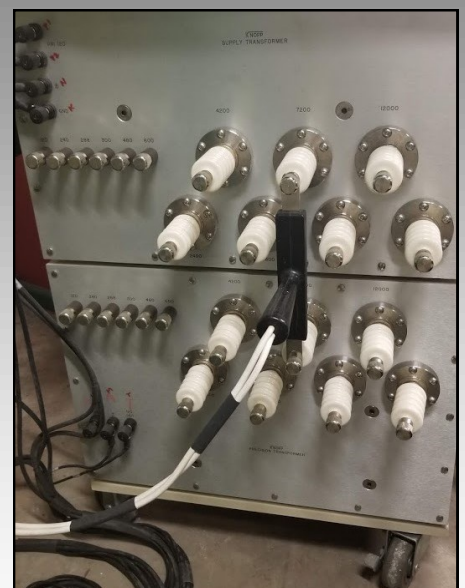




A TESCO COMPANY

# PRODUCT CATALOG



**Knopp, Inc., a TESCO Company**  
1307 66th Street, Emeryville, CA 94608  
510-653-1661 | [www.knoppinc.com](http://www.knoppinc.com)



**ABOUT US.** Knopp Inc., a TESCO company, is a design and manufacturing company located in Emeryville, California alongside the beautiful San Francisco Bay.

We build high quality precision voltage and current transformers, electric meter and transformer test equipment, and electrical instruments for the utility and electrical industries. Our voltage and current transformer test equipment is used by electric utilities throughout the world to verify the accuracy of transformers used to measure electric energy.



**HISTORY.** Knopp, Inc., was founded in 1928 in then Oakland, CA, by Otto Knopp under the name Electrical Facilities. Mr. Knopp (pronounced KAH-NOPP) was the Chief of the Bureau of Tests and Inspection at Pacific Gas & Electric. He had observed a need for some specific types of products and test equipment which were presently going unfilled, and decided to begin the manufacture of some of this equipment himself.

The company was just beginning to get underway from its small, conservative start when the crash of 1929 occurred, followed by the Great Depression. This caused years of struggling to keep the business going with year after year of operating losses, yet Mr. Knopp continued patenting his inventions and designing new products for the fledgling company.

In 1932, Mr. Knopp's son Harold joined the firm. In 1936 the company made its first operating profit—a whopping \$750! In 1943 Mr. Knopp's daughter Helen joined the firm. Harold and Helen Knopp continued to operate the company after Mr. Knopp's death in 1946. In 1957 the company moved to its present location in Emeryville, CA, and continued manufacturing quality, precision items to a global market.

In 1976, Harold and Helen decided to retire and they sold the majority of their shares of Knopp Inc. to Quantum-Precision Inc., a company that had been established by two former Sangamo Electric Company employees—Alexander Finlay and Ralph W. Karle. Mr. Karle passed away in 1996, and Mr. Finlay passed away in 2017 leaving the future of the company uncertain.



In 2018 TESCO - The Eastern Specialty Company acquired Knopp and continues Mr. Knopp's legacy of building quality, precision products for use all over the world today.

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# PRODUCT CATALOG

## **CURRENT TRANSFORMER TESTING SYSTEMS AND STANDARDS**

- ◆ ANSI Standard Burden Sets
- ◆ Automatic Current Transformer Comparator: KATC-C2
- ◆ Automatic Voltage Transformer Comparator: KATC-V2
- ◆ Burden Set—Current: BSC-102
- ◆ Current Transformer Testing System: KC-1500
- ◆ Current Transformer Testing System: KCTS-8000
- ◆ Precision Multirange Current Transformers: P-5000 & P-12000

## **VOLTAGE TRANSFORMER TESTING SYSTEMS AND STANDARDS**

- ◆ Loading Transformer: CL-6
- ◆ Precision Multirange Voltage Transformers: WP-14000
- ◆ Precision Multirange Voltage Transformers: WP-36000
- ◆ Uniload Voltage Transformer Test Set: 2J6
- ◆ Uniload Voltage Transformer Test Set: 2J4-4
- ◆ Voltage Transformer Testing System: KVTS

## **HAND INSTRUMENTS**

- ◆ Low Impedance Voltage Tester: K-60
- ◆ Phase Sequence Indicator: K-3, K-6, K-7
- ◆ Polyphase Socket Tester: K-281
- ◆ Single Phase Socket Tester: K-280
- ◆ Temporary Power Outlet: K-271, K-272, K-273
- ◆ Third Rail Voltage Tester: 4E2-1

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# ANSI STANDARD BURDEN SETS

## VOLTAGE AND CURRENT

Testing and calibrating instrument transformers often requires standard burdens of reliable accuracy and stability, and burdens that are immune to stray fields and harmonics. The burden sets described below have been carefully designed to meet these requirements. They provide the standard burdens required for the testing of current and voltage transformers for metering service, and for the testing (within the current rating provided by the sets) of current transformers for relaying applications, all as called for by ANSI/IEEE C57.13-2016.

One burden set, the Type BSC-5, provides in one unit three of the ANSI standard burdens for current transformers for metering service, i.e., B-0.1, B-0.2, and B-0.5. The BSC-24 set includes B-0.9 and B-1.8, while the BSC-25 includes all metering burdens (B-0.1 through B-1.8). The heavier burdens are provided by two sets. The Type BSC-8 covers the ANSI burdens B-1, B-2, and B-4 for current transformers for relaying applications; the Type BSC-9A includes the ANSI B-4 and B-8 burdens.

***All the current burden sets are designed to be used with external leads consisting of a 5-foot pair of #8 copper conductors. This becomes very significant at the lower burden values, since the external leads constitute a significant part of the total burden.***

The standard burdens for voltage transformers (120 volt secondaries) are covered by three sets. Three of the burdens, i.e., W, X, and Y, are combined in one unit, the Type BSP-6 burden set. The burdens in this set are independent of each other, each with its own pair of binding posts. The standard burden Z is supplied in a separate unit, the Type BSP-7. Two of these BSP-7 burden sets can be used in parallel to obtain ANSI burden ZZ. The ANSI M burden is contained in the BSP-20 unit.

The burden sets are of the portable type, supplied in beige finished metal housings with engraved bakelite terminal boards. Extensive design and development work in perfecting these burden sets, and the quality material and skillful workmanship employed assure excellent performance and quality throughout.

Accuracy: Resistance and inductance within 1.0%

Stability: Variation with current of the 60 Hz. impedance and power factor of the current transformer burdens does not exceed 2.0% in the range from 0.5 to 10 amperes, and the variation does not exceed 1.0% from 1 to 10 amperes, and 0.5% from 2.5 to 10 amperes. Variation of either inductance or resistance of the voltage transformer burdens operated at 60 Hz. does not exceed 0.2% from 100 to 140 volts. These data include the effects of self-heating in an ambient temperature ranging from 60°F to 80°F.

Shielding: The maximum leakage field four inches from the cases of the burden sets operated at rated current or voltage is less than 0.5 oersted. Stray 60 Hz. magnetic fields of 100 oersteds changes the rated current of the voltage transformer burdens less than 0.25% and the rated voltage drop of the current transformer burdens less than 0.1%.

Harmonics: The percent harmonics in the voltage drop of the current transformer burdens is less than 1.0% throughout the range up to 10 amperes. The percent harmonic current taken by the voltage transformer burdens is approximately 0.2% at 80 volts, 0.3% at 120 volts, and 0.6% at 160 volts.



### specifications

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# ANSI STANDARD BURDEN SETS (CONT.)

On special order, sets for frequencies other than 60 Hz. can be supplied.

Leads: Leads are not supplied with the burden sets.

All the current transformer burden sets are adjusted for a 5-foot pair of #8 closely spaced copper conductors. For the best accuracy it is important to use equivalent leads. This is especially true for the B-0.1 burden as the leads constitute approximately 20% of this value. If special lead size and length must be used, the burden sets can be furnished, at extra cost, and adjusted to suit the leads specified.

With the Type BSP-6 Knopp Standard Burden Set, a pair of closely spaced #14 copper leads as much as 20 feet in length may be used with negligible effect on the burden provided by the set. A pair of closely spaced #12 copper leads not exceeding 5 feet in length may be used with the Type BSP-7 Knopp Standard Burden Set with negligible effect on the burden provided by the set.

## CURRENT TRANSFORMER BURDENS

Type	ANSI Desig.	Imp. (Ohms)	Volt-Amperes*	Power Factor*	Width (in.)	Length (in.)	Height (in.)	Weight (lbs.)
BSC-5	B-0.1	0.1	2.5	0.9	7.125	9.75	6.313	13
	B-0.2	0.2	5.0	0.9				
	B-0.5	0.5	12.5	0.9				
BSC-8	B-1	1.0	25	0.5	8.25	11.625	7.75	22
	B-2	2.0	50	0.5				
	B-4	4.0	100	0.5				
BSC-9A	B-4	4.0	100	0.5	8.25	12	7.75	25
	B-8	8.0	200	0.5				
BSC-10	B-0.1	0.1	2.5	0.9	8.25	15.75	7.75	26
	B-0.2	0.2	5.0	0.9				
	B-0.5	0.5	12.5	0.9				
	B-1	1.0	25	0.5				
	B-2	2.0	50	0.5				
BSC-24	B-0.9	0.9	22.5	0.9	8.25	11.625	7.75	17
	B-1.8	1.8	45	0.9				
BSC-25	B-0.1	0.1	2.5	0.9	8.25	16.75	7.75	27
	B-0.2	0.2	5.0	0.9				
	B-0.5	0.5	12.5	0.9				
	B-0.9	0.9	22.5	0.9				
	B-1.8	1.8	45	0.9				

\* Values are for 60 Hz. and 5 amperes in the secondary.

## VOLTAGE TRANSFORMER BURDENS

Type	ANSI Desig.	Volt-Amperes*	Power Factor*	Width (in.)	Length (in.)	Height (in.)	Weight (lbs.)
BSP-6	W	12.5	0.10	8.25	11.625	7.438	15
	X	25.0	0.70				
	Y	75.0	0.85				
BSP-7	Z	200	0.85	7.875	9.375	8.813	15
BSP-20	M	35.0	0.20	7.875	9.375	8.813	18

\* Values are for 60 Hz. And 120 volts in the secondary.

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# AUTOMATIC CURRENT TRANSFORMER COMPARATOR

## KATC-C2

### issue solved

*Got older, slower equipment? Knopp's KATC is faster, more robust and more accurate!*

Knopp's KATC-C2 is a high accuracy current comparator that is compatible with all older generation Knopp comparators, and is designed to be a direct, plug-in replacement requiring no modification of the existing Knopp Current Transformer Test Systems.

Save time and money on service by upgrading your comparator to our new next generation model!

### features

- Easily Interchangeable with other Knopp comparators; no modification needed
- Compatible with TESCO Test Manager
- Ability to test transformers with 5 ampere secondaries
- Automatic sensing of 50 or 60 Hertz current
- Calculation and display of ANSI accuracy class
- Usage and hookup error detection and alerts, resistant to excessive test current
- Fast testing time (under one minute)
- Continuous instantaneous readings
- Automatic operation (no manual "nulling" or adjustments required)
- Demag
- Auto-ranging capability
- Eliminated the possibility of burning up resistors by turning up the current too fast
- 5" Full color LCD, 800 x480
- KATC-2C-1 model allows the ability to test down to unity



### specifications

<b>Dimensions:</b>	19" wide, 18.1" Deep, 5.25" High. Note: This is a standard 3U rack enclosure.
<b>Weight:</b>	Approximately 25 pounds
<b>Input power:</b>	85 to 250 VAC, 2.5A, 50/60Hz
<b>Test Frequency:</b>	50±1 Hz, 60±1 Hz
<b>Standard Input:</b>	Range: 50 mA to 20 A Phase Error: ±90 degrees RCF: $0 \leq RCF \leq 10$ Ratio Error: $-100\% \leq \text{Ratio Error} \leq +1000\%$ Accuracy Class: $0\% \leq \text{Accuracy Class} \leq 100\%$ Resolution: RCF: 0.00001 Phase: 0.001 degrees Accuracy Class: 0.01
<b>I/O Connections:</b>	I/O connection Two (2) USB 2.0 (Front panel) Ethernet (Front Panel) RS-485 Multi-drop (Rear panel/internal communications)
<b>Transformer Inputs:</b>	S: High side reference transformer U: High side transformer under test (TUT) E: Low side reference transformer Ē: Low side transformer under test (TUT)
<b>Related Equipment:</b>	KATC-2C-1 allows the ability to test down to unity KCTS-8000 Current Transformer Testing System KCTS-1500 Current Transformer Testing System

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# AUTOMATIC VOLTAGE TRANSFORMER COMPARATOR

## KATC-V2



### specifications

**Dimensions:** 19" wide x 18.1" deep x 5.25" high.  
Note: This is a standard 3U rack enclosure.

**Weight:** Approximately 25 pounds

**Input Power:** 85 to 250 VAC, 2.5A, 50/60 Hz

**Test Frequency:** 50 $\pm$ 1 Hz, 60 $\pm$ 1 Hz

**Standard Input** Range: 40V to 350V  
Phase Error:  $\pm 90$  degrees  
RCF:  $0 \leq \text{RCF} \leq 10$   
Ratio Error:  $-100\% \leq \text{Ratio Error} \leq +1000\%$   
Accuracy Class:  $0\% \leq \text{Accuracy Class} \leq 100\%$   
Resolution: RCF: 0.00001  
Phase: 0.001 degrees  
Accuracy Class: 0.01

### Resolution:

	RCF	Phase Angle (Minutes)	Acc. Class
0.0% $\leq$ Acc. Cl. <0.2%	0.00001	0.01	0.01
0.2% $\leq$ Acc. Cl. <0.7%	0.00001	0.1	0.01
0.7% $\leq$ Acc. Cl. <1.4%	0.0001	0.1	0.01
1.4% $\leq$ Acc. Cl. <10.0%	0.0001	1	0.01
10.0% $\leq$ Acc. Cl.	0.0001	1	0.1

**Accuracy:**  $\pm(0.75\%$  of reading + Least Significant Digit)  
or ( $\pm 0.01\%$  ratio error and  $\pm 0.3$  min. phase error), whichever is greater.

**Burden:** Standard Transformer—typically less than 0.2 VA at 5A.  
Test Transformer—typically less than 0.2 VA if within 0.6% Accuracy Class.

**I/O Connections:** Two (2) USB 2.0 (front panel); Ethernet (front panel); RS485 Multi-drop (rear panel for internal communications)

**Transformer Inputs:** S: High side reference transformer, U: High side transformer under test (TUT), G: Ground (low side reference and TUT).

**New Inputs:** AC line input current monitor; AC line input voltage monitor; TUT primary voltage monitor

**Accessories:** New external cable set included

**Related Equipment:** Knopp's KTVS Voltage Transformer Testing System

### issue solved

*Got older, slower equipment? Knopp's KATC-V2 is faster, more robust and more accurate!*

Knopp's KATC-V2 is a highly accurate state-of-the-art voltage transformer comparator that is compatible with all older generation Knopp comparators, and is designed to be a direct, plug-in replacement with additional test set cables to fit in the existing Knopp Voltage Transformer Test Systems. Save time and money on service by upgrading your comparator to our new next generation model!

### features

- Interchangeable with other Knopp comparators
- Compatible with TESCO Test Manager
- Automatic sensing of 50 or 60 Hertz voltage
- Calculation and display of ANSI accuracy class
- Fast testing time (less than one minute)
- Automatic operation (no manual "nulling" or adjustments required)
- Auto-ranging capability
- Full color LCD display
- Emergency shutoff feature through control of the interlock relay
- Direct plug in replacement that comes with enhanced cable harnessing

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# BURDEN SET—CURRENT

## BSC-102

### introduction

The industry has recognized the actual load (burden) on CTs is lower than the standard ANSI burdens allow. So a new IEEE Specification (IEEE C57.13.6) accommodates that fact by introducing two new burdens and two new accuracy classes. This new specification address **“High Accuracy”** CTs.

Knopp has a new Burden Set that includes the two new burdens in the IEEE Specification: The E-0.04 and E-0.2 burdens. The new Burden Set is called the BSC-102. These burdens are of much lower impedance than that of the other ANSI burdens to much more closely match the real world.

### testing

To test CTs using the new **“High Accuracy”** specification, a means to measure accuracy at lower currents is needed in addition to the new Knopp BSC-102. All new Knopp Current Transformer test systems include a new KATC-C1 Comparator that has been upgraded to allow accuracy measurements down to 4 mA (less than 1% of test current) instead of the previous 4%. Older KATC-C and KATC-C1 Comparators can be modified to allow for this extended range testing with the new BSC-102.

Note that this Comparator modification also allows accuracy measurements of all “Extended Range” CTs.

### implementation

All new KCTS-8000 CT Test Systems will have the BSC-102 built in and the KATC-C1 will have the necessary modification to accommodate. The required burden (E-0.04 or E-0.2) is built-in and selected by the front panel Burden select switch.

Existing installations of the KCTS-8000 CT Test System can be modified. The BSC-102 Burden Set box can be mounted on top of the KCTS and connected to the “external burden” terminals. The Comparator would have to be returned for modification at Knopp.



### specifications

Here are characteristics of the BSC-102:

Burden Designation	Resistance (Ohms)	Inductance (millihenrys)	Impedance (Ohms)	Volt-amperes	Power factor
E-0.04	0.04	0.0	0.04	1.0	1.0
E-0.2	0.20	0.0	0.20	5.0	1.0

Dimensions: The approximate overall dimensions of the BSC-102 is 8-1/4” long x 7-1/4” wide x 7-3/4” high

Weight: The net weight of the BSC-102 is approximately 7 pounds.

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# CURRENT TRANSFORMER TESTING SYSTEM

## KC-1500

### description

The Knopp Type KC-1500 Current Transformer Testing System is designed to measure the accuracy of instrument transformers having 1 and 5 ampere secondaries and primaries of up to 1500 amperes. The KC-1500 is capable of testing transformers with 1 or 5 ampere secondaries. The system uses a high accuracy multi-range current transformer as a reference standard.

The system is well suited for utilities whose current transformer testing needs include primary currents up to and including 1500 amperes. The phase angle and ratio errors of the transformer-under-test (TUT) are measured by the built-in Knopp Automatic Transformer Comparator.

Some of the standard features of the KC-1500 are:

- ◆ AUTOMATIC and AUTORANGING Type KATC-C1 Current Transformer Comparator provides minimum measurement time (typically within three seconds after adjustment of test current).
- ◆ DIGITAL DISPLAY of test current, ratio error (in Percent or Ratio Correction Factor), and phase angle error (in Minutes or Milliradians).
- ◆ ACCURACY CLASS for which the TUT qualifies is digitally calculated and displayed.
- ◆ SELF CHECK feature allows the KC-1500 system accuracy to be easily verified without the use of an external reference standard.
- ◆ PROTECTIVE CIRCUITRY senses error conditions, such as wrong ratio or wrong polarity, and removes power from the KC-1500 loading circuitry.
- ◆ ZERO START feature requires that the test current control be at zero before power can be applied to the loading circuitry (and thus the TUT).
- ◆ STANDARD ANSI BURDENS include B-0.1/B-0.2/B-0.5/B-0.9/B-1/B-1.8
- ◆ PORTABILITY means the system can easily be transported to a field testing location.
- ◆ SERIAL (RS-232C) output port to allow transfer of test results to a printer or computer.
- ◆ 120 VOLT OPERATION allows the use of readily available power sources in the lab or the shop
- ◆ CONNECTION KIT which includes cables to facilitate connection of most instrument transformers to the KC-1500 terminals.

### options include:

Additional ANSI BURDENS for relay testing and other purposes are also available including B-1/B-2/B-4/B-8. Burdens up to B-1.8 are rated for 400% tests while the remaining burdens (B-2, B-4, B-8) are rated for 200% tests.

### operation

The desired ANSI burden is connected to the test system. The required primary range is selected by a rotary switch in combination with the use of the appropriate test terminals on the KC-1500. After the TUT is connected, and the test current adjusted, the HOLD push-button on the Comparator is pressed. This holds the results on the Comparator display while the operator returns the test current to zero. After the test results are recorded or printed, RESET is pressed to prepare the system for the next test.

### specifications

dimensions:	Console 1: 65" (16.5 cm) High, 30.3" (77.0 cm) Wide, 16.0" (40.6 cm) Deep
	Console 2: 9.5" (24.1 cm) High, 28.2" (71.6 cm) Wide, 24.7" (62.7 cm) Deep
weight:	Console 1: 55 pounds (24.9 kg) Console 2: 95 pounds (43.1 kg)
note:	Weight does not include Burden sets or Hardware and cable connection kit
input power:	120 VAC, single phase, 60 Hz, at 15 amperes maximum
system accuracy:	Within $\pm 0.025\%$ on ratio and $\pm 2$ minutes on phase angle at 1.2, or less, accuracy class
test current ranges:	5, 10, 15, 20, 25, 30, 40, 50, 75, 100, 150, 200, 300, 400, 500, 600, 800, 1000, 1200, and 1500 amperes



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# CURRENT TRANSFORMER TESTING SYSTEM

## KCTS-8000

### description

The Knopp Current Transformer Testing System (Type KCTS-8000) is designed to measure the accuracy of instrument transformers having 1 or 5 ampere secondaries and primaries of up to 8000 amperes. The system uses a high accuracy current transformer as a reference standard. All ANSI standard burdens are included. The phase angle and ratio errors of the transformer-under-test (TUT) are measured by the built-in Knopp Automatic Transformer Comparator.

Standard features of the KCTS include:

- ◆ AUTOMATIC and AUTORANGING Type KATC-C1 Current Transformer Comparator provides minimum measurement time (typically within three seconds after adjustment of test current).
- ◆ DIGITAL DISPLAY of test current, ratio error (in Percent or Ratio Correction Factor), phase angle error (in Minutes or Milliradians), and Accuracy Class of the TUT.
- ◆ SELF CHECK feature allows the KCTS system accuracy to be easily verified without the use of an external reference standard.
- ◆ PROTECTIVE CIRCUITRY senses error conditions, such as wrong ratio or wrong polarity, and then removes power from the KCTS loading circuitry.
- ◆ ZERO START feature requires that both coarse and fine test current controls be at zero before power can be applied to the loading circuitry (and thus the TUT).
- ◆ MOTORIZED CONTROL of the test current is provided to minimize test time. This allows AUTOMATIC RUNDOWN of the test current after the test is complete.
- ◆ SERIAL (RS-232C) output port to allow transfer of test results to a printer or data collection system.
- ◆ CONNECTION KIT which includes cables to facilitate connection of most instrument transformers to the KCTS terminals.
- ◆ ANSI BURDENS 0.04 through 8 (see list of included burdens) and good down to Accuracy class 0.15 Testing.
- ◆ DEMAGNETIZATION of Transformers prior to test.

### operation

Demagnetize transformer prior to test. The desired ANSI burden is selected by a rotary switch, while the required primary range is selected by a rotary switch in combination with the use of the appropriate test terminals on the KCTS. After the TUT is connected, and the test current adjusted, the HOLD push-button on the Comparator is pressed. This holds the test results on the Comparator display while the motorized test current control is automatically returned to zero. After the test results are recorded or printed, RESET is pressed to prepare the system for the next test.

### specifications

dimensions: 45" (114 cm) High, 55.5" (141 cm) Wide, 35" (89 cm) Deep

weight: 1330 lbs. (603 kg)

input power: 208 or 240 VAC (specify at time of order), single phase, 60 Hz, at 200 amperes maximum. And a separate 120 VAC source at 5 amperes.

system accuracy: Within  $\pm 0.025\%$  on ratio and  $\pm 2$  minutes on phase angle at 1.2, or less, accuracy class

test current ranges: 5, 10, 15, 20, 25, 30, 40, 50, 60, 75, 80, 100, 120, 125, 150, 160, 200, 250, 300, 400, 500, 600, 750, 800, 1000, 1200, 1500, 1800, 2000, 2500, 3000, 4000, 5000, 6000, 7500, and 8000 amperes

400% tests shall be able to be performed on all ranges up to, and including 2000 amperes. 200% tests shall be able to be performed on all ranges up to, and including, 4000 amperes.

Included ANSI burdens: E-0.04 (extended range), E-0.2 (extended range), B-0.1, B-0.2, B-0.5, B-0.9, B-1.8

Relaying burdens: B-1, B-2, B-4, B-8

Burdens up to B-1.8 are rated for 400% tests while the remaining burdens (B-2, B-4, B-8) are rated for 200% tests. Provisions are made for use of an external burden.



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# PRECISION MULTIRANGE CURRENT TRANSFORMERS

## P-5000 & P-12000

### introduction

This Type P-5000 transformer is a laboratory standard. The unit's excellent accuracy and the Knopp One-to-One calibrating feature make this precision transformer well-suited as a standard for calibration work. This transformer can provide a very accurate determination of the ratio and phase angle characteristics of current instrument transformers having ratios from 5 to 5,000 amperes. This transformer also can accurately extend the range of a 5 ampere ammeter or wattmeter to cover all current values up to 5,000 amperes.

### primary ranges

The P-5000 provides eight self-contained primary ranges from 5 to 100 amperes. These ranges are brought out to binding posts on the top of the transformer. A 240 turn secondary is provided for use with these primary taps; other secondary taps are provided for other ranges as described below. Ranges above 100 amperes are obtained by passing a primary conductor through the transformer window. Various primary ranges are obtainable by varying the number of through-turns and choosing from among the available secondary taps. These ranges are: 125, 150, 200, 240, 250, 300, 375, 400, 500, 600, 625, 750, 800, 1000, 1200, 1250, 1500, 2000, 2500, 3000, 4000, and 5000A.

### burden and accuracy

The Type P-5000 Transformer, like other Knopp Precision Multirange Transformers, has excellent ratio and phase angle characteristics with respect to both inter-range accuracy and overall accuracy. This is made possible through a properly engineered design and through exclusive, highly perfected compensating and winding methods.

The transformer is designed and compensated for the highest possible accuracy at the burden specified by the purchaser, but also may be used with excellent results with other burdens up to 25 volt-amperes. When used with the burden for which compensated, the ratio of this transformer standard is well within  $\pm .02\%$  and the phase angle is well within 2 minutes on all ranges.

### calibration

A Report of Calibration, traceable to the National Institute of Standards and Technology (NIST) is included with the transformer.

We recommend that the accuracy of the transformer be checked by a certified laboratory every five (5) years. Additionally, the One-to-One accuracy of the transformer can be checked when desired by comparing the 5 ampere primary tap to the 5 ampere (240 turn) secondary. Any reliable error-measuring instrument can be used for this purpose. One-to-One data will be included with this transformer when shipped.

### rating and insulation

All windings are rated at 100% continuous current. Current up to

200% can be applied on a 25% duty-cycle basis in which the "ON" period does not exceed 30 minutes.

The transformer housing insulates the inserted primary from the secondary and primary windings for up to 2500 volts. The wound primary is for use on circuits not exceeding 250 volts.

### specifications

**dimensions:** The approximate overall dimensions of the Type P-5000 are 11.5" (29.2 cm) wide, 4.5" (11.4 cm) deep, and 13.875" (35.2 cm) high.

**weight:** The net weight of the Type P-5000 is approximately 32.5 pounds (14.7 kg) and the shipping weight is approximately 50 pounds (22.7 kg).

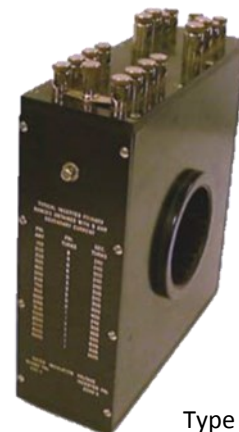
### Type P-12000

The Type P-12000 Precision Multi-Range Current Transformer has the following taps:

**2000 Amps, 3000 Amps, 4000 Amps, 5000 Amps, 6000 Amps, 7000 Amps, 7500 Amps, 8000 Amps, 9000 Amps, 10,000 Amps, And 12,000 Amps**

**Dimensions:** The approximate overall dimensions of the Type P-12000 are 15" wide, 4.75" deep, and 15" (38.1 cm) high

**Weight:** The net weight of the Type P-12000 is approximately 35 pounds (15.9 kg) and the shipping weight is approximately 50 pounds (22.7 kg)



Type P-5000

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# LOADING TRANSFORMER

## CL-6

### application

Where currents up to 1000 amperes are required, the Type CL-6 portable Knopp Loading Transformer is very useful in the testing and calibrating of current-actuated protective and switching devices, current-carrying apparatus, and transformers, such as:

- ◆ Sectionalizers
- ◆ Fuse links
- ◆ Meters
- ◆ Meter sockets
- ◆ Fuse boxes
- ◆ Connectors
- ◆ Cables
- ◆ Busses
- ◆ Overcurrent relays
- ◆ Thermal Overload relays
- ◆ Motor starter overload relays
- ◆ Oil circuit breakers
- ◆ Transformer breakers
- ◆ Disconnect switch contacts
- ◆ Instrument current transformers
- ◆ Air circuit breakers (thermal, magnetic, and thermal-magnetic)

### rating and ranges

The CL-6 is a 5 KVA transformer. This unit may be used continuously at that output when used with rated voltage on the 110- and 220-volt connections. It is of conservative and quality design, assuring good waveform and dependable service under all field testing conditions.

Frequency: 50/60 cycles

Input: Taps for 90, 110, 180, and 220 volts

Output: 5 volts, 1000 amperes (parallel connection);  
10 volts, 500 amperes (series connection)

The output currents indicated are maximum for continuous duty, and on intermittent duty the output currents may be increased to 750 amperes at 10 volts and 1500 amperes at 5 volts on a 40% duty cycle of 20 minutes on and 30 minutes off.

A suitable variable transformer can be used to adjust the output current to the desired value up to the output limits indicated.

If more capacity is required than one transformer can supply, two or more of these transformers may be connected in parallel or series.

Also available is the Type CL-6-S1:

Output: 10 volts, 500 amperes  
20 volts, 250 amperes

### description

This readily portable Knopp Loading Transformer weighs only 60 pounds and measures only 12" long, 9" wide, and 10" high. Its sturdy enclosure provides protection and adequate ventilation. Two convenient carrying handles are provided.

The insulating terminal panel is rigidly secured to the transformer frame, and heavy-current, bus-bar-type terminals are securely bolted to the panel. The two output terminals each have two connection surfaces, one on a vertical plane and one on a horizontal plane, for maximum convenience in connecting the heavy current leads and in changing, when necessary, the series-parallel links. The links and the output connections cannot interfere with each other. All terminals and connection links are plated.

Both the primary and the secondary are insulated for a 4000 volt, 60 cycle, one-minute test. A grounding stud is provided on the enclosure.



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# PRECISION MULTIRANGE VOLTAGE TRANSFORMER

## WP-14000

### introduction

This Type WP-14000 Transformer is primarily a laboratory standard. Its excellent accuracy and the Knopp one-to-one calibrating feature make it well-suited as a standard for precision calibrating work. This transformer makes possible very accurate determination of the ratio and phase angle characteristics of voltage instrument transformers having ratings from 120 to 14,400 volts. This transformer also makes it possible to accurately extend the range of a 120 volt voltmeter or wattmeter to cover all voltage values up to 14,400 volts.

Several versions of the WP-14000 Transformer exist. These versions are differentiated by affixing a suffix to the Type designation (e.g. WP-14000-4). The differences among the versions generally lie in the number and value of the intermediate voltage ranges. As an example, the WP-14000-4 transformer includes 288 and 300 volt ranges not found on the WP-14000-1 transformers.

### primary ranges

The primary ranges for the WP-14000-4 are:

120, 240, 288, 300, 480, 600, 2400, 4800, 7200, 8400, 12,000 and 14,400 volts. The secondary is 120 volts.

### burden and accuracy

The WP-1400 Transformer, like other Knopp Precision Multirange Transformers, has excellent ratio and phase angle characteristics with respect to both inter-range accuracy and overall accuracy. This is made possible through a properly engineered design and through exclusive, highly perfected compensating and winding methods.

The transformer is furnished compensated for the highest possible accuracy at the burden specified by the purchaser, but it may be used with excellent results with other burdens up to 25 volt-amperes. When used with the burden for which compensated, the ratio of this transformer standard is well within 0.02% and the phase angle is well within 2 minutes on all ranges.

### calibration

A Report of Calibration, traceable to the National Institute of Standards and Technology (NIST) is included with the transformer.

We recommend that the accuracy of the transformer be checked by a certified laboratory every five (5) years. Additionally, the one-to-one accuracy of the transformer can be checked when desired by

comparing the 120 volt primary tap to the 120 volt secondary. Any reliable error-measuring instrument can be used for this purpose.

### construction

For long, dependable service, the coil is cast in epoxy, and the core and coil assembly is housed in a beige steel case with engraved aluminum panel fitted with porcelain high-voltage bushings.

### specifications

**dimensions:** The approximate overall dimensions of the Type WP-14000 are 20" (50.8 cm) wide (not including the handles, 15" (38.1 cm) deep, and 18" (45.7 cm) high including the bushings.

**weight:** The net weight of the Type WP-14000 is approximately 175 pounds (79.4 kg) and the shipping weight is approximately 250 pounds (113.4 kg). The dolly's net weight is 17 pounds (7.7 kg), and its shipping weight is approximately 30 pounds (13.6 kg).



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# PRECISION MULTIRANGE VOLTAGE TRANSFORMER

## WP-36000

### introduction

This Type WP-36000 Transformer is primarily a laboratory standard. The high degree of accuracy and multiplicity of ranges makes this transformer the standard for precision calibration work. With the aid of this transformer, very accurate determination can be made of the ratio and phase angle characteristics of voltage transformers having ratings from 14,400 to 36,000 volts.

Additionally, the range of a voltmeter or wattmeter can be accurately extended by this transformer to cover all voltage values from 14,000 to 36,000 volts.

### primary ranges

Several models are available. The models are differentiated by the two intermediate ranges:

**Model WP-36000-1: 14400, 18000, 20760, and 36000 volts.**

**Secondary: 120 volts**

**Model WP-36000-2: 14400, 16800, 24000, and 36000 volts.**

**Secondary: 120 volts**

**Model WP-36000-3: 14400, 21000, 24000, and 36000 volts.**

**Secondary: 120 volts**

Other intermediate ranges are available. Consult Knopp for more information.

### burden and accuracy

The WP-36000 Transformer, like other Knopp Precision Multirange Transformers, has excellent ratio and phase angle characteristics with respect to both inter-range accuracy and overall accuracy. This is made possible through a properly engineered design and through exclusive, highly perfected compensating and winding methods.

The transformer is furnished compensated for the highest possible accuracy at the burden specified by the user, but it may be used with excellent results with other burdens up to 25 volt-amperes. When used with the burden for which compensated, the ratio of this transformer standard is well within  $\pm 0.02\%$  and the phase angle is well within 2 minutes on all ranges.

### calibration

The WP-36000 does not provide the Knopp One-to-One Calibrating Feature. However, for those who have a WP-14000 Knopp Precision Multirange Voltage Transformer Standard with the Knopp One-to-

One feature, the benefit of the One-to-One calibration can be extended to the WP-36000 by comparing the 14400-volt ranges of the two transformers, using the WP-14000 as the standard.

### description

This transformer is oil-insulated and is equipped with high-voltage cast-glass bushings. The plus-minus end of the winding is grounded to the core and case, and the transformer should be grounded through the ground terminal provided.

### specifications

**dimensions:** The approximate overall dimensions are: 30" (76.2 cm) wide, 24" (609.6 cm) deep, and 32" (812.8 cm) high, including bushings.

**weight:** The net weight is approximately 570 lbs. (259 kg), and the shipping weight is approximately 700 lbs. (318 kg).



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# UNILoad VOLTAGE TRANSFORMER

## 2J6

### introduction

The Type 2J6 Knopp Uniload Voltage Transformer Test Set consists of three major parts:

- ◆ A Knopp Precision Multirange Voltage Transformer Standard with four primary ranges (from 14,400 volts to 36,000 volts) and a 120 volt secondary.
- ◆ A Knopp Heavy-Duty Supply Transformer with a primary of either 120 volts or 240 volts (as ordered) and with secondary ranges the same as the primary ranges of the precision transformer standard.
- ◆ A mounting base which aligns and supports the above two transformers.

This Type 2J6 test set is available in various models shown in the following table. Custom versions are also available.

Test Set Type No.	Voltage Trans. Type No.	Supply Trans. Type No.	Ranges Provided in Transformers
2J6-1	WP-36000-1	LP-36000-1	14,400; 18,000; 20,760; 36,000
2J6-2	WP-36000-2	LP-36000-2	14,400; 16,800; 24,000; 36,000
2J6-3	WP-36000-3	LP-36000-3	14,400; 21,000; 24,000; 36,000

For convenience and safety, a special high-voltage connection bar and lead set for selecting the proper voltage range on the supply transformer and precision standard are provided with each 2J6 set. The connection bar is designed to prevent incorrect connections during tests.

The Knopp Supply Transformer mounts alongside the Knopp Precision Transformer with an interlocking feature for rigidity. Hook-eyes are also provided on the top of each transformer for lifting.

### accuracy and burden

When the Knopp Precision Transformer in the 2J6 set is compensated for, and used with, a secondary burden of 15 volt-amperes, for example, the ratio of this precision transformer is well within 0.02% and the phase angle is well within 2 minutes. The transformer, in common with other Knopp Precision Multirange Transformers, is wound so that it has practically the same ratio and phase angle accuracy on all ranges.

### calibration

The transformer standard can be checked against any 14,400 volt transformer standard, such as the Type WP-14000 Knopp Precision Multirange Voltage Transformer

### dimensions and weight

The equipment measures approximately 38.75" wide, 23.75" deep, and 30" high. The net weight is approximately 1,220 pounds.





# UNILoad VOLTAGE TRANSFORMER

## 2J4-4

### introduction

The Type 2J4-4 Knopp Uniload Voltage Transformer Test Set consists of three major parts:

- ◆ A Type WP-14000-4 Knopp Precision Multirange Voltage Transformer Standard with primary ranges of 120; 240; 288; 300; 480; 600; 2,400; 4,200; 4,800; 7,200; 8,400; 12,000; and 14,400 volts. Secondary: 120 volts.
- ◆ A Type LP-14000-4 Knopp Heavy-Duty Supply Transformer (similar in size and appearance to the WP-14000-4).
- ◆ A rubber-tired carriage which supports the WP-14000-4 and LP-14000-4 and provides mobility to the complete Uniload Test Set.

For convenience and safety, a connection arrangement which prevents incorrect connections during tests is used for selecting the proper voltage range on the supply transformer and the precision standard.

The Type LP-14000 Knopp Supply Transformer mounts on top of the Type WP-14000-4 Knopp Voltage Transformer, with an interlocking feature for rigidity. Handles are also provided on each transformer for an added convenience should you wish to use the transformers separately and away from the carriage.

### accuracy and burden

When the Type WP-14000-4 Precision Standard Transformer is used with a secondary burden of 15 volt-amperes, to give an example, the ratio of this voltage transformer is well within .02% and the phase angle is well within 2 minutes. The transformer is wound so that it has practically the same ratio and phase angle accuracy on all ranges.

### calibration

The transformer standard can be calibrated by itself without a standard of comparison by means of the Knopp One-to-One method.

### primary ranges

The primary ranges for the 2J4-4 are:

120/240/288/300/480/600/2400/4200/4800/7200/8400/12000/14400 volts.

All ranges are referenced to a 120 volt secondary.

### specifications

The equipment measures approximately 23" wide (not including handles), 15" deep, and 40" high.

The net weight is approximately 500 pounds.





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# VOLTAGE TRANSFORMER TESTING SYSTEM

## KVTS

### description

The Knopp Voltage Transformer Testing System is designed to measure the accuracy of instrument transformers having 120 volt secondaries and up to 14,400 volt primaries (special order for up to 36,000 volt primaries is available). The system includes a control console which contains the control circuitry, ANSI standard burdens, and the Knopp Automatic Transformer Comparator. The Knopp precision and loading transformer set is also included (see picture below) and is connected to the console via a special cable.

Some of the features of the KVTS are:

- ◆ AUTOMATIC and AUTORANGING Voltage Transformer Comparator (Type KATC-V) provides minimal measurement time (typically a few seconds after adjustment of test voltage).
- ◆ DIGITAL DISPLAY of test voltage, ratio error (in percent or ratio correction factor), and phase error (in minutes or milliradians) is provided by the Comparator (KATC-V).
- ◆ ACCURACY CLASS for which the transformer-under-test qualifies is calculated and digitally displayed by the Comparator (KATC-V).
- ◆ SELF CHECK feature allows the system accuracy to be easily verified without the use of an external standard.
- ◆ PROTECTIVE CIRCUITRY senses unusual error conditions such as wrong ratio or polarity and then automatically removes power from the KVTS loading circuitry to protect the KVTS, precision transformer, and the transformer-under-test.
- ◆ ZERO START feature requires that both coarse and fine controls of test voltage be at zero before power can be applied to the loading circuitry.
- ◆ COMPUTER or PRINTER communication is available through an RS -232 port.
- ◆ VOLTAGE TRANSFORMER TEST SET includes a high precision multi-range voltage transformer and a heavy duty supply transformer plus the T-bar assembly and wheeled base.
- ◆ INTERCONNECTING CABLES between the control console and the transformer test set.
- ◆ All ANSI BURDENS including W, X, M, Y, Z and ZZ.

### operation

The desired ANSI burden is selected by a rotary switch on the console. The appropriate range is selected at the precision/loading transformer set. After the operator connects the transformer-under-test and adjusts the test voltage, the HOLD button on the

Comparator is pressed. The results will be automatically sent to a computer/data collection system.

### specifications

dimensions:	61.5" (156.5 cm) High; 24" (61 cm) Wide; 37" (94cm) Deep (console) and 36" (91.5 cm) High; 25" (63.5 cm) Wide; 20" (50.8 cm) (Deep) Voltage Test Set
weight:	350 lbs. (159.7 kg) (console) and 300 lbs. (transformer test set)
input power:	120 VAC, 60 Hz; single phase; 10 amperes maximum
system accuracy:	Within $\pm 0.025\%$ on ratio and $\pm 2$ minutes on phase angle at 1.2 accuracy class or less.
primary ranges:	120 / 240 / 288 / 300 / 480 / 600 / 2,400 / 4,200 / 4,800 / 7,200 / 8,400 / 12,000 / 14,400 volts.
Consult factory on other ranges.	
burdens:	ANSI W, X, M, Y, Z, and ZZ; switch selectable. Provisions are made for use of an external burden.
connecting cable:	15 feet long (between transformer set and console).



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# LOW IMPEDANCE VOLTAGE TESTER

## K-60



### FOR AC AND DC 120 TO 600 VOLTS

**MODEL K-60 KNOPP VOLTAGE TESTER** for AC and DC with polarity indicator. Double safety indication is by solenoid and by neon lamp.

**GENERAL DESCRIPTION:** Knopp Voltage Testers offer portability and ease of use with full protection. These exceptionally versatile and useful tools are backed by a reputation for quality in the design and manufacture of electrical test equipment.

### FEATURES

**SAFE AND DEPENDABLE:** Knopp Voltage Testers are designed and build with safety, the **key** criteria! Dual voltage indication is provided by solenoid and neon lamp, operating **independently**. The lamp gives a bright warning signal. Voltages are shown by a positive, easy-to-read, moving indicator. There is a signal by hum and vibration; and the user is protected by high-grade, properly applied insulation, and by separation of incoming leads (they do not cross over each other within the housing). Interior separation of the circuit is a basic design feature of the case.

Nylon insulation covers prod tips to within 9/16" of end to prevent shorts across tips. The K-60 has no exposed metal parts. The scale and plate are both of insulating material.

**DURABLE:** The rugged Cycloc housing and sturdy internal chassis of Polysulfone – each of one-piece construction – are securely interlocked and designed for durability and hard use. All electrical connections are soldered.

**U.S. MADE:** The K-60 is manufactured entirely in the United States.

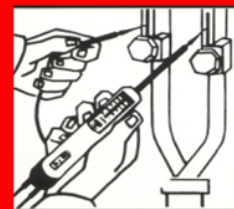


### **NO-BULK PROD STORAGE**

The Model K-60 features a **NO-BULK** prod storage. Prods are stored as a pair on the back of the case with tips covered. Storage is quick and easy. Prods snap onto the back of the case as a pair in a single step.

### **IN-LINE PROD MOUNT**

To make testing in difficult and tight places easy, the Knopp K-60 features an **IN-LINE** mount - a straight extension of the instrument giving sure aim and probing action. In addition, the K-60 has a dual mounting system to allow one-hand testing of side-by-side circuits such as convenience outlets.



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# LOW IMPEDANCE VOLTAGE TESTER (CONT.)

## specifications

**Voltage Measurements:** Operating on the solenoid principle, these dependable Knopp Voltage Testers tell whether the circuit is opened or closed, indicate the nominal AC circuit voltages of 120, 240, 480, and 600, and the nominal DC circuit voltages of 120, 240, and 600, whether the voltage is 25 or 60 Hz.

**Polarity Determination:** The polarity of DC circuits can be quickly and positively determined with the neon-light polarity indicator featured in the Knopp K-60 model.

**A-C, Pure DC, and Rectifier DC Identification:** Vibration and humming of the testers indicate that the circuit is AC or unfiltered rectified DC, since there is no hum or vibration with pure DC. Rectifier DC (pulsating DC) can be easily distinguished from AC with the aid of the neon lamp in the tester.

**Compactness and Ease-of-Handling:** The Knopp Voltage Tester features its exclusive, cylindrical SLIM-GRIP design that fits securely and comfortably in your hand, and in addition, the K-60 provides the alternative "pistol grip" for reaching into deep and tight test places. The housing diameter is less than an inch and a quarter (1.25"). When the prods are stored, the K-60 is exceptionally compact and is easily carried in the pocket or pouch. And the

unique dual-mounting system makes possible **single-hand** testing.

**Stainless Steel Prods / Flat-Tip Design:** Prods are made from hard stainless steel, which will not rust and which resists wear and bending; the ends of the prods are especially flattened to facilitate using the prods in narrow openings (such as small convenience outlets).

**Prod Insulation:** Sturdy, 4" long laminated phenolic prod handles provide tough, moisture and oil-resistant non-warping insulation. The stainless steel tips are nylon-insulated to within 9/16" of the point for additional protection. Thus, the operator has the protection of more than 5" of insulation, and there is almost no chance of causing shorts between prods.

**QUALITY DESIGNED ... QUALITY BUILT:** Knopp products are backed by more than 70 years of experience in the design and manufacture of electrical test equipment. Knopp, Inc., pioneered numerous major improvements in voltage test devices, including dual voltage indication, polarity indication, strain relief lead anchorage in **both** case and prod handles, the use of stainless steel for prod tips, and the **prod mount**. Knopp quality and dependability are bywords in the industry and are your assurance the Knopp Voltage Testers are the best ever built, incorporating every possible advance in design and quality construction.

SPECIFICATIONS										
Cat. No	Model	Voltage Scales	Polarity Indication	Dual Voltage Indication	Prod Storage	Approx. Dimensions		Approx. Weight		
						Diam.	Case Length	Lead Length	Net	Ship
14460	K-60	AC 120, 240 480, 600 DC 120, 240, 600	Yes	Yes	Yes	1-3/16"	6-3/8"	26"	9 oz.	13-14 oz.
14480	Cordura Carrying Case									
14475	Lead Assembly Set consisting of pair of leads with handles and prod tips (on red and one black) plus two lead anchors for securing leads in tester case.									



Fused leads are available at an additional cost.

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# PHASE SEQUENCE INDICATORS

## K-3, K-6, K-7

**ROTARY TYPE • NO LAMPS • RELIABLE • RUGGED •  
VERSATILE • TIME SAVING**

**POSITIVE, STRAIGHTFORWARD SEQUENCE INDICATION IS PROVIDED** over a wide variety of voltage and frequency by direction of rotor rotation. No need for range switching or terminal changing. Also indicates an open phase.

**MODELS K-3: 60-600 volts, 25-60 Hz**

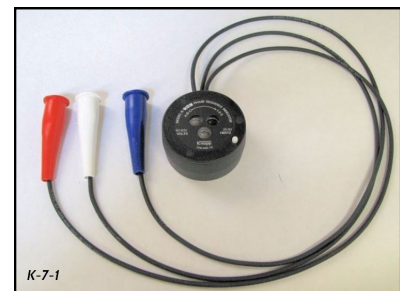
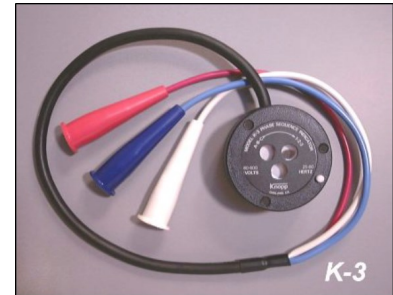
**MODEL K-6: 24-480 volts, 400 Hz**

**MODEL K-7: 60-600 volts, 25-60 Hz**

**K-7 has several options with different lead lengths and colors.**

See back of brochure for application on other frequencies.

Use of the Knopp Phase Sequence Indicator saves man-hours and protects valuable equipment against damage. It pays for itself in a short time.



## specifications

The following salient features are reasons for this instrument's proven reliability and long life, for its convenience, simplicity, and safety in use and for its durability in rigorous service.

1. Specially designed induction motor unmistakably indicates the phase sequence by direction of rotation of rotor disc.
2. The Lead Set is permanently connected to the instrument to save testing time and prevents errors in connecting.
3. For ease and certainty in identifying connections, the test clips are permanently marked with letters A, B, and C, and the corresponding flexible leads and clip insulators are coded red, white, and blue.
4. The patented circuit and switch arrangement makes for instrument protection and personnel safety. Because
5. of the switch, the Indicator clips can be left connected to the circuit-under-test between "before" and "after" readings of the phase sequence – timesaving and error preventing. Between these tests the instrument can be left hanging from the clips.
6. There are **no exposed metal parts**. The instrument housing is made of laminated phenolic, and is cylindrically shaped, an exceptionally rugged service-proven construction. The three window panes are small and deeply recessed for protection from impacts.
7. Good visibility of the rotor movement is assured. The black area of the aluminum rotor blacks out windows in phase sequence.
8. Only 21 oz. in weight, the indicator is small and easily carried.

## applications

The primary function of the Phase Sequence

Indicator is to indicate the order of succession in time of the different voltage peaks of a multiphase supply. In addition, the Knopp Sequence Indicator enables one to make continuity tests. It is a valuable instrument in diverse fields involving polyphaser power apparatus, being employed by line and installation crews for public utility systems and industrial-plant electrical departments. It is, furthermore, helpful in the testing departments of public utility systems for laboratory and field testing.

The Knopp Phase Sequence Indicator is used in connection with the making of three-phase circuit installations or alterations, and replacement installations of motors and generators, also for making continuity tests of circuits of polyphase systems. Moreover, it is valuable in making connections of power-factor meters, volt-ampere meters, watt and watt-hour meters, and relays. Some of these applications are discussed in the following paragraphs.

(continued)

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# PHASE SEQUENCE INDICATORS (CONT.)

## applications

### Phasing-In Power Circuits After Alterations

The most frequent application for the Knopp Phase Sequence Indicator is for phasing-in a power line which has supplied power to motors and plants, and where line alterations are made in the circuit feeding this line. It is necessary to determine the sequence before alteration is made so that the **same sequence** can be reestablished for the consumer by the line crew after alteration has been made. This will avoid any possibility of damage incident to reversing the consumers' motors and machinery.

### Connecting Motors and Generators

Use of the Knopp Sequence Indicator protects apparatus and enhances service efficiency. By indicating which terminals of a newly installed polyphaser power circuit are to be connected to the sequence-identified motor terminals, it eliminates the trial-and-error method and thus prevents damage and saves time.

Obviously the trial-and-error method is not permissible for direct-connected electric motors which, because of the nature of the machines they drive, cannot be operated in reverse. Furthermore, reversal of a generator's phase rotation when being paralleled would result in a short circuit.

Suppose a three-phase motor load is to be connected to a new set of three-phase conductors. Before a change is made, the original power sequence to the load is determined by attaching the Sequence Indicator to the line side of the motor switch. After temporary new connections are made, the line is again energized and the phase sequence checked. If the original sequence is reversed, two of the new conductors can be interchanged to give the original sequence. Since only minute power is required to operate

the Knopp Sequence Indicator, there is no need for making tight connections until the correct order has been established.

### Motor and Generator Terminal Markings

It will be obvious that the Knopp Sequence Indicator may be used to correlate definitely the motor and generator conductor markings with the phase sequence of applied or generated voltage.

### Connections of Polyphase Power-Factor Meters

Where instrument transformers are employed for power factor metering, mistakes are easily made in the connections. The phase sequence of the input current for the current coils should be checked for the correct order of attachment, as indicated by the manufacturer's diagrams. The phase sequence of the voltage coils is determined by the Sequence Indicator.

### Reactive-Volt-Ampere Connections

When varmeters are being connected in polyphaser circuits, it is necessary to use the correct phase order so as to assure the correct meter indications. The Knopp Indicator furnishes direct and positive means of determining the proper sequence.

### Two-Phase, 3-Wire Operations

The Knopp Sequence Indicator (catalog No. 44030, 3-phase, 3-wire type) will operate satisfactorily on 2-phase, 3-wire systems. However, it should be noted that on such systems the voltage between the outers is 1.4 times the phase voltage. This factor should be taken into consideration when using the Indicator on higher voltage circuits, bearing in mind the voltage rating of the instrument.

### Open-Phase Indication

The presence of an open circuit in at least one phase of a three-phase supply is indicated by the failure of the Sequence Indicator to rotate when connected to the circuit.

### Six-Phase Sequence

The Indicator can be used to determine the phase order of six-phase circuits by arranging the six terminals into two groups of three, each group having equal voltage between all pairs of terminals and both groups having the same sequence, the two 3-phase triangles should form a hexagon with equal voltage sides.

The Knopp Phase Sequence Indicator includes a three-phase induction motor having an aluminum-disc rotor mounted for free rotation on a cushioned glass-hard bearing and having field windings placed at 120 geometrical-degree intervals about the rotor axis. One terminal of each winding is extended beyond the case to a distinctly colored conductor and to a lettered test clip for attachment to one conductor of the tested system; and the second terminal of each winding is connected to one of three contacts of the insulated protector-switch. The protector-switch must be held closed to energize the windings and is so arranged that accidental or even continuous closure of the switch is unlikely.

The flexible cable withstands severe handling and is intended for suspending the instrument from the line wires or terminals with the test clips. The free ends of the conductors are shorter than the sheathed portion so that, when the instrument is suspended, a detached clip cannot contact the operator while the switch is closed. Since the cable is anchored in the sealed housing, clockwise rotation of the rotor always means that the phase order of the tested terminals is that of the marks A, B, C, on the clips attached thereto.

CATALOG NUMBER	MODEL	TYPE	FREQUENCY	VOLTAGE	LEAD LENGTH	DIMENSIONS		APPROX. WEIGHT	
						Diameter	Height	Net	Shipping
44030	K-3	3-phase 3-wire	25-60*	60-600	36"	3-1/4"	1-5/8"	21 oz.	24 oz.
44035	K-6	3-phase 3-wire	400	24-480	36"	3-1/4"	1-5/8"	21 oz.	24 oz.
N/A	K-7	3-phase 3-wire	25-60*	60-600	26"	3-1/4"	1-5/8"	20 oz.	23 oz.
N/A	K-7-1	3-phase 3-wire	25-60*	60-600	36"	3-1/4"	1-5/8"	21 oz.	24 oz.
N/A	K-7-2	3-phase 3-wire	25-60*	60-600	72"	3-1/4"	1-5/8"	23 oz.	26 oz.
N/A	K-7-3	3-phase 3-wire	25-60*	60-600	50"	3-1/4"	1-5/8"	22 oz.	25 oz.
N/A	K-7-4	3-phase 3-wire	25-60*	60-600	36"	3-1/4"	1-5/8"	21 oz.	24 oz.
44050	Cordura Carrying Case								

\* Suitable for use on frequencies above 60 Hz, provided the circuit voltages are equal to, or exceed, the following: 150 volts for 133 Hz; 200 volts for 180 Hz; 250 volts for 360 Hz; 300 volts for 400 Hz.

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# PHASE SEQUENCE INDICATORS (CONT.)

MODEL	LEADS	VOLTAGE	HERTZ	PHASE COLOR
K-3 ONLY	36" LONG	60 TO 600	25 TO 60	A—RED B—WHITE C—BLUE
K-3-1	36" LONG	60 TO 600	25 TO 60	A—RED B—YELLOW C—BLUE
K-3-2	36" LONG	60 TO 600	25 TO 60	A—RED B—GREEN C—BLUE
K-3-3 PANEL MOUNT	36" LONG	60 TO 600	25 TO 60	A—RED B—WHITE C—BLUE
K-3-4	36" LONG	60 TO 600	25 TO 60	A—RED B—BLUE C—BLACK
K-3-4S	36" LONG	60 TO 600	25 TO 60	A—RED B—BLACK C—BLUE
K-3-5	60" LONG (1' Sheath only)	60 TO 600	25 TO 60 (Oversized clips & Ins.)*	A—RED B—WHITE C—BLUE
K-3-7	50" LONG (normal sheathing)	60 TO 600	25 TO 60	A—RED B—WHITE C—BLUE
K-3-7S	50" LONG (normal sheathing)	60 TO 600	25 TO 60	A—RED B—BLUE C—GREEN
K-6	36" LONG	24 TO 480	400	A—RED B—WHITE C—BLUE
K-6-3 PANEL MOUNT	36" LONG	24 TO 480	400	A—RED B—WHITE C—BLUE
K-7	26" LONG (3 individual)	60 TO 600	25 TO 60	A+1—BLACK B+2—WHITE C+3—RED
K-7-1	36" LONG (3 individual)	60 TO 600	25 TO 60	A—RED B—WHITE C—BLUE
K-7-2	72" LONG (3 individual)	60 TO 600	25 TO 60	A—RED B—WHITE C—BLUE
K-7-3	50" LONG (3 individual)	60 TO 600	25 TO 60	A—RED B—WHITE C—BLUE
K-7-4	36" LONG (3 individual)	60 TO 600	25 TO 60	A+1—BLACK B+2—WHITE C+3—RED

*\*Oversized clip=40A; 3/4" Opening. Normal clip=20A; 5/8" Opening.*



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# POLYPHASE SOCKET TESTER

## K-281

### functionality

Knopp's K-281 Polyphase Socket Tester is designed to detect dangerous backfeed conditions, grounds, short circuits and wiring errors in either a 120/240, 120/208, or 277/480 volt meter socket. Also available in a Canadian Polyphase (347/600 volt).

It is equipped with high intensity Power Lights and Fault Lights to show whether or not the meter is safe to set. The Polyphase Socket Tester also comes with a heavy duty handle for quick and easy installation.



### specifications

- 120/240 meter socket
- 120/208 meter socket
- 277/480 meter socket
- 347/600 Canadian Polyphase
- Sturdy handle for easy removal
- 6 jaw design
- UV stabilized plastic
- UL 94-5 VA Flame Rating
- Fiberglass reinforced polycarbonate





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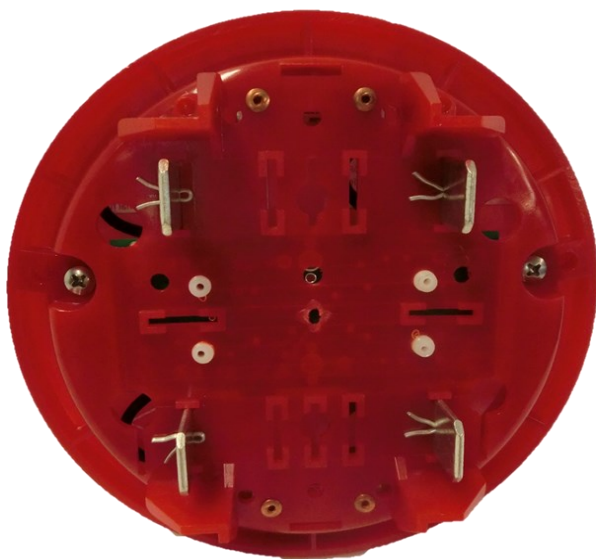
# SINGLE PHASE SOCKET TESTER

## K-280

### functionality

Knopp's K-280 Single Phase Socket Tester is designed to detect short circuits, backfeed and wiring errors in a 120/240 volt, 3-wire, single phase self-contained meter socket.

This unit is equipped with high intensity Power Lights and Fault Lights to show whether or not the meter is safe to set. It also comes with a heavy duty handle for quick and easy installation.



### specifications

- 120/240 Volt
- Sturdy handle for easy removal
- 4 jaw design—2S Meter Form
- UV stabilized plastic
- UL 94-5 VA Flame Rating
- Fiberglass reinforced polycarbonate

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# TEMPORARY POWER OUTLET

## K-271, K-272, K-273

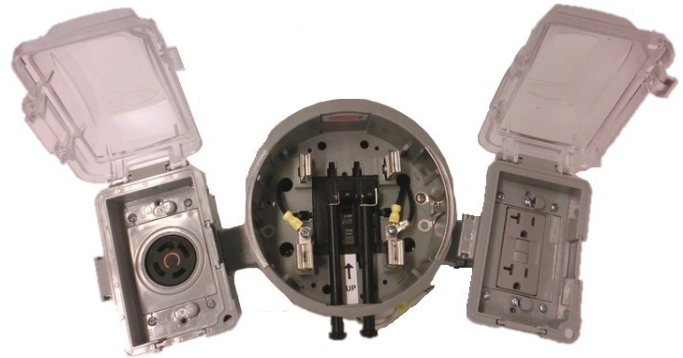
### functionality

Knopp's Temporary Power Outlets are an easy and safe solution for construction sites or other areas where power is not easily accessible. The device provides temporary electric service by isolating power from the breaker panel.

Easy-to-use and versatile, Knopp's Temporary Power Outlet eliminates the need for portable generators and can be used for motor homes, travel trailers, marine shore power, construction sites, and solar pump stations. Emergency situations such as hurricane restoration, storm outages and fire damage can also utilize this device.

Configurations available for either Ring (R) or Ringless (RL) style meters. Optional Power on Indicator Light, and optional kit available that includes a jumper cover for added safety.

***Meets all ANSI and UL dimension requirements for meter sockets.***



### specifications

- UL Listed Components
- UV Stabilized plastic, UL 94-5VA Flame Rating
- Weatherproof
- Reusable
- Lockable receptacle cover
- NEMA GFCI Duplex Outlets or Twist Lock Outlets
- 20A or 30A internal circuit breaker with external reset
- Isolated Load Side Jaw Blades (no power is provided to load side of meter socket)
- Protection of meter with proven surge ground system
- Adapter, breakers and 20 amp GFCI outlets housed in a strong fiberglass reinforced polycarbonate housing
- Safer ground-fault and overcurrent protected electric service
- 200A meter adapter can be fitted with either a meter or a jumper
- Optional kit available for each model that includes a TESCO Cat. 277 Jumper Cover.

Model Numbers	Description
<b>K-271-R</b> <b>K-271-RL</b>	NEMA L14-30R Twist Lock and GFCI 20amp Standard 520 Receptacle
<b>K-272-R</b> <b>K-272-RL</b>	(2) GFCI 20amp Standard 520 Receptacle
<b>K-273-R</b> <b>K-273-RL</b>	Trailer/Motor Home hookup and GFCI 20amp Standard 520 Receptacle



# THIRD RAIL VOLTAGE TESTER 4E2-1

## description

The Knopp 4E2-1 Third Rail Voltage Tester is designed to detect electrical potential (voltage) between the third rail and ground on high voltage electrified transit systems. Two, redundant neon bulbs are used to indicate the presence of voltage.

Features of the 4E2-1 include:

Can be used on AC or DC

Can be used up to 1500 volts

Can span a distance of up to four (4) feet

Uses a dual neon lamp principle for double safety protection

The prod handle and the tester housing are both made from moisture- and oil-resistant laminated phenolic. The prod tips are made from stainless steel. The tester housing includes a rubber hand guard to guide the operator in proper placement of his or her hand. There are no exposed metal parts other than to the two prod tips. All internal connections are soldered.

The Third Rail Tester uses two independent circuits to detect the presence of voltage. This provides double safety protection for the operator. The neon indicating lamps are mounted in specially shielded cavities within the instrument so that the neon glow indication can be unmistakably seen – even under the most adverse conditions of bright, direct sunlight on the instrument during tests.

The 4E2-1 Third Rail Tester was originally developed for the BART (Bay Area Rapid Transit) System in San Francisco/Oakland, CA. It has since gained wide acceptance as a reliable instrument for use in detecting the presence of third rail voltage.

## specifications

dimensions: overall length: 48" (122 cm)  
tester housing: 20" (50.8 cm) long and 1.25" (3.20 cm) diameter  
prod handle: 8" (20.3 cm) long and 0.625" (1.60 cm) diameter

weight: 12 ounces (0.34 kg)

maximum voltage: 1500 volts

frequency: DC through 60 Hz.

maximum current draw: <4 milliamperes at 1500 volts



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