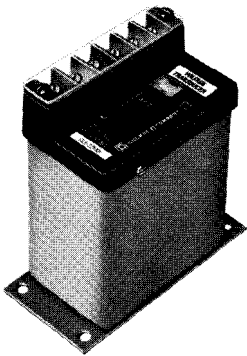


Transducers and Solid State Relays

CONTENTS

Description	Class	Pages	Description	Class	Pages
0.25% AC Voltage Transducers	8410	.....2	Transducer Relays.....	8430	.....13
0.25% AC Current Transducers	8410	.....3	Remote Control Transmitter	8430	.....14
0.25% Watt Transducers	8410	.....4-5	Phase Loss Relay	8430	.....15
0.25% Var Transducers.....	8410	.....6-7	Under Voltage Relays	8430	.....16
Process Signal Amplifier	8410	.....8	Over Voltage Relays	8430	.....17
Frequency Transducers	8410	.....9	Over /Under Voltage Relay	8430	.....18
Power Factor Transducer.....	8410	.....10	Over/Under Frequency Relay	8430	.....19
WIRING DIAGRAMS	8410	.....11-12	WIRING DIAGRAMS	8430	.....20-21
DIMENSIONS	8410	.....12	DIMENSIONS	8430	.....20
			Capacitor Fault Relays	8450	.....22
			WIRING DIAGRAMS	8450	.....23
			DIMENSIONS.....	8450	.....23



Catalog No.
CLE-201001

FEATURES

- Accuracy — $\pm 0.25\%$ of Rated Output
- Accuracy maintained from 10 - 180V input
- Accuracy load-independent
- Meets IEEE SWC test
- Withstands $1.2 \times 50 \mu\text{s}$ 6KV crest impulse
- Negligible temperature effect on accuracy
- Excellent long term stability
- Provisions for monitoring output current while in service (available as option, add "T" to catalog number).

APPLICATIONS

- Use with SQUARE D Transducer Relay for remote control functions (PR-101-TR and PR-201-TR)
- Transmission of voltage signals over long distance with no loss in accuracy
- Energy Management Systems
- Motor and Power Control Circuits

DESCRIPTION

The CLE-201001 transducer accurately converts a sinusoidal AC voltage to a proportional dc output current. The output current can then be indicated on analog or digital instruments or feed data loggers, recorders, or computer inputs. The output can also drive analog to digital converters used in Energy Management Systems or other control systems, such as the Model CLE-207100 process amplifier.

An extremely stable constant current amplifier permits the dc signal to be transmitted over long distances with no loss in accuracy. Excellent temperature and long term stability characteristics are provided. Premium selected solid state devices are used for increased reliability. The output is insensitive to load variations, making it ideal for remote instrumentation or control applications where long lead wires and varying load resistance is encountered. Full scale calibration of $\pm 10\%$ is provided through a sliding access port. A multiturn adjustment potentiometer is provided for precise settings. Zero adjustments are not required. The transducer is self-powered for the entire input range and has a burden $< 1.5\text{VA}$.

The 0.25% of reading accuracy is maintained over the entire Input Range, permitting overloads to be measured with the same accuracy as the Rated Input. As long as the Compliance Voltage Limit (11 volts dc) is not exceeded, ($I_{\text{out}} \times R_L \leq 11\text{V}$) operation above the rated input provides the same linearity, accuracy and performance at the Rated Input.

The transducers are designed to withstand the surge requirements of IEEE STD. 472 and ANSI C37.90A (SWC). Additionally, the unit withstands an Impulse test of $1.2 \times 50 \mu\text{s}$ 6KV crest unidirectional and up to 100VRMS, 2sec. across the output terminals. High dielectric withstand capability and complete input/output/case isolation is provided.

The mounting dimensions and wiring connections match those of other commonly used transducers for ease in replacement.

An in-line test jack can be provided as an option to permit monitoring the output current while in service. Add the letter "T" to the catalog number to specify this option.

SPECIFICATIONS

Input Range.....	0-180V
Rated Input.....	150V
Burden at 120V 60HZ.....	$< 1.5\text{VA}$
Overload (continuous).....	180V
Frequency Range	
(Specify Nominal).....	50-500Hz
Operating Humidity.....	0-95%
Temperature Range.....	-25°C to $+75^\circ\text{C}$
Maximum Temperature	
Effects on Accuracy.....	$\pm 0.5\% \text{RO}$
Accuracy @ 25°C (10-180V)	
(%RO at nominal frequency).....	$\pm 0.25\% \text{RO}$
Output at Rated Input.....	1mA dc
Output Ripple.....	$< 0.5\% \text{RO}$
Output Load Required.....	0-10K Ω

Compliance Voltage (max.).....	11Vdc
Calibration Adjustment.....	$\pm 10\%$
Response Time (to 99%).....	$< 400\text{ms}$
Stability, % of full scale per yr.....	$\pm 0.25\%$
Dielectric Withstand Voltage.....	1500 V RMS (1 min.)
Surge Withstand Capability.....	ANSI C37.90A
	IEEE STD.472
Impulse Test.....	Unidirectional
	1.2x5 μs 6kV crest
	70A Short Circuit
	6kV crest 100 kHz
Test Voltage Across Output.....	100VRMS, 2s

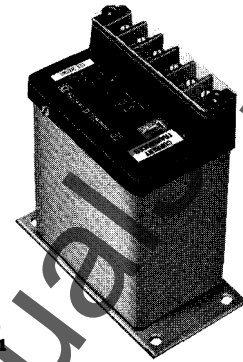
DIMENSIONS: Style 2 on page 12
CONNECTIONS: Figure 1 on page 11

FEATURES

- Accuracy — $\pm 0.25\%$ of Rated Output
- Accuracy maintained from 0 - 6.5A input
- Accuracy load-independent
- Meets IEEE SWC test
- Withstands $1.2 \times 50\mu s$ 6KV crest impulse
- Negligible temperature effect on accuracy
- Excellent long term stability
- Provisions for monitoring output current while in service (available as option, add "T" to catalog number).

APPLICATIONS

- Use with SQUARE D Transducer Relays for remote control functions (PR-101-TR and PR-201-TR)
- Transmission of current signals over long distance with no loss in accuracy
- Energy Management Systems
- Motor and Power Control Circuits



Catalog No.
CLE-202001

DESCRIPTION

The CLE-202001 transducer accurately converts a sinusoidal AC current to a proportional dc output current. The output current can be indicated on analog or digital instruments or feed data loggers, recorders, or computer inputs. The output can also drive analog to digital converters used in Energy Management Systems, or other control systems, such as the Model CLE-207100 process amplifier.

An extremely stable constant current amplifier permits the dc signal to be transmitted over long distance with no loss in accuracy. Excellent temperature and long term stability characteristics are provided. Premium selected solid state devices are used for increased reliability. The output is insensitive to load variations, making it ideal for remote instrumentation or control applications where long lead wires and varying load resistance is encountered. Full scale calibration of $\pm 10\%$ is provided through a sliding access port. A multiturn adjustment potentiometer is provided for precise settings. Zero adjustments are not required. The transducer is self-powered for the entire input range, and has a burden $< .15VA$.

The 0.25% of reading accuracy is maintained over the entire Input Range, permitting overloads to be measured with the same accuracy as the Rated Input. As long as the Compliance Voltage Limit (11 volts dc) is not exceeded, ($I_{out} \times R_L \leq 11V$) operation above the rated input provides the same linearity, accuracy and performance as at the Rated Input.

The transducers are designed to withstand the surge requirements of IEEE STD.472 and ANSI C37.90A (SWC). Additionally, the unit withstands an Impulse test of $1.2 \times 50\mu s$, 6KV crest unidirectional and up to 100VRMS, 2 sec. across the output terminals. High dielectric withstand capability and complete input/output/case isolation is provided.

The mounting dimensions and wiring connections match those of other commonly used transducers for ease in replacement.

An in-line test jack can be provided as an option to permit monitoring the output current while in service. Add the letter "T" to the catalog number to specify this option.

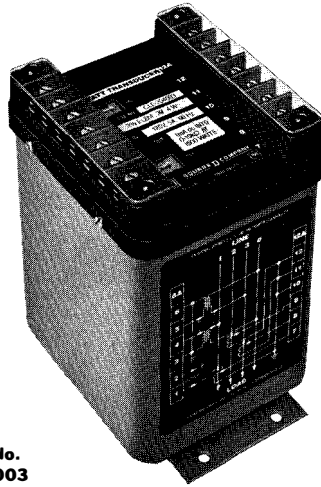
SPECIFICATIONS

Input Range	0-6.5A
Rated Input .....	.5A
Burden at 120V 60HZ	$< 0.15VA$
Overload	10A continuous 250A for 1 sec.
Frequency Range (Specify Nominal)	50-500Hz
Operating Humidity	0-95%
Temperature Range	$-25^{\circ}C$ to $+75^{\circ}C$
Maximum Temperature Effects on Accuracy	$\pm 0.5\%RO$
Accuracy @ $25^{\circ}C$ (0-6.5A) (%RO at nominal frequency)	$\pm 0.25\%RO$
Output at Rated Input	1mA dc
Output Ripple	$< 0.5\%RO$

Output Load Required	0-10K Ω
Compliance Voltage (max.)	11Vdc
Calibration Adjustment	$\pm 10\%$
Response Time (to 99%)	$< 400ms$
Stability, % of full scale per yr.	$\pm 0.25\%$
Dielectric Withstand Voltage	1500 V RMS (min.)
Surge Withstand Capability	ANSI C37.90A IEEE STD.472
Impulse Test	Unidirectional 1.2x50 μs 6kV crest 70A Short Circuit 6kV crest 100 kHz
Test Voltage Across Output	100VRMS, 2s

DIMENSIONS: Style 2 on page 12
CONNECTIONS: Figure 2 on page 11

TYPE CLE-20400



Catalog No.
CLE-204003

DESCRIPTION

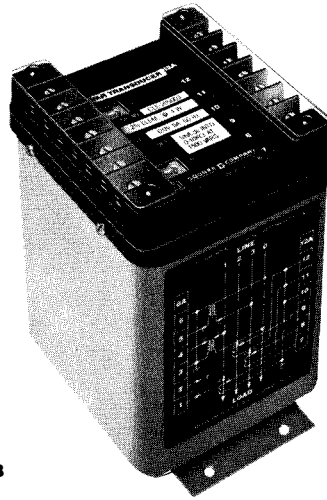
The CLE- 20400 Watt Transducer utilizes unique digital circuitry eliminating zero adjustments while providing excellent long term stability. The 0.2% of reading accuracy provides the optimum overall accuracy/cost ratio. This field serviceable transducer matches industry accepted sizes and connections. Constant current or constant voltage outputs are available. 1, 1½, 2, 2½, and 3 element versions are available. Consult chart on page 5 for type desired. Order by catalog number.

FEATURES

- Field serviceable
- Sliding access doors for calibration and test
- Complete technical manual available
- Identified service test points terminals provided on component circuit boards
- All components symbolized on circuit boards for ease of maintenance
- DC standards can be used to calibrate multiplier board
- Multiplier board plugs in to facilitate removal and calibration
- Test jack provided for monitoring output current while in service
- All integrated circuits are burned-in to eliminate failures and color coded to indicate the burn-in screening
- Most components are located on a plug-in multiplier board to facilitate service



TYPE CLE-20500



Catalog No.
CLE-205003

DESCRIPTION

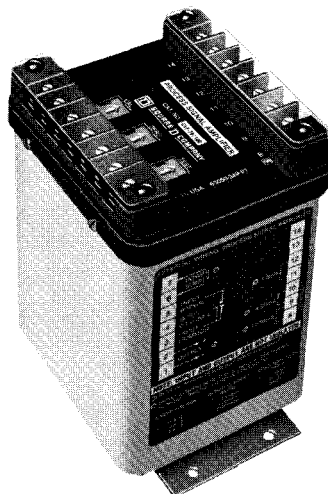
The CLE-20500 Var Transducer utilizes unique digital circuitry eliminating zero adjustments while providing excellent long term stability. An internal, extremely stable 90° phase shifter converts the CLE-20400 Watt Transducer to an equally precise Var Transducer. The 0.2% of reading accuracy provides the optimum over-all accuracy/cost ratio. This field serviceable transducer matches industry accepted sizes and connections. Constant current or constant voltage outputs are available. 1, 1½, 2, 2½, and 3 element versions are available. Consult chart on page 7 for type desired. Order by catalog number.

FEATURES

- Field serviceable
- Sliding access door for calibration and test
- Complete technical manual available
- Identified service test points terminals provided on component circuit boards
- All components symbolized on circuit boards for ease of maintenance
- DC standards can be used to calibrate multiplier board
- Multiplier board plugs in to facilitate removal and calibration
- Test jack provided for monitoring output current while in service
- All integrated circuits are burned-in to eliminate failures and color coded to indicate the burn-in screening
- Most components are located on a plug-in multiplier board to facilitate service



TYPE CLE-207100



Catalog No.
CLE-207100

APPLICATION

The Process Signal Amplifier converts either a 0-1mA dc or 0-10V dc transducer output to the input signal requirements of many recorders, process controllers and signal conditioners. The three most commonly used output signals are available, 1-5mA dc, 4-20mA dc or 10-50mA dc. These outputs are selectable by means of jumper strap provided with the unit. The Process Signal Amplifier is supplied connected for 4-20mA output with either a 0-1mA dc or 0-10V dc input. 0.25% RO accuracy furnishes the tight accuracies required in transducer applications.

DESCRIPTION

The Process Signal Amplifier is an all-electronic device designed to provide a standard, non-isolated Process Signal output. This amplifier converts a 0-1mA dc or 0-10V dc input into a field selectable output current of 1-5mA dc into a 0-4K Ω load, 4-20mA dc into a 0-1K Ω load or 10-50mA dc into a 0-400 Ω load. The amplifier is protected against damage from

transients, surges or overloads. The Process Signal Amplifier is housed in a sturdy steel can with injection molded plastic cover. This permits such features as unbreakable terminal block covers, sliding access ports for calibration and test, and in-line test jack for monitoring output current during operation.

SPECIFICATIONS

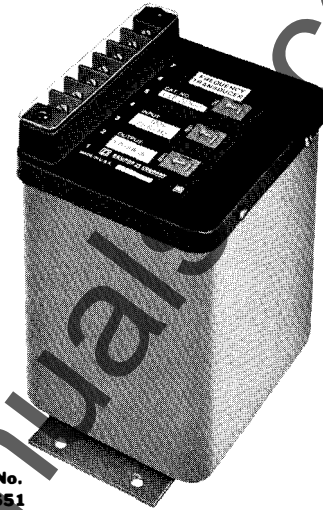
Input Resistance	
Current Input .....(Forward Biased Diode)	\approx 600 Ω
Voltage Input	10K Ω
Input Current Range	0-1.25mA dc
Rated Input Current	1.0mA dc
Input Voltage Range	0-12.5V dc
Rated Input Voltage Range	10V dc
Rated Output Current Range	1-5mA dc
(field selectable)	4-20mA dc
	10-50mA dc
Accuracy	\pm .25%RO
Output Load Resistance	0-4000 Ω 1-5mA range
	0-1000 Ω 4-20mA range
	0-400 Ω 10-50mA range
Output Ripple Peak	< .5%RO
Response Time (99%)	< .1ms
Open Circuit Output Voltage	< 30V dc
Temperature Range	-25°C to +75°C
Temperature Influence	< \pm .005%/°C
Relative Humidity	0-95%

Stability (per year)	< .1%RO
Calibration Adjustment	\pm 10% RO
Zero Adjustment	\pm 10% RO
Power Supply	85-135V 50-60 Hz
Burden @ 120VAC	4.8VA max.
Input Current Overload	5mA dc continuous
Input Voltage Overload	50V dc continuous
Dielectric Test Voltage	1800VRMS 60 Hz 1 min.
Between independent circuits	
Input circuits to case and	
Output Circuits to case	
Transient Test Voltage	ANSI C37.90A - 1974
Across input circuits	
and input circuits to case	IEEE STD. 472 - 1974
Impulse Test	6kV crest 100KHz
Unidirectional Impulse Test	1.2x50 μ s 6kV crest
	70A Short Circuit Test
Output Short or Open Circuit	Protected

DIMENSIONS: Style 3 on page 12
CONNECTIONS: Figure 9 on page 11

APPLICATION

A Frequency Transducer produces a highly accurate dc output that is linearly proportional to the input frequency of the driving source. The dc output signal is immune to load variations that fall within the load restrictions as specified in the tables below. This feature permits remote monitoring with no loss in accuracy. The output can drive analog instruments, transducer relays, recorders or the Square D Process Signal Amplifier.



Catalog No.
CLE-203651

DESCRIPTION

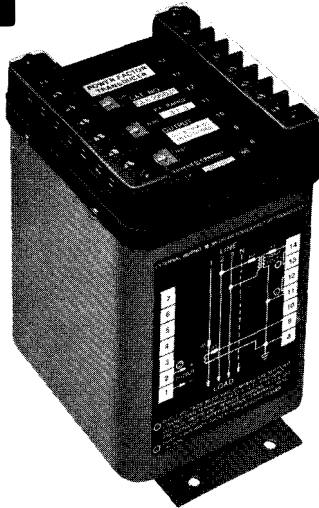
The Square D Company Series CLE-203000 Frequency Transducers are all-electronic devices which provide a highly accurate dc output signal that is linearly proportional to the frequency of the system being monitored. The accuracy of the output signal is maintained within $\pm 0.02\%$ of the nominal center frequency. Units having either a 0-1mA dc or 0-10V dc

output are available to match the input requirements of indicating or recording devices. The frequency transducer is protected against voltage surges or transients. It is housed in a grey finished steel housing having unbreakable terminal blocks and sliding access covers for all internal adjustments, (span and zero).

SPECIFICATIONS

DESCRIPTION	CURRENT OUTPUT MODELS			VOLTAGE OUTPUT MODELS		
	CLE-203451	CLE-203551	CLE-203651	CLE-203452	CLE-203552	CLE-203652
Input Voltage ($\pm 15\%$)	120V AC	same	same	120V AC	same	same
Overload (continuous)	180V AC	same	same	180V AC	same	same
Frequency Range	375-425 Hz	45-55 Hz	55-65 Hz	375-425 Hz	45-55 Hz	55-65 Hz
Burden (max.)	3.0 VA	same	same	3.0 VA	same	same
Temperature Range	-20°C to 70°C	same	same	-20°C to 70°C	same	same
Response (to 99%)	≤ 400 ms	same	same	≤ 400 ms	same	same
Output (RO)	0-1mA dc	0-1mA dc	0-1mA dc	0-10V dc	0-10V dc	0-10V dc
Load Resistance (RL) ohms	0-10K	0-10K	0-10K	2K- ∞	2K- ∞	2K- ∞
Accuracy % of Center Frequency	$\pm 0.02\%$ 25°C	same	same	$\pm 0.02\%$ 25°C	same	same
Ambient Temperature Effects (max)	$\pm 0.0025\%$ /°C	same	same	$\pm 0.0025\%$ /°C	same	same
Ripple (peak)	1.0% max.	same	same	1.0% max.	same	same
Adjustments	Zero ($\pm 10\%$) Span ($\pm 10\%$)	same	same	Zero ($\pm 10\%$) Span ($\pm 10\%$)	same	same

DIMENSIONS: Style 1 on page 12
CONNECTIONS: Figure 3 on page 11



Catalog No.
CLE-206A31

APPLICATION

A Phase Angle Transducer produces a highly accurate dc output that is linearly proportional to the phase angle difference between the voltage and current of the AC power system. This dc output has a direct cosine relationship to power factor. Bipolar output indicates not only power factor but also whether lagging or leading conditions exist. Although the output is proportional to the phase angle difference, actual power factor, being equal to the cosine of the angle, is readily available. Two potential ranges are provided (nominal 120VAC or 240VAC) to permit connections to either 3 ϕ , 3W or 3 ϕ , 4W voltage transformer connections.

DESCRIPTION

The Phase Angle Transducer is an all-electronic computing device that is accurately proportional to the phase angle difference between the voltage and current of the AC power system. The power factor is equal to the cosine of the phase angle. A conversion is required if the output is to represent power factor. The output polarity is positive for lagging phase

angle, (current lagging voltage) and negative for leading phase angle. The output will be "0" for 0° phase angle (unity). This series of transducers includes single and three phase transducers with output of ± 1 mA dc or ± 10 V dc. The three phase transducers provide a true indication of power factor only when balanced load conditions prevail.

SPECIFICATIONS

Potential Range	95-135 VAC or (field selectable) 190-270VAC	Accuracy*	$\pm .60$ deg. max. or $\pm .01$ PF max.
Current Range	0.2-6.5 A AC	Output Ripple (peak)	0.5% max.
Burden Potential Circuit (120/240V)	1.75VA max.	Response Time (to 99%)	400ms max.
Burden Current Circuit (5A)	4VA max.	Zero Adjustment	$\pm 2\%$ of span min.
Frequency	50-60Hz	Calibration Adjustment	$\pm 8\%$ of span min.
Temperature Range	-25 to 75°C		
Temperature Influence	$\pm .30$ deg. max. or $\pm .005$ PF max.		

*Includes worst combined effects of current, voltage, frequency and load resistance

WITHSTAND CAPABILITIES

Potential Overload (continuous)	175V or 350V (depends on potential input connections)
Current Overload	15A continuous 50A 10 S/H 250A 1 S/H
Dielectric Withstand Voltage	1800V RMS 60Hz 1 min. between independant circuits, input and output circuits to case.
Transient Test Voltage (SWC)	ANSI C37.90A - 1974 IEEE STD. 472 - 1974
Impulse Test	6KV crest 100KHz
Unidirectional Impulse	1.2x50 μ s 6kV crest 70A short circuit current
Test voltage Across Output	100V RMS 2 sec.
Output Open or Short Circuit	Protected

TYPE SYSTEM	RANGE PHASE ANGLE (PF)	OUTPUT	
		0 \pm 1mA dc (RL= 0-10K)	0 \pm 10V dc (RL= 2K- ∞)
Single Phase or 3 ϕ ,4W	0 \pm 72.5° (.3-0-.3)	CLE-206A31	CLE-206A32
	0 \pm 60° (.5-0-.5)	CLE-206A51	CLE-206A52
	0 \pm 45.5° (.7-0.7)	CLE-206A71	CLE-206A72
3 ϕ ,3W or 3 ϕ ,4W	0 \pm 72.5 (.3-0-.3)	CLE-206B31	CLE-306B32
	0 \pm 60 (.5-0-.5)	CLE-206B51	CLE-206B52
	0 \pm 45.5 (.7-0.7)	CLE-206B71	CLE-206B72

DIMENSIONS: Style 3 on page 12
CONNECTIONS: Figure 10 or 11 on page 12

AC Voltage Transducer
CLE-201001

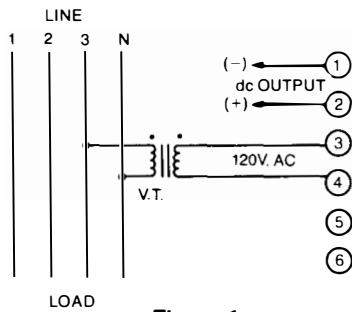


Figure 1

AC Current Transducer
CLE-202001

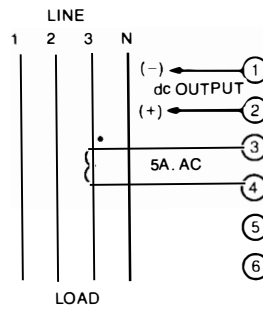


Figure 2

Frequency Transducer
CLE-203451 CLE-203452
CLE-203551 CLE-203552
CLE-203651 CLE-203652

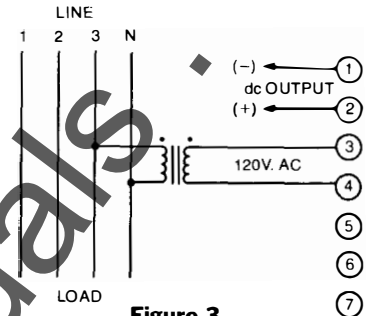


Figure 3

Watt Transducers
CLE-204000, CLE-204005
Var Transducers
CLE-205000, CLE-205005

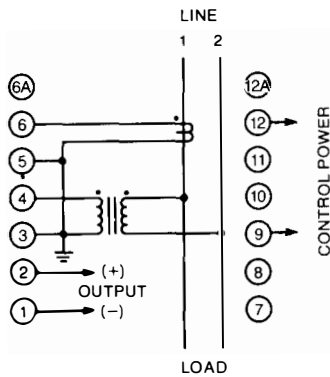


Figure 4

Watt Transducers
CLE-204001, CLE-204006
Var Transducers
CLE-205001, CLE-205006

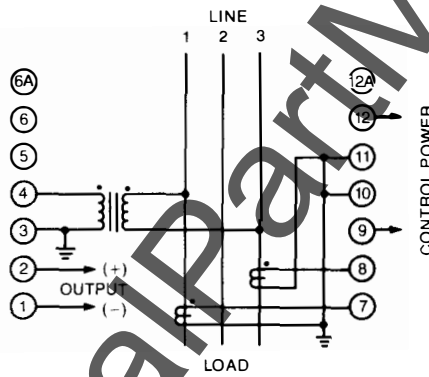


Figure 5

Watt Transducers
CLE-204002, CLE-204007
Var Transducers
CLE-205002, CLE-205007

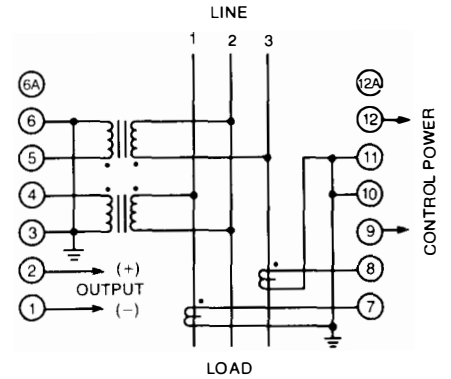


Figure 6

Watt Transducers
CLE-204003, CLE-204008
Var Transducers
CLE-205003, CLE-205008

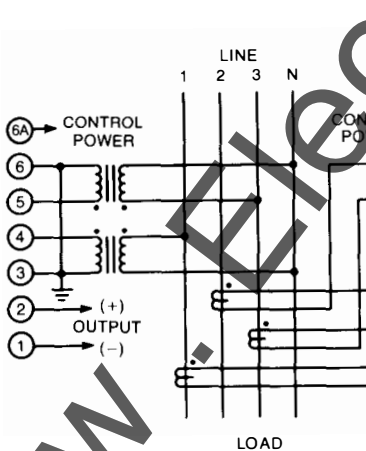


Figure 7

Watt Transducers
CLE-204004, CLE-204009
Var Transducers
CLE-205004, CLE-205009

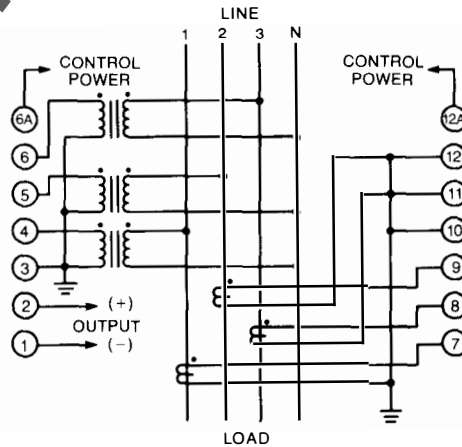


Figure 8

Process Signal Amplifier
CLE-207100

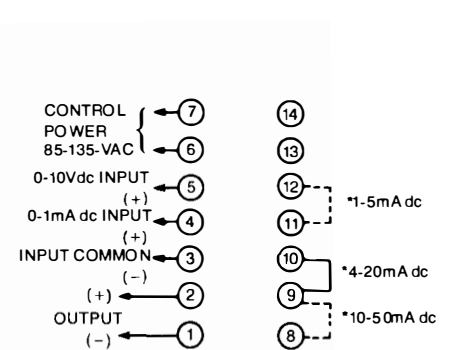


Figure 9

*STRAP POSITION FOR OUTPUT CURRENT DESIRED. SHOWN CONNECTED FOR 4-20mA dc OUTPUT.

**PHASE ANGLE TRANSDUCERS
(SINGLE PHASE OR 3 ϕ , 4W)**
CLE-206A31, CLE-206A32
CLE-206A51, CLE-206A52
CLE-206A71, CLE-206A72

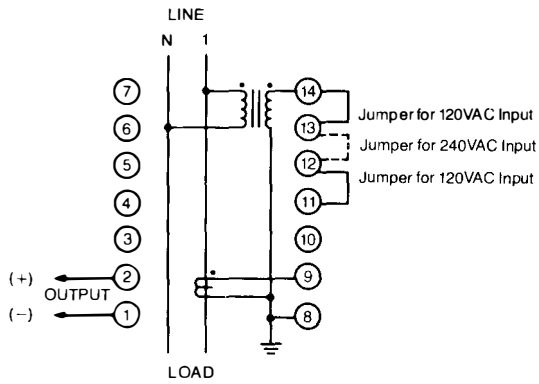


Figure 10

**PHASE ANGLE TRANSDUCERS
(3 ϕ , 3W or 3 ϕ , 4W)**
CLE-206B31, CLE-206B32
CLE-206B51, CLE-206B52
CLE-206B71, CLE-206B72

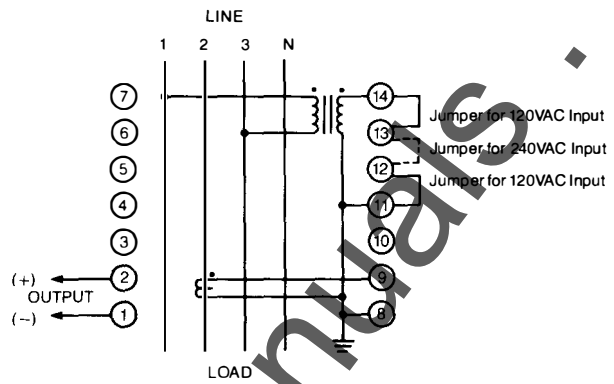
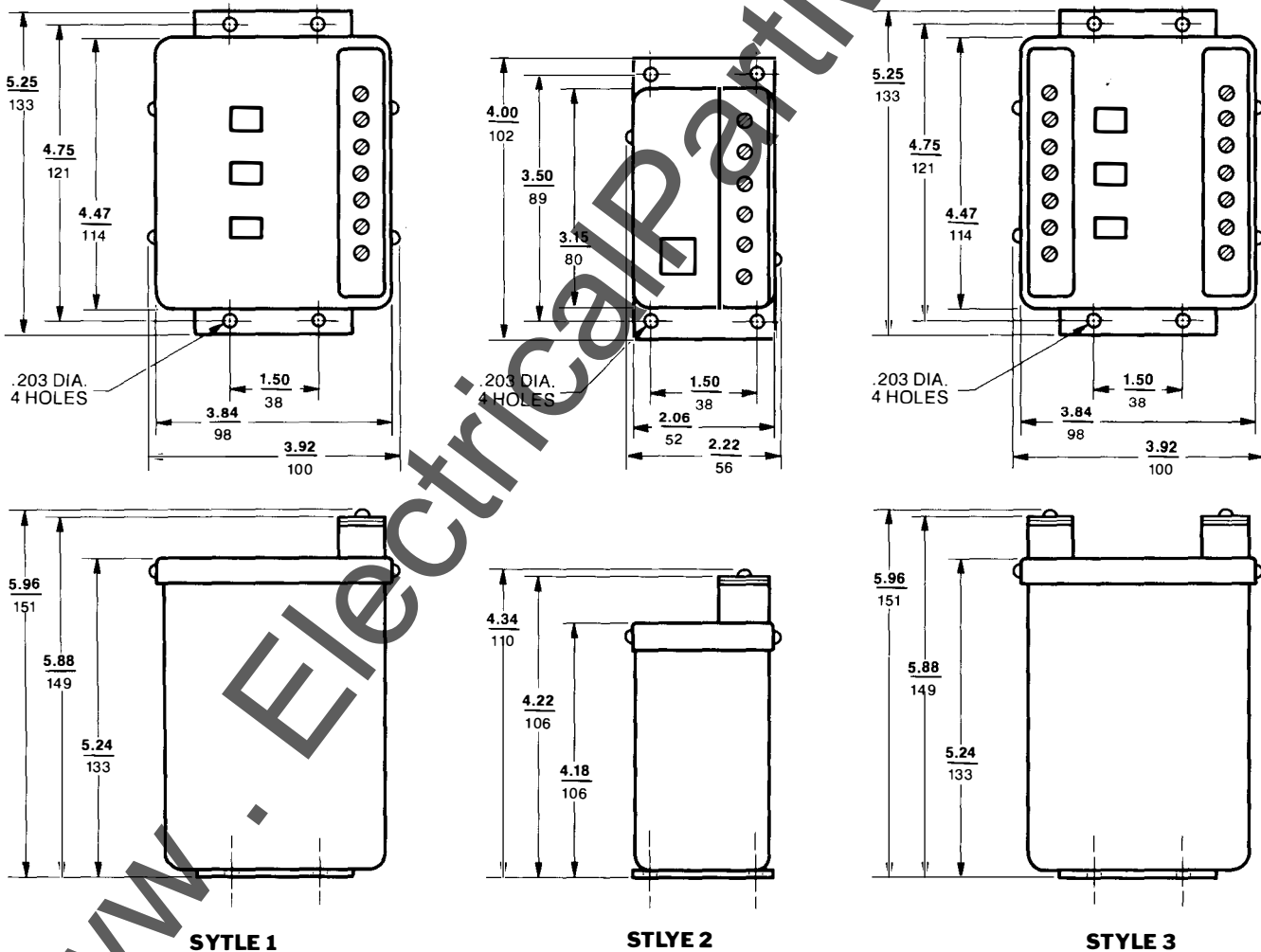


Figure 11

TRANSDUCER DIMENSIONS



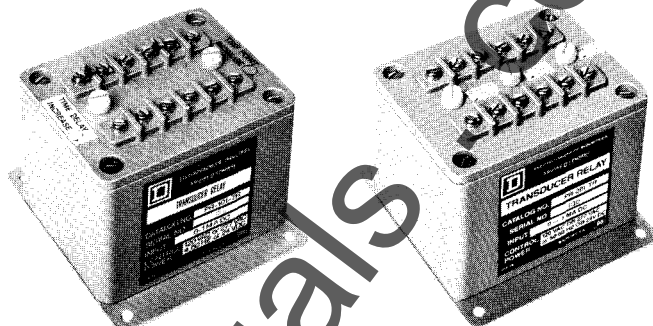
Dual Dimensions: Inches
Millimeters



PR-101-TR, PR-201-TR

APPLICATION

These Transducer Relays operate from the output of a constant 0-1mA dc transducer. The TR relay output contacts can be used to actuate alarms, contactors, shunt trip breakers, or other customer furnished signalling or actuating devices. They can be utilized to detect over and under frequency, over and under current, or over and under voltage, depending on the type of transducer used as the input-device. The relays can also be used for process control or load demand control applications using watt transducers. The TR relays can be used with Square D Company's Series 24000 instrument/transducers, Series 25000 and CLE-200000 transducers or with any transducer having a 0-1mA dc output.



Catalog No.
PR-101-TR

Catalog No.
PR-201-TR

DESCRIPTION

The TR relay utilizes solid state sensing circuitry for improved reliability and repeatability. The output relay contacts are one Form C (SPDT). The relay contacts can be made to latch by installing a jumper between terminals 5 and 6. In order to remove the latched condition, the jumper between terminals 5 and 6 must be temporarily opened. The trip points can be adjusted by removing the appropriate plastic plug, located on the top cover, and adjusting a potentiometer with a small screwdriver.

The TR relays are housed in a non-conductive fiberglass reinforced polyester case, and can be either base-plate or through-the-door mounted. All electrical connections are made on the top cover using number 6 screw connectors.

The PR-101-TR relay has one adjustable trip point that can be set within the 0-1mA dc input range. The output relay contacts will transfer (relay de-energizes) when the predetermined Trip Point level is reached. Connect jumper between terminals 2 and 3 to enable sensing of over voltage, over frequency, over current, etc. Without jumper on 2 and 3, relay will trip for under voltage, under frequency, under current, etc.

The PR-201-TR relay has two adjustable set points. The over and under trip point, and time delay functions are adjustable, allowing this TR relay to be used in many unique applications. The under trip point can be adjusted between zero and 0.94 milliamperes input when the over trip is set at 1.0 milliamperes, and zero to 0.18 milliamperes input when the over trip point is set at 0.20 milliamperes. The minimum trip point differential (deadband) is 0.06mA when the over trip is set at 1.0mA decreasing linearly to 0.02mA when the over trip is set at 0.2mA. When setting the over and under trip points, the over trip must be set first, then the under trip. The under trip must always be readjusted following any adjustment of the over trip.

The output relay will de-energize (contacts 10 and 11 close, 11 and 12 open) when the input signal falls below or exceeds upper preset level, or if control power is lost.

SPECIFICATIONS

Control Power Requirements:120 or 277VAC, 50/60Hz
or 24Vdc \pm 10%

Input:0-1mA dc

Input Impedance:1000 ohms; polarity and
overcurrent protected

Ambient Temperature Range:-20°C to 80°C

Pick Up/Drop Out
Differential:10 μ A max. (PR-201-TR) 5% of
setting, max. (PR-101-TR)

Repeatability at 25°C:Better than \pm 0.5%

Temperature Affect: \pm 1.5% Maximum variation over
specified temperature range

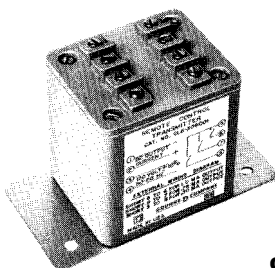
Output Relay Contacts: ..1 Form C (SPDT) rated 5A resistive
at 120Vac 2.5A. resistive at 240Vac
Inductive Rating at 120VAC 35%
PF 5A continuous, 15A make 1.5A
break

Time Delay:0.25 seconds to 10 seconds, adjustable.
Factory set at 4 seconds. Time delay
common to over and under trip circuit
(PR-201-TR)

Trip Points:
Over Function Trip Range*:0.2mA to 1.0mA adjustable
Factory set at 0.8mA
Under Function Trip Range*:0 to 0.94mA, adjustable
Factory set at 0.7mA

*Both modes available simultaneously on PR-201-TR. Either mode available singularly on PR-101-TR.

DIMENSIONS: Style 2 on page 20
CONNECTIONS: Figure 1 on page 21



**Catalog No.
CLE-306001**

APPLICATION

The Remote Control Transmitter, Type RCT catalog number CLE-306001, is utilized in remote control applications. The RCT transmits a constant current dc control signal at three different levels of 0.5, 0.75 and 1.0 mA dc. By selecting the programming sequence and using Square D Company's PR-101-TR, Transducer Relay, one, two or three devices can be controlled from a remote location.

DESCRIPTION

The solid state RCT provides a constant current dc control signal that will remain constant even though the load may vary from 0 to 10,000 ohms. If the load exceeds 10,000 ohms, the output from the RCT will be unreliable and should not be used. If three transducer relays (each transducer relay has a 1000 ohm input impedance) are installed at the remote sites, that leaves 7000 ohms of additional load. If number 18 wire is used from the RCT to the transducer relays, they can be installed and accurately operated at a distance of 100 miles, or if number 22 wire is used, the transducer relays can be operated at a distance of 40 miles and still not exceed the 10,000 ohm maximum load.

The control signal from the RCT varies from no output to 0.5, 0.75 and 1.0 mA DC by selecting the appropriate terminals.

The programming terminals are 5, 6, 7 and 8 and normally a 4-position switch is used to select the desired terminals. When

the switch is in the "off" position, the control signal is 0.0 mA dc; when terminal 5 (the common terminal) shorts to 8, the control signal will be 0.5 mA dc; when 5 shorts to 7 (5 to 8 opens) the control signal will be 0.75 mA DC; and when 5 shorts to 6 (5 to 7 opens) the control signal will be 1.0 mA dc.

Three transducer relays with their trip point set at either 0.5, 0.75 or 1.0 mA DC are required for the operation of three separate remote devices.

When the control signal from the RCT is 0.5 mA dc, only the transducer relay set to trip at 0.5 mA will operate, but if the control signal is 1.0 mA dc all three transducer relays will operate.

The RCT is packaged in a non-conductive fiberglass reinforced polyester case that can either be base plate or back mounted. All electrical connections are made on the top cover using number 6 screw connectors.

SPECIFICATIONS

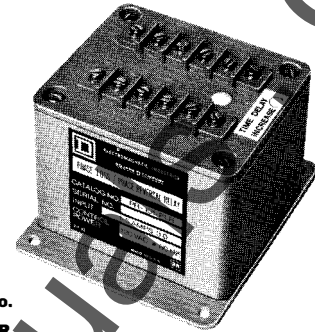
Control Power	120V±10% 50/60 Hz
Output Current:	
Programming	R.O. (Rated Output)
Terminal 5, 6, 7, 8 open	0.0 mA dc
Terminal 5 shorted to 6	1.0 mA dc
Terminal 5 shorted to 7	0.75 mA dc
Terminal 5 shorted to 8	0.50 mA dc
Output Loading	0-10,000 ohms
Output Load Influence	< 0.1% of R.O.

Operating Temperature Range	-20°C to +70°C
Temperature Influence	< 1% of R.O.
Output Voltage (open circuit)	15V DC
Response Time	< 20 milliseconds
Output Ripple	< 1% P-P

DIMENSIONS: Style 1 on page 20
CONNECTIONS: Figure 2 on page 21

APPLICATION

The PR-101-PLR Phase Loss/Phase Reversal relay will provide protection to three-phase motors and motor-driven equipment in the event of improper phase-sequence or a loss of one or more phases. The relay is used in conjunction with a shunt trip breaker, contactor, motor starter, or other customer furnished motor disconnecting means. This relay must be used with a 3 wire control circuit. If it is used with a 2 wire control circuit, a separate interlock mechanism must be added to prevent the relay from "cycling" off and on when an open phase or a phase reversal occurs. The PLR relay is used when the need for reliable protection of motors and motor driven equipment is essential.



Catalog No.
PR-101-PLR

DESCRIPTION

The PLR relay utilizes all solid state sensing and is fabricated in a non-conductive fiberglass reinforced polyester case that can be baseplate or through-the-door mounted. All connections for power and output relay contacts are made on the top cover of the relay using number 6 screw connectors.

The PLR relay incorporates an electro-mechanical output relay with one set of form C contacts (SPDT) rated 5 amperes resistive at 120 VAC. The normally open contact between terminals 10 and 9 and the normally closed contact between terminals 10 and 11 will remain in that state as long as control power and all phases are present and the phase sequence is correct. When an abnormal phase sequence or a loss of either control power or one of the phases occurs, the PLR relay contacts will automatically transfer. After the load is disconnected, the PLR relay will return to the normal standby state i.e. the contacts between terminals 10 and 11 reclose.

If single phase power is applied to a three phase motor, it will not operate. It will be subjected to excessive mechanical and thermal stresses, due to the high currents produced and the lack of ventilation in a standstill motor. If a phase failure occurs, the PLR relay senses this condition, when the motor is drawing current, and will actuate a disconnecting device. If this condition should occur to an unprotected motor while the motor was running it would continue to operate by drawing

excessive current from the remaining two lines. A phase failure relay sensing only voltage might not detect a phase loss condition because the open phase winding in the motor will generate a voltage almost equal to the phase voltage that was lost. Since the PLR relay senses current, the open phase condition will be detected and the relay will trip disconnecting the motor from the line.

A reversal of any two of the three phases can occur when maintenance is performed on cabling or switching equipment. This condition could damage motor driven machinery if not detected quickly. The PLR relay incorporates a separate circuit that compares the phase angle relationships (phase to phase) to ensure proper phase sequence. The PLR relay will detect a phase reversal and disconnect the motor from the line.

Due to the current sensing features of the PLR relay, the load must pull current before the reverse phase condition can be sensed. **Do not utilize this relay for protecting motors driving equipment unable to tolerate a momentary bump in the reverse direction.**

TIME DELAY

The time delay adjustment can be reached by removing the nylon plug, located in the top of the case, and adjusting a potentiometer with a small screwdriver.

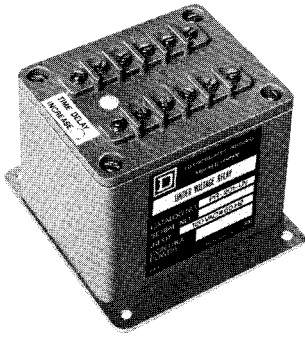
SPECIFICATIONS

- Maximum continuous current through relay current sensing elements5 amperes
- Minimum1 ampere
- Control Power (Nominal).....120 VAC at 5 VA
- Line Frequency60 Hz
- Burden to External CT's01 ohm (.25 VA) each phase
- Output relay contacts.....1 form C (SPDT) rated 5 amperes resistive at 120 VAC
- Time Delay0.1 to 8 seconds, adjustable, factory set at 2 seconds

DIMENSIONS: Style 2 on page 20
CONNECTIONS: Figure 1 on page 20

CURRENT TRANSFORMERS

Current transformers are not furnished with the PLR relay. The PLR relay's low burden of .01 ohm (each phase), makes it probable that the installation can utilize existing current transformers (if present). A calculation of the burdens on the existing CT's must be performed to determine if they can sustain the additional .01 ohm burden of the relay. If additional CT's are required, Square D Company manufactures a large variety of CT's to accommodate virtually any requirement.



**Catalog No.
PR-201-UV**

APPLICATION

The Under Voltage relays are reliable single phase protective relays that furnish undervoltage protection by providing contacts for actuating shunt trip breakers, contactors, alarms or signalling devices when the input voltage falls below a predetermined level.

DESCRIPTION

The UV relay utilizes solid state sensing circuitry for improved reliability and repeatability. When the input voltage falls below a predetermined level (trip point) the UV relay contacts transfer, (relay de-energizes).

The trip point is adjustable as specified and the time delay is adjustable from 100 milliseconds to 6 seconds.

Pick up and drop out differential is less than 2 volts and remains constant over the entire adjustment range.

The trip point and time delay can be set by removing the appropriate plastic plug and adjusting a potentiometer with a small screwdriver.

The UV relay is housed in a non-conductive fiberglass reinforced polyester case and can be base plate or through-the-door mounted. All connections for power and output relay contacts are made on the top cover, using number 6 screw connectors.

SPECIFICATIONS

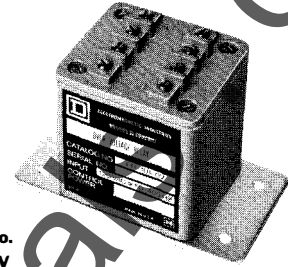
Ambient Temperature Range -20°C to +80°C
 Repeatability at 25°C Better than ±.5%
 Pick up/drop out differential less than 2V
 Output relay contacts. . . . 2 form C (DPDT), rated 5 amperes resistive at 120VAC, 2.5 amperes resistive at 240VAC, 1/10 hp

DESCRIPTION	CATALOG NUMBER	
	PR-201-UV	PR-101-UV
Nominal Line Voltage	120VAC	240VAC
Line Frequency	50 to 400Hz	50 to 400Hz
Trip Point-Adjustable	90 to 110VAC	175 to 215VAC
Factory Set At (60Hz)	98VAC	200VAC
Time Delay-Adjustable	0.1 sec. to 6 sec.	0.1 sec. to 6 sec.
Factory Set At	4 sec.	4 sec.

DIMENSIONS: Style 2 on page 20
CONNECTIONS: Figure 2 on page 20

APPLICATION

The PR-101-OV Over Voltage relay is a reliable single phase protective relay that will provide overvoltage protection by providing contacts for actuating shunt trip breakers, contactors, alarms or signalling devices when the input voltage exceeds a predetermined level.



Catalog No.
PR-101-OV

DESCRIPTION

The OV relay utilizes solid state sensing circuitry for improved reliability and repeatability. When the input exceeds a predetermined level (trip point) the OV relay contacts transfer, (relay energizes). The output contacts will remain transferred until the input voltage is interrupted, at which time they will return to their normal state. The OV relay trip point is adjustable between 130 and 150 VAC and the time delay is fixed at 1 second maximum.

The trip point can be set by removing the plastic plug, located on the top cover, and adjusting a potentiometer with a small screwdriver. The OV relay is housed in a non-conductive fiberglass reinforced polyester case and can be either base plate or through-the-door mounted. All connections for power and output relay contacts are made on the top of the case using number 6 screw connectors.

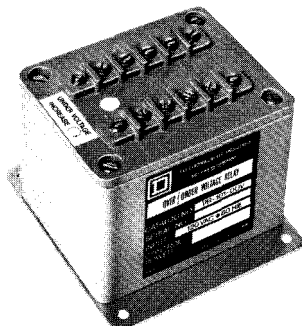
SPECIFICATIONS

Nominal Line Voltage120VAC
 Maximum Input Voltage 150VAC continuous
 Line Frequency50-400Hz
 Ambient Temperature Range.....-20° to +80°C
 Trip Point130 to 150VAC,
 adjustable, factory
 set at 140VAC

Repeatability at 25°CBetter than +.5%
 Output Relay
 Contacts2 Form C (DPDT), rated 5 amperes
 resistive at 120VAC, 2.5 amperes at
 240VAC, 1/10 hp
 Time Delay1 second maximum, fixed

DIMENSIONS: Style 1 on page 20
CONNECTIONS: Figure 3 on page 20

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Catalog No.
PR-101-OUV

APPLICATION

The PR-101-OUV, Over/Under Voltage relay, is a reliable single phase protective relay that will provide protection from an overvoltage and/or undervoltage condition. When the input voltage exceeds or falls below preset levels (trip points), a set of relay contacts transfer providing a means of actuating shunt trip breakers, contactors, alarms or signalling devices.

DESCRIPTION

The OUV relay utilizes solid state sensing circuitry for improved reliability and repeatability. The output relay contacts are one (1) form C (SPDT), and will transfer (relay de-energizes) when the input voltage exceeds or falls below preset levels.

The OUV trip points for both overvoltage and undervoltage are adjustable and easily accessible. The adjustments can be reached by removing the appropriate plastic plug, located on

the top of the case, and adjusting a potentiometer with a small screwdriver.

The OUV relay is housed in a non-conductive fiberglass reinforced polyester case and can be either base plate or through-the-door mounted. All connections for power and output relay contacts are made on the top of the case, using number 6 screw connectors.

SPECIFICATIONS

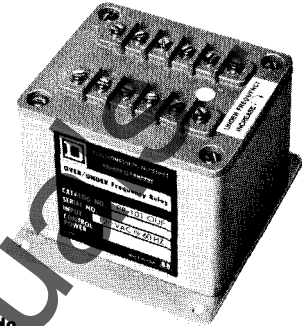
Nominal Line Voltage120VAC
 Maximum Input Voltage150VAC continuous
 Line Frequency60Hz
 Ambient Temperature Range-20°C to +80°C
 Under Voltage Trip Point99 to 125VAC, adjustable,
 factory set at 120VAC
 Over Voltage Trip Point110 to 140VAC, adjustable,
 factory set at 132VAC

Repeatability at 25°CBetter than ±.5%
 Pick Up/Drop out differentialless than 2V
 Output Relay
 Contacts1 Form C (SPDT), rated 5 amperes
 resistive at 120VAC, 2.5 amperes
 resistive at 240VAC - 1/10 hp
 Time Delay2 ±.5 seconds, fixed

DIMENSIONS: Style 2 on page 20
CONNECTIONS: Figure 2 on page 20

APPLICATION

The PR Series of Over/Under Frequency Relays, are reliable single phase protective relays that will provide overfrequency and underfrequency protection. Output contacts may be used for actuating shunt trip breakers, contactors, alarms or signaling devices when the input power frequency exceeds or falls below predetermined levels.



Catalog No.
PR-101-OUF

DESCRIPTION

The over frequency and underfrequency trip points are adjustable (see specifications below) by means of a screw adjustment that can be reached by removing the appropriate plastic plug and adjusting a potentiometer with a small screwdriver.

The OUF relay is housed in a non-conductive fiberglass reinforced polyester case and can be base plate or back mounted. All electrical connections are made on the top cover using number 6 screw connectors.

The OUF relay utilizes solid state sensing for improved reliability and repeatability. When the input power frequency exceeds or falls below predetermined levels (trip point) the OUF relay contacts transfer (relay de-energizes). The output relay contacts are two sets of Form C (DPDT). Three frequency relays are available: for 60Hz power system use the PR-101-OUF, for 50Hz power systems use the PR-201-OUF, and for 400Hz power system use the PR-301-OUF.

SPECIFICATIONS

DESCRIPTION	CATALOG NUMBER		
	PR-101-OUF	PR-201-OUF	PR-301-OUF
Nominal Line Voltage	120V ± 10%	120V ± 10%	120V ± 10%
Nominal Line Frequency	60 Hz	50 Hz	400 Hz
Ambient Temperature Range	-20°C to +80°C	-20°C to +80°C	-20°C to +80°C
Over Frequency Trip Point (Adjustable)	62Hz to 67Hz Factory Set at 62Hz	52Hz to 55Hz Factory Set at 52Hz	420Hz to 450Hz Factory Set at 430Hz
Under Frequency Trip Point (Adjustable)	53Hz to 58Hz Factory Set at 58Hz	45Hz to 48Hz Factory Set at 48Hz	350Hz to 380Hz Factory Set at 370Hz
Repeatability at 25°C Pickup/Dropout Differential Temperature Effect	Better than ±0.5% 0.7Hz Max. ± 1% Max. Variation Over Specified Temperature Range	Better than ± 0.5% 0.7Hz Max. ± 1% Max. Variation Over Specified Temperature Range	Better than ± 0.5% 0.7Hz Max. ± 1% Max. Variation Over Specified Temperature Range
Output Relay Contacts	2 Form C (DPDT) rated 5 amperes resistive at 120VAC	2 Form C (DPDT) rated 5 amperes resistive at 120VAC	2 Form C (DPDT) rated 5 amperes resistive at 120VAC
Time Delay (Fixed)	1 Second	1 Second	1 Second

DIMENSIONS: Style 2 on page 20
CONNECTIONS: Figure 2 on page 20

PHASE LOSS/REVERSE RELAY
PR-101-PLR

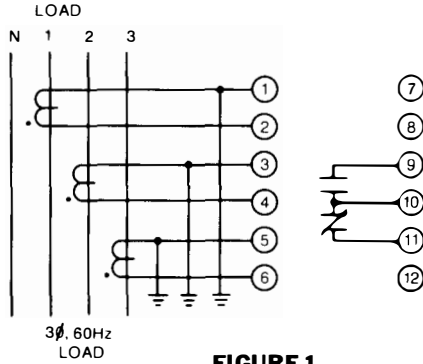


FIGURE 1

UNDER AND OVER/UNDER VOLTAGE RELAY
PR-101-UV
PR-201-UV
PR-101-OUV

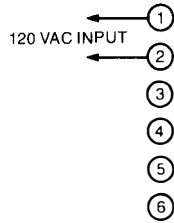
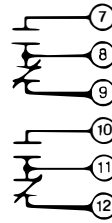


FIGURE 2

OVER/UNDER FREQUENCY RELAY
PR-101-OUF
PR-201-OUF
PR-301-OUF



OVER VOLTAGE RELAY
PR-101-OV

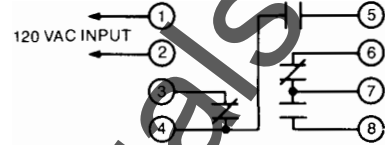
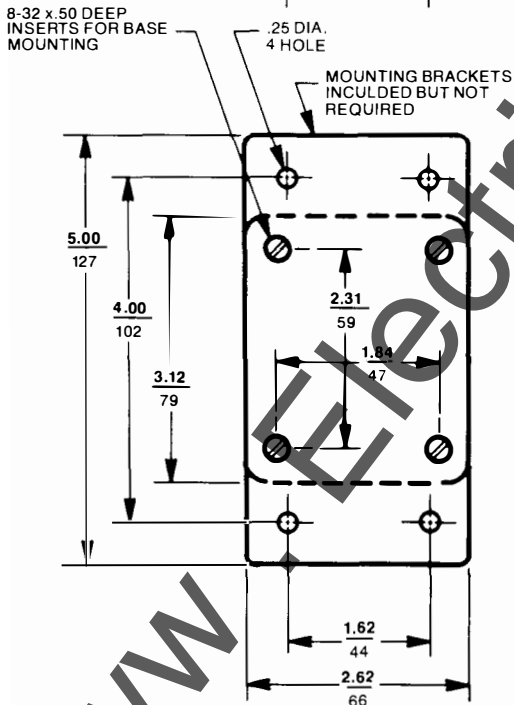
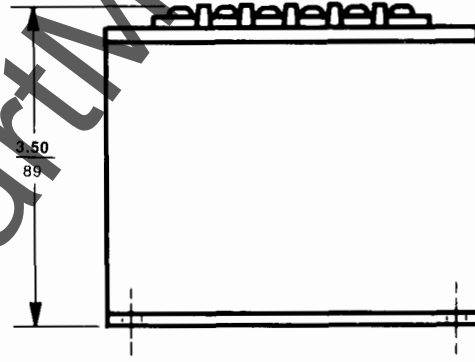
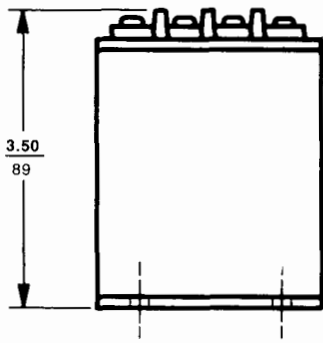
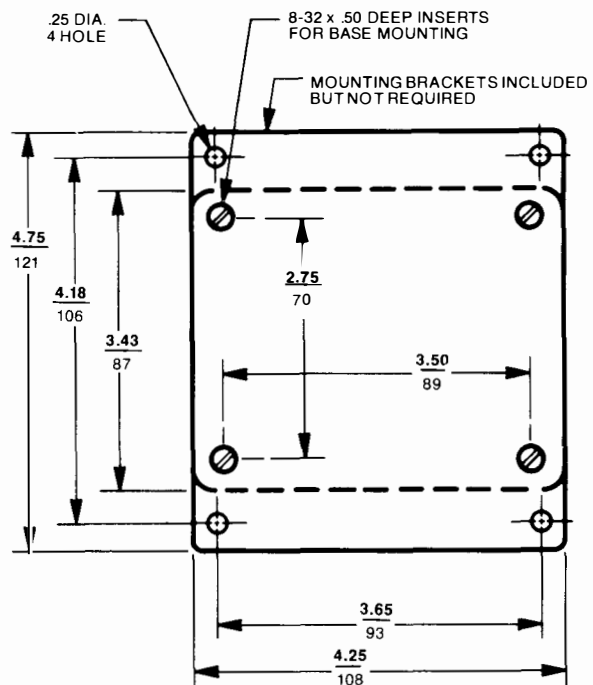


FIGURE 3

RELAY DIMENSIONS



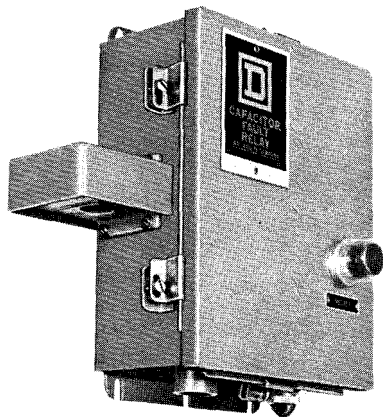
STYLE 1



STYLE 2

Dual Dimensions: Inches
Millimeters





Catalog No. CLE-108001-005

APPLICATION

A major concern for the user of capacitors containing PCB (polychlorinated biphenyls) is the regulation imposed by the EPA (Environmental Protection Agency) under the "Toxic Substance Control Act, section 6(e)," which requires expensive procedures for containing and disposing of not only the ruptured capacitor, but also the contaminated environment around the installation.

The Capacitor Fault Relay, Type CFR, when used with switched, shunt connected, grounded neutral capacitor banks, provides a means of disconnecting capacitor banks when a capacitor begins to fail, before rupture occurs.

The CFR detects low level fault currents, caused by capacitor degradation, and is not intended for detection of catastrophic faults. Normally the catastrophic fault will be cleared by the fuse protection system.

The CFR may be used in pole-top or station-type capacitor bank systems.

DESCRIPTION

The solid state circuitry of the CFR provides reliable and consistent operation, virtually immune to noise and voltage surges that commonly occur on power lines. The CFR surpasses the ANSI C37.90a-1974, IEEE Standard 472-1974 Surge Withstand Capability Test and the Unidirectional Impulse Test.

Current flow in the common lead of the grounded neutral connection of the capacitor bank is sensed by the CFR and when this current exceeds the trippoint and time delay, the CFR will trip. The sensor core material is made of a low hysteresis alloy that is not affected by unidirectional high current pulses, and does not retain residual flux.

Manual resetting is not required if control power is interrupted and then restored.

The CFR provides four current sensing ranges as follows:

Range	Range Setting
0.01 to 1.0 Amperes	1 Ampere
0.1 to 10 Amperes	10 Amperes
0.2 to 20 Amperes	20 Amperes
1 to 100 Amperes	100 Amperes

The appropriate range is selected by inserting a supplied jumper plug in the socket labeled with the highest current range expected.

The current sensing trip point on all ranges is adjustable from minimum to maximum settings as listed in the above table. The current sensitivity control is marked in 10% increments. Time delay setting is adjustable from 0.5 to 10 seconds with the adjustment control marked in 10% increments. Sixty (60) Hz harmonics are rejected by the use of a low pass filter in the measurement circuit.

When connected as shown, with 120VAC control power applied and no fault current in the grounded neutral connection, the normally closed (N.C.) contacts are terminals 4/5, the normally open (N.O.) contacts are terminals 3/4. If the fault current exceeds the trip point, the CFR will trip and the N.C. contacts are terminals 3/4; the N.O. contacts are terminals 4/5. Magnetic latching circuitry is provided to prevent automatic resetting after the CFR has tripped due to fault current. This condition requires manual resetting by actuating the reset button, located on the front cover. Note that the CFR, Cat. No. CLE-108001-005 will operate only if the neutral fault current exceeds the preset trip point.

A green light, contained within the front panel mounted reset switch, is illuminated when control power is applied and the relay is sensing a "no fault" condition. When the CFR trips, the green light extinguishes and a red light mounted on the bottom of the case illuminates, indicating that a fault has occurred.

If more than one set of form C contacts is required, an accessory relay, Catalog No. PN 26004-01228 is available as an option that will provide two additional sets of form C contacts. No additional wiring is required to use the optional relay. A socket and all associated connections are provided in the CFR for this additional relay.

A watertight/dust-tight NEMA 4 enclosure with stainless steel hinges, clamps and clamp screws allow installation of the CFR in severe environments.

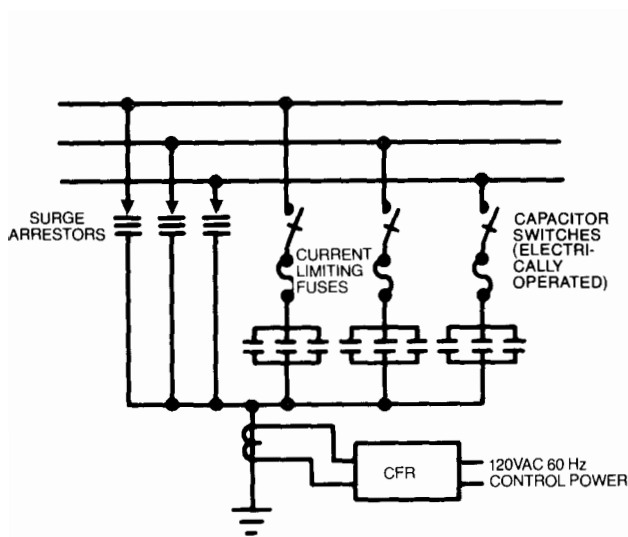
All electrical connections are made internally to an eleven terminal barrier block with number 8 screw connectors.

SPECIFICATIONS

Control Power Requirements	120 VAC, ±10%, 60Hz, 12VA (customer furnished).
Operating Temperature Range	-30°C to +70°C
Humidity (150°F at 99% RH)	0.1% affect on trip point and time delay
Trip Point	factory set at 5.0 Amperes on 10 Ampere range
Time Delay	0.5 to 10 seconds adjustable — factory set at 5 seconds
Output Relay Contacts	1 Form C (DPDT) rated 10 amperes resistive, ¼ H.P. at 120 VAC; and 1/3 H.P. at 240 VAC, 80% power factor
Optional accessory relay	SQ-D PN 26004-01228 provides two additional independent sets of form C contacts

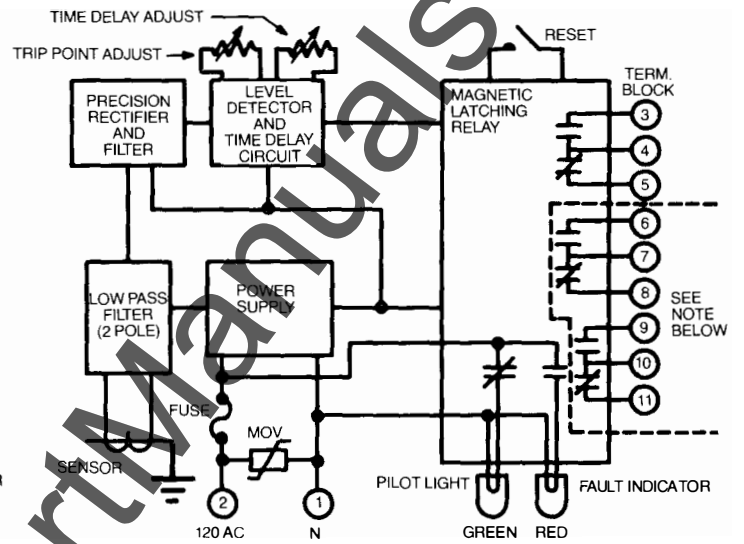
Harmonic Rejection	60Hz	-0db	240Hz	-25db
	120Hz	-13db	300Hz	-29db
	180Hz	-20db	420Hz	-34db
Maximum Potential on Ground Bus	2,000 V, 60Hz			
Overcurrent Rating (On Ground Bus)	.80A for 10 Sec. 3,000A for 0.01 Sec. 18,000A for ¼ cycle			
Radio Frequency Influence Test	No effect when 5VAC, at frequencies between 10 MHz and 500 MHz injected directly in the power input			
Transient Test	ANSI C37.90a-1974 (SWC), IEEE Standard 472-1974 — 2.5 kV Crest			
Impulse Test	.6 kV Crest at 100 KHz			
Unidirectional Impulse Test	1.2 x 50 microseconds, 6 kV Crest 70 ampere short circuit current			

**CAPACITOR FAULT RELAY
INSTALLATION DIAGRAM**



WYE CONNECTED CAPACITOR BANKS
SHOWING 3 CAPACITORS IN PARALLEL
(TYPICAL ARRANGEMENT)

**CAPACITOR FAULT RELAY
BLOCK DIAGRAM**

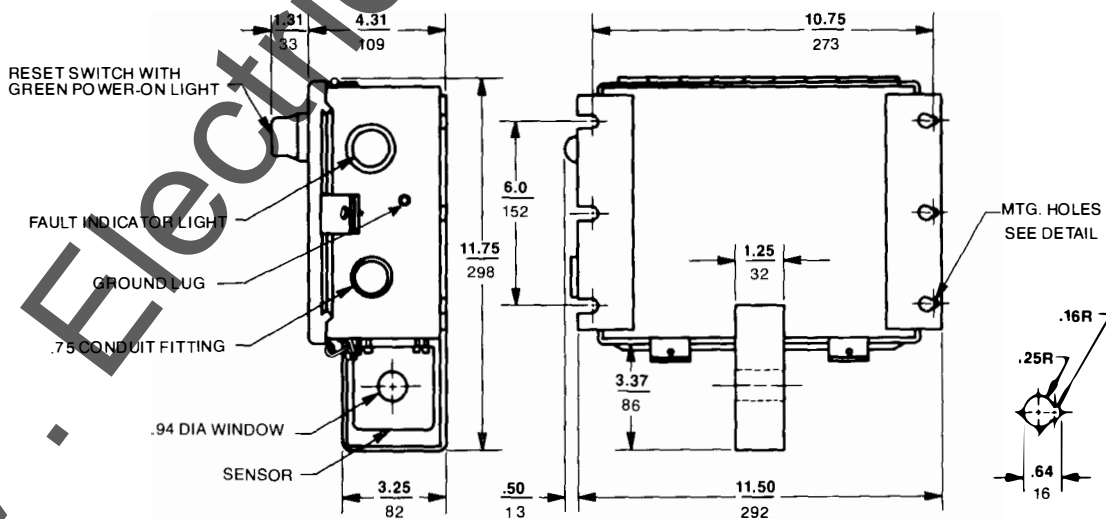


RELAY CONTACTS
SHOWN IN "ARMED" STATE.

CONTACT RATING: 10 AMPERES
1/4 hp. @ 120 VAC
1/3 hp. @ 240 VAC
80% PF

NOTE: These relays contacts are available only
when accessory relay part number
26004-01228 (not supplied) is installed.

CAPACITOR FAULT RELAY DIMENSIONS



Dual Dimensions: Inches
Millimeters

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SQUARE D COMPANY