjustments are accessible from the outside of the case. These are bench type adjustments. These trimmers are accessible from the top in watt transducers and the bottom in var transducers. Inasmuch as the multiplier circuit has a relatively high output, no zero adjustment is ever necessary. This is in contrast to the Hall type which does require a zero adjuster because the low output of the Hall circuitry necessitates a high-gain amplifier.

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. Relay engineers have adopted SWC specification in IEEE Standard 472-1974 (ANSI C37.90a, 1974).

In designing the V-4 transducers Westinghouse was able to draw upon the 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. Relays cannot tolerate a transient which would cause a false trip while a transducer output may be momentarily affected so long as the unit is not damaged.

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 open circuit oscillatory wave, 1.0 to 1.5 MHz, 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

Illinois Power Company
Clinton - Unit 1
Safety-Related

Trox No 4536-00

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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 condition. Surge voltage is then applied.

a) Between case and power supply to all other ac terminals tied together.

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.

Accuracy
The linearity of the V-4 watt and Var transducers is 0.1% at reference conditions. (This is sometimes referred to as 0.1% accuracy/linearity, but this is a coined term which can be misleading). The Westinghouse transducers are rated at their operating accuracy of 0.5% which includes the entire range of any combinations of influences which might reasonably be expected in actual service.

Long-Term Stability
A stability of at least 0.25% per year is anticipated based on experience with similar circuitry and published data on components.

Specifications

Watt Transducer	Type VP4-846
Var Transducer	Type VV4-846
2-Element	For 3-phase, 3-wire
2½-Element	For 3-phase, 4-wire
Input Watts/Vars	
2-Element	1000
2½-Element	1500
Input Current, ac	5A
Input Voltage, ac	120V
Input Frequency	60 Hz
Output current, dc	0-±1 mA
Output Load Resistance	0-10,000 Ohms
Linearity at Reference Conditions (stated as a percent of rated output)	±0.1% max.
Reference Conditions:	
Input Current	0-8.5A
Temperature	23°C
Power Factor	1.0
Input Voltage	120V
Frequency	60 Hz
Load	5000 ohms
Power Supply	120 V
Operating Accuracy (Under operating conditions stated as a percent of rated output)	
With ±10% Calibration Range	±0.5%
With 0-110% Calibration Range	±0.8%
Operating Conditions:	
Input Current	0-8.5A
Temperature	23±13°C
Power Factor	Any
Input Voltage	75-132V
Frequency Watt	±1 Hz
Var	±.07 Hz
Load	0-10,000 ohms
Power Supply	85-135V
3rd Harmonic Content	0-3%

Extreme Influences (Percent of Rated Output)

Current Linearity, 0-10A	±0.3%
Voltage Linearity, 0-140V (with external power supply to amplifier)	±0.1%
Power Factor 1-0-1, lag or lead	
Watt	±0.2%
Var	±0.1%
Temperature, −20 to +65°C	
±10% Cal. Adj.	
Typical	±0.25%
Maximum	±0.5%
0-110% Cal. Adj.	
Typical	±0.5%
Maximum	±1.0%
Frequency	
Watt 60±10 Hz	±0.1%
Var 60±0.1 Hz	±0.15%
Current Waveform 0-40% Third Harmonic Content, Watts Only	±.25%

Other Operating Characteristics

Output Adjustment	±10%
Optional Output Adjustment	0-110%
Ripple (peak-to-peak of rated output)	1.0%
Response Time (to 99% of rated output)	400 m sec
Power Supply	85-135V, 50-400 Hz

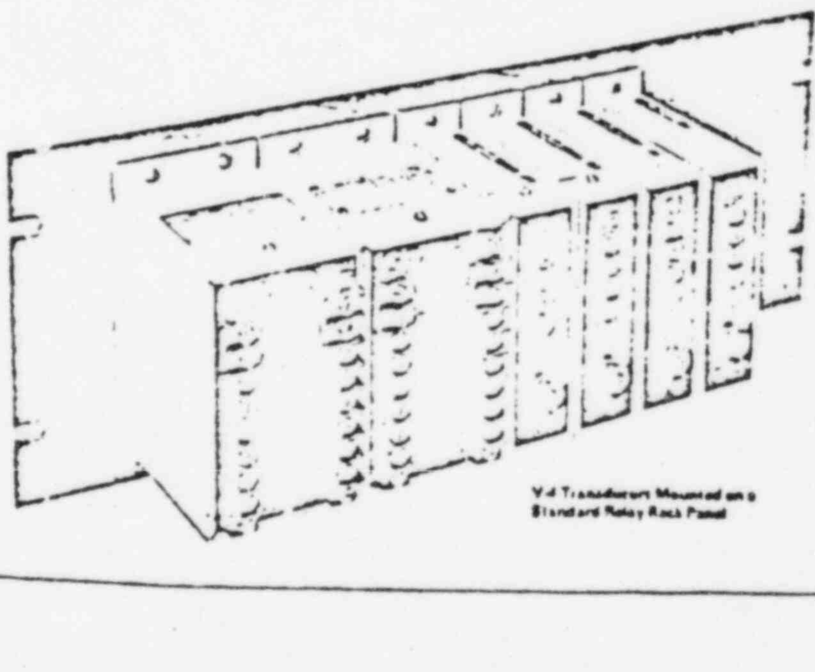
Burden

Current Circuit	0.2VA at 1.0 PF
Potential Circuit	0.3VA at 0.5 PF
Power Supply	4VA at 0.75 PF

Withstand Capability

Storage Temperature	−40 to 100°C
Overload, Current	10A continuous 250A 1 sec/hr
Overload, Voltage	150V continuous
Dielectric Test	1500V
Surge	IEEE Std. 472 - 1974 (ANSI C37.90a - 1974)
Output	120V ac 5 Min.

Weight: Watt & Var 2¼ lb. (1 kg) Net 3½ lb. (1.5 kg) Shipping



V-4 Transducers Mounted on a Standard Relay Rack Panel

Further Information
Prices: Price List 43-870
Applications: Application Data 43-870
Instructions: IL 43-861.1
Current and Voltage Transducers (Constant Current): Descriptive Bulletin 43-875
Other Transducers
Descriptive Bulletin 43-861-1% Low-Output
Descriptive Bulletin 43-840-½% Watt Low-Output
Descriptive Bulletin 43-841-½% Frequency
Descriptive Bulletin 43-842-½% Pulse
Descriptive Bulletin 43-844 – Current and Voltage Teleductor

Calc. No. 19ED-17
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Rev: 0 4-16-95
Project No. 4536-00

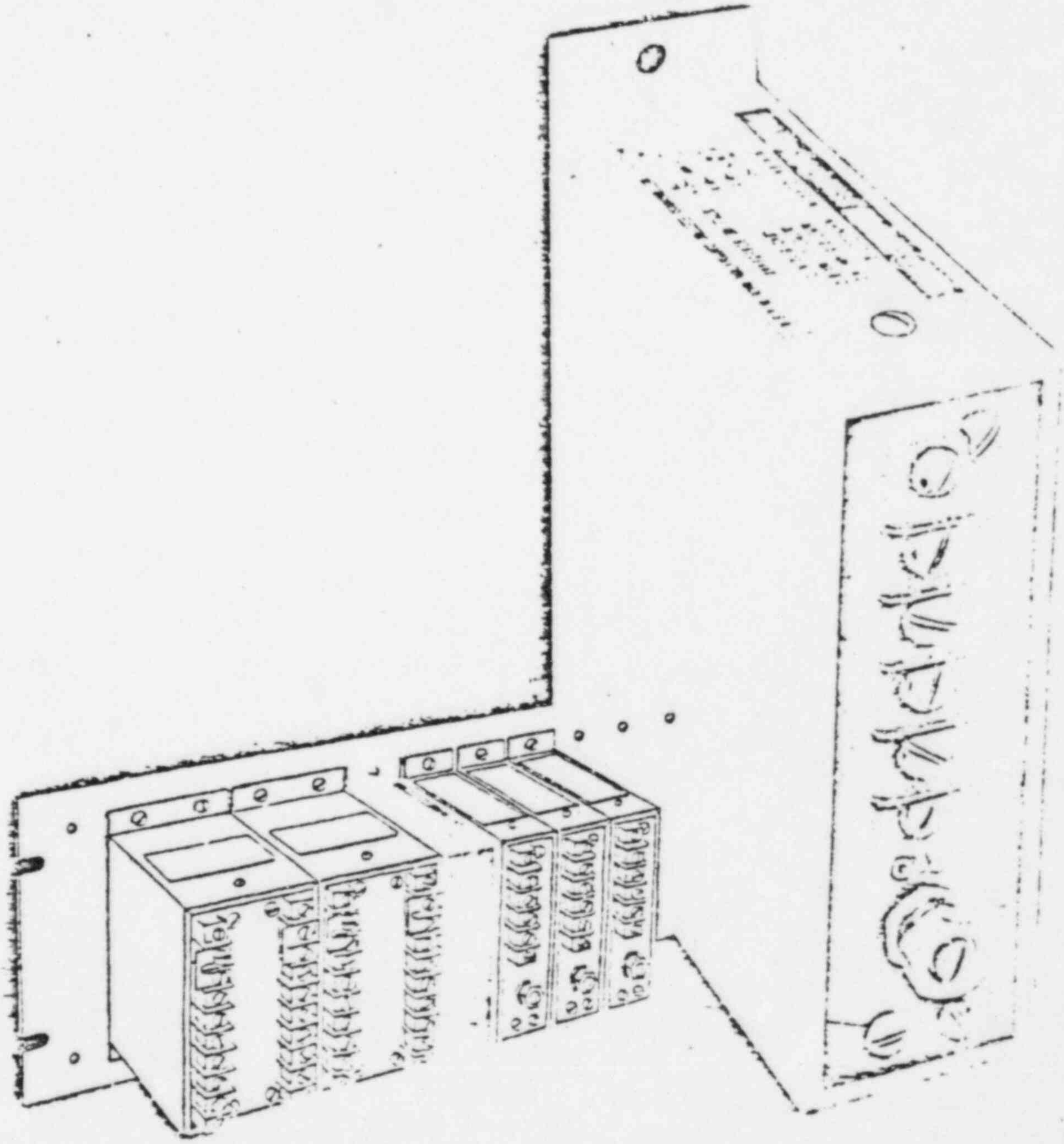
Illinois Power Co
Clinton - Unit 1
Safety-Related

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

April, 1975
New Information
E, D, C/2043 DB

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

Type V-4 Voltage and Current Transducers



Westinghouse Electric
43-875 DWE A
Page 2 Descriptive Bulletin

Illinois Power Co
Clinton Unit 1

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Rev. 0 4-16-85
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Safety-Related

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.

[illegible]ation
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.

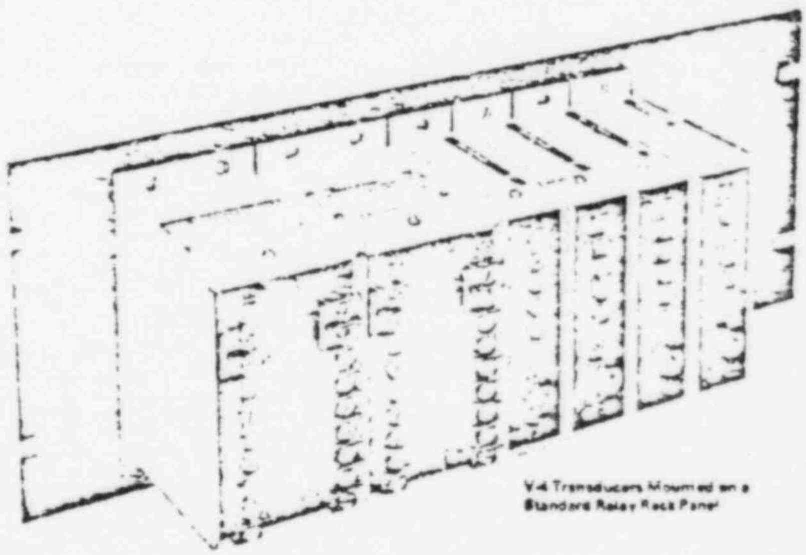
b) Between case and each dc output terminal.

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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Project No. 4536-00
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Illinois Power Co
Clinton Unit 1

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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Descriptive Bulletin

Illinois Power Co
Clinton Unit 1

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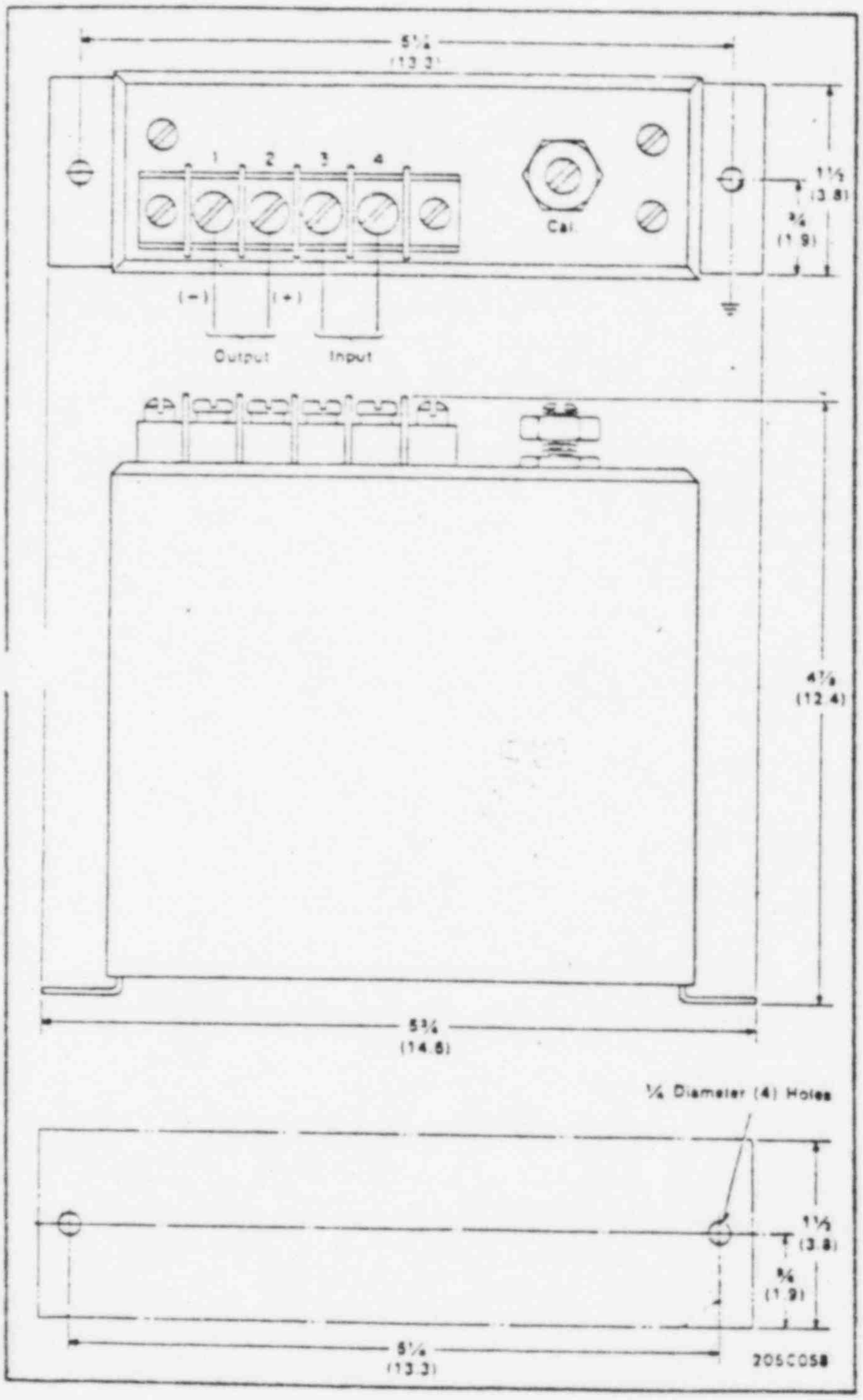
Safety-Related

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 43-851
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

Printed in U.S.A.

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

ILLINOIS POWER COMPANY
CLINTON POWER STATION
CPS UNIT 1

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4-16-85

FIELD PROBLEM REPORT

Project # 4536-00
Safety-Related

[1] FPR NO. 147
SHEET 1 of 3

[2] ORIGINATOR/DATE
Anderson 10/23/80

[3] REFERENCES:
E02-1AP12, Inst. Index, Applic. Data Sheets
SU FILE NO. 510

[4] SYSTEM Aux. Power
DESIGNATION CODE AP

[5] NEED DATE
November 29, 1980

[6] Aug.D/FP
SAFETY
☒ NON-SAFETY

[7] QUESTION/PROBLEM

The Indicators (and Isolators) on the attached sheets will read ≈5% low due to an incorrect resistor size. S&L designed resistor strings contain a 5K(10K) ohm resistor that is driven by a 0-1 m Amp signal. The indicator is then driven by the voltage developed across this resistor. S&L neglected the loading effect of the indicator/isolator (100K ohm/200K ohm) which results in an inaccuracy of 4.76%. This is in addition to the 2% accuracy of the indicator.

[8] RECOMMENDED RESOLUTIONS

(1) S&L Replace the 5K/10K ohm resistors in the resistor string with one that will compensate for the loading effect of the indicator/isolator.

(2) S&L Review their entire design to verify that other instances, such as this, do not occur in other systems.

Responsible Engineer
Assigned To
Reviewed :
~~[illegible]~~
Info E02-1AP12

[9] APPROVAL/DATE
[signature]

[10] ENGINEERING DISPOSITION
By [signature] Date 7/28/81

Upon completion ALL 5KΩ METER RESISTORS WITH 5.26KΩ RESISTORS, 1% TOLERANCE OR LESS. REPLACE ALL 10KΩ ISOLATOR RESISTORS WITH 10.52KΩ RESISTORS, 1% TOLERANCE OR LESS.

2. DESIGN HAS BEEN REVIEWED AND THERE ARE NO OTHER INSTANCES WHERE THESE TYPES OF VOLTAGE DIVIDERS WERE USED

[11] DOCUMENT REVISION REQD.
☒ YES
☐ NO

[12] AFFECTED DOCUMENT(S)/NUMBER(S)
E02-1AP12

[13] AS-BUILTS REQD.
☐ YES
☒ NO

[14] ACCEPTANCE/DATE/ORGANIZATION
MARK S. ZAL 6-11-81 S&L 6-17-81

[15] FIELD ENG. APPROVAL/DATE
[signature] 6/18/81

N100-178 (11-79)

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Clinton - Unit 1 Safety-Related

DRAWING	Indicator/Isolator	Function	Indicator/Isolator Data Sheet
E02-1AP12-014	1UO-AP614A	Bus 1ET4-4KV Bus 1B1 Amps	MD020
E02-1AP12-014	1UO-AP614B	Bus 1ET4-4KV Bus 1B1 Watts	MD020
E02-1AP12-017	1JI-AP826	Bus 1RT6-6.9KV Bus 1B Watts	EI 052A
E02-1AP12-017	1II-AP828A	Bus 1RT6-6.9KV Bus 1B Amps	EI 052A
E02-1AP12-017	1JI-AP823	UAT1B-6.9KV Bus 1B Watts	EI 052A
E02-1AP12-017	1II-AP825A	UAT1B-6.9KV Bus 1B Amps	EI 052A
E02-1AP12-018	1II-AP990	Aux. Trans 1M Amps	EI 052B
E02-1AP12-018	1II-AP873	Aux. Trans 1E Amps	[illegible]52B
E02-1AP12-018	1II-AP861	Aux. Trans 1I Amps	EI 052B
E02-1AP12-018	1II-AP853	Aux. Trans 1G Amps	EI 052B
E02-1AP12-018	1II-AP869	Aux. Trans 1K Amps	EI 052B
E02-1AP12-018	1II-AP415	Aux. Trans F Amps	EI 052A
E02-1AP12-018	1II-AP940	Aux. Trans N Amps	EI 052B
E02-1AP12-019	1UO-AP619A	DG1A Watts	MD020
E02-1AP12-019	1UO-AP619B	DG1A Vars	MD020
E02-1AP12-019	1UO-AP619C	DG1A Amps	MD020
E02-1AP12-020	1UO-AP620B	DG1B Watts	MD020
E02-1AP12-020	1UO-AP620C	DG1B Vars	MD020
E02-1AP12-020	1UO AP620D	DG1B Amps	MD020
E02-1AP12-027	1II-AP979	Aux. Trans Q Amps	EI 053B
E02-1AP12-027	1II-AP753	Aux. Trans I Amps	EI 053A
E02-1AP12-027	1II-AP416	Aux. Trans G Amps	EI 053A
E02-1AP12-027	1II-AP418	Aux. Trans K Amps	EI 053A
E02-1AP12-028	1II-AP417	Aux. Trans J Amps	EI 053A
E02-1AP12-028	1II-AP982	Aux. Trans R Amps	EI 053B
E02-1AP12-028	1II-AP749	Aux. Trans H Amps	EI 053A
E02-1AP12-028	1II-AP759	Aux. Trans L Amps	EI 053A
E02-1AP12-030	1II-AP738	Aux. Trans C Amps	EI 052A
E02-1AP12-030	1II-AP870	Aux. Trans O Amps	?
E02-1AP12-030	1II-AP974	Aux. Trans P Amps	EI 052B
E02-1AP12-030	1II-AP419	Aux. Trans D Amps	EI 052B

Illinois Power Co
Clinton Unit 1
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INACCURACIES OF INDICATORS AND ANALOG ISOLATORS

DRAWING	Indicator/Isolator	Function	Indicator/Isolator Data Sheet
E02-1AP12-001	1JI-MP804	Generator Gross MW	EI 009A
E02-1AP12-001	1EY-MP833	Generator Gross MW	MD827L
E02-1AP12-001	1JI-MP805	Generator Gross MVAR	EI 009A
E02-1AP12-004	1II-AP889A	UAT1A-4KV Bus 1A Amps	EI053B
E02-1AP12-004	1JI-AP891	UAT1A-4KV Bus 1A Watts	EI 053A
E02-1AP12-004	1II-AP893A	Bus 1RT4-4KV Bus 1A Amps	EI 053A
E02-1AP12-006	1JI-AP894	Bus 1RT4-4KV Bus 1A Watts	EI 053B
E02-1AP12-006	1II-AP901A	Bus 1RT4-4KV Bus 1B Amps	EI 053B
E02-1AP12-006	1JI-AP903	Bus 1RT4-4KV Bus 1B Watts	EI 053B
E02-1AP12-006	1II-AP898A	UAT1B-4KV Bus 1B Amps	EI 053B
E02-1AP12-006	1JI-AP900	UAT1B-4KV Bus 1B Watts	EI 053B
E02-1AP12-007	1II-AP805A	RAT 1Amps	EI 051F
E02-1AP12-008	1II-AP807A	ERAT Amps	EI 051F
E02-1AP12-009	1JI-AP810	UAT1A-6KV Bus 1A Watts	EI 052A
E02-1AP12-009	1II-AP812A	UAT1A-6KV Bus 1A Amps	EI 052A
E02-1AP12-009	1JI-AP815	Bus 1RT6-6KV Bus 1A Watts	EI 052A
E02-1AP12-009	1II-AP817A	Bus 1RT6-6KV Bus 1A Amps	EI 052A
E02-1AP12-010	1II-AP743	Aux. Trans E Amps	EI 052A
E02-1AP12-010	1II-AP936	Aux. Trans M Amps	EI 052B
E02-1AP12-010	1II-AP865	Aux. Trans 1J Amps	EI 052B
E02-1AP12-010	1II-AP849	Aux. Trans 1F Amps	EI 052B
E02-1AP12-010	1II-AP857	Aux. Trans 1H Amps	EI 052B
E02-1AP12-010	1II-AP845	Aux. Trans 1D Amps	EI 052A
E02-1AP12-010	1II-AP985	Aux. Trans 1L Amps	EI 052B
E02-1AP12-011	1UO-AP611A	4KV Bus 1A1 Volts	MD020
E02-1AP12-011	1II-AP762A	Bus 1RT4-4KV Bus 1A1 Amps	EI 014B
E02-1AP12-011	1II-AP833	Aux. Trans. 1A Amps	EI 014B
E02-1AP12-011	1II-AP703	Aux. Trans A Amps	EI 014B
E02-1AP12-012	1UO-AP612A	Bus 1ET4-4KV Bus 1A1 Amps	MD020
E02-1AP12-012	1UO-AP612B	Bus 1ET4-4KV Bus 1A1 Watts	MD020
E02-1AP12-013	1UO-AP613A	4KV Bus 1B1 Volts	MD020
E02-1AP12-013	1II-AP770A	Bus 1RT4-4KV Bus 1B1 Amps	EI 015B
E02-1AP12-013	1II-AP837	Aux. Trans 1B Amps	EI 015B
E02-1AP12-013	1II-AP709	Aux. Trans B Amps	?