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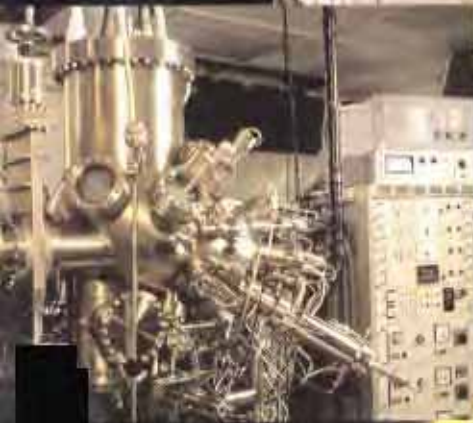


# STACO ENERGY<sup>®</sup> PRODUCTS CO.

Your Tailored Power Solutions Provider™

# Variable Transformer Voltage Controls

## 0.24 to 1500 kVA



# Table of Contents

Introduction and How to Specify and Order .....	1
Product Design and Engineering Data .....	2
Schematics and Wiring Diagrams .....	8
Product Sections by Series	
100/200 Series .....	10
500 Series .....	12
1000/1200 Series .....	14
1500 Series .....	18
2500 Series .....	20
5000 Series .....	22
6000 Series .....	30
Isolated Series .....	35
Enclosed Cord and Plug	
3PN Series .....	36
L Series .....	37
Variable Transformer Controllers	
FRC-20 Full Range Controller .....	38
Type MP Microprocessor Controller .....	39
"Quick Step" Motorized Variable Transformers .....	40
Paralleling Chokes .....	40
<i>Product Quick Selector</i> .....	41





# Introduction

STACO Energy Products Co. has been a leading manufacturer of Variable Transformers for over 60 years, building standard as well as custom-designed products for industrial, commercial, and military applications.

STACO's complete line of variable transformers and AC voltage controls are available from a nationwide network of industrial and scientific distributors. Local STACO distributors and representatives have factory trained personnel capable of assisting you in selecting the transformer best suited for your application. Contact our customer service department for the name of the distributor or representative near you.

If our standard products do not meet your specific requirements, contact us at STACO. Our engineering staff is available to solve your special application requirements. Often, it

just requires minor revisions to standard components, enabling STACO to keep your costs to a minimum.

## How to Order and Specify

Selecting the STACO Variable Transformer best suited for your specific requirements is easy once you make the following basic determinations:

**Input** — Line voltage? Single or three phase? Frequency?

**Output** — Voltage? Amperage? KVA?

To assist you in making the proper selection, an explanation of STACO's standard numbering system is described below. The Product Quick Selector, a tabular listing by rating for each product, starts on page 41.

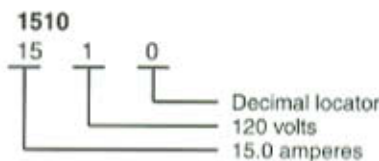
## STACO Numbering System

The basic single units (open construction) are identified by 3 or 4 digits, i.e., 501-B, 1010B, 5021, etc. The first two digits designate current; the third, voltage; the fourth is simply a decimal locator.

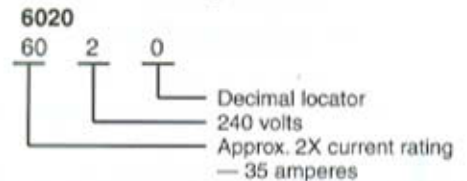
1. In a 3 digit number, the first digit indicates amperes; the second indicates the additional fraction of amperes, the third indicates voltage.



2. In a 4 digit number where the third digit is 1, the first two digits indicate amperes, the third designates 120 volts.



3. In a 4 digit number where the third digit is 2, the first two digits are twice (approximately) the amperes, the third designates 240 volts.

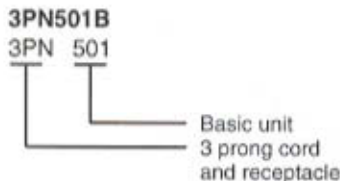


## Prefixes & Suffixes

STACO Variable Transformers are available in many different configurations. These other models can be identified by adding the following prefixes or suffixes to the basic 3 or 4 digit numbers.

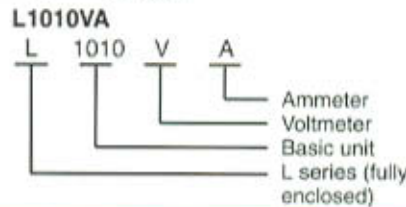
### Prefixes

5M	} "5," etc. — speed in seconds of travel
15M	
30M	
60M	M — motorized
3PN	3 prong cord and receptacle
J	Isolated unit
L	L series (fully enclosed)



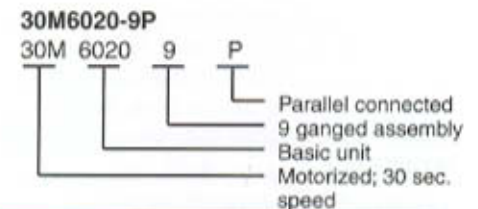
### Suffixes

— 2 thru	Ganged units "-2," 2 gang, etc.
— 27	
— A	Ammeter
— C	Cased
— D	Delta connected
— E	Nema 1 drip-proof enclosure
— G	Military
— H	400 Hertz
— K	Less knob



### Suffixes continued

— N	Less dial
— P	Parallel connected
— PS	Parallel series, connected
— S	Series connected
— T	Terminal box
— V	Voltmeter
— W	Wattmeter
— Y	Wye connected



## 120 Volt Series Unit Ratings

SERIES	MAX. CONSTANT CURRENT	AMPERES* CONSTANT IMPEDANCE
171	1.75	2.2
201	2.0	2.5
221-B	2.5	3.2
291	3.0	3.5
501-B	5.0	7.0
1010B	10.0	13.0
1210B	12.0	15.0
1510	15.0	20.0
2510	25.0	30.0
5011	50.0	—
6011	60.0	—

\* Nominal ratings. Consult each catalog Series for detailed specifications.

## 240 Volt Series Unit Ratings

SERIES	MAX. CONSTANT CURRENT	AMPERES* CONSTANT IMPEDANCE
252	0.8	1.0
1020B	3.5	5.0
1220B	5.0	7.0
1520	9.5	12.0
2520	10.0	13.0
5021	28.0	—
6020	35.0	—

\* Nominal ratings. Consult each catalog Series for detailed specifications.

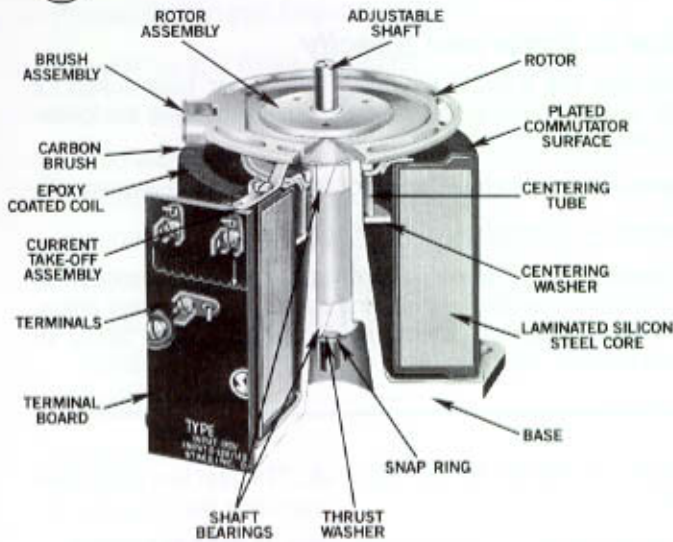
## Dimensions

Dimensions are provided throughout this catalog in inches [millimeters].





Listed by the Canadian Standards Association  
File No. LR18948



Type 1010B Cutaway

## General Information

STACO ENERGY PRODUCTS CO. is a leading manufacturer of variable transformers, the most versatile and reliable voltage controls available. Variable transformers have many industrial and laboratory applications as basic components to control voltage, current, power, heat, speed, light, and electromechanical force.

A basic STACO Variable Transformer consists of a single layer, magnet wire, winding on a toroidal core of laminated silicon steel. A carbon brush, connected to an output lead, is rotated over a precision ground, plated commutator track to tap off voltage at any turn from zero to the maximum output voltage of the winding.

STACO research has developed design features and proprietary processes providing longer lasting, more reliable products. Particularly important is the high-temperature foundation material bonding the coil securely to the core assembly. This material, which has a high thermal transfer characteristic, dissipates heat from the brush contact area, increases the heat-distribution of the core itself and provides the transformer with greater tolerance to transients and short-term overloads.

### VOLTAGE RATINGS

Basic single STACO Variable Transformers are rated either 120 volts or 240 volts. Higher voltage requirements are met by combining or ganging 120-volt or 240-volt units. A 480-volt, single-phase application can be met with two 240-volt variable transformers ganged in a series connection. In three-phase applications, three 120-volt units are ganged in a wye connection to result in a 240-volt line-to-line three-phase assembly. Similarly, three 240-volt units are ganged in a wye connection to result in a 380-volt or a 480-volt line-to-line three-phase assembly. In each of these instances, the individual transformers, or coils, are identified with the basic voltage rating, either 120 volts or 240 volts. When variable transformers are connected in open delta for three-phase applica-

tions, two 120-volt units are ganged for 120-volt line-to-line usage. For 240-volt open delta applications, two 240-volt units are ganged with the open delta assembly. In any of the above voltage applications, higher current requirements are met by paralleling two or more units in the ganged assembly.

### EFFICIENCY & REGULATION

In contrast to inefficient, wattage-burning resistive-type controllers such as rheostats, STACO Variable Transformers have an extremely low power loss and efficiencies as high as 98%.

STACO Variable Transformers deliver any desired voltage (within the transformer rating) with negligible variation in output voltage from no-load to full-load current. Voltage drop tables and a sample regulation curve are provided in this section.

### DISTORTIONLESS VOLTAGE CONTROL

STACO Variable Transformers produce an accurate transfer of input wave to output circuit, providing distortionless voltage control (a requisite of many sophisticated electronic applications).

### PLATED COMMUTATOR SURFACE

The commutator surface of each coil is specially plated with precious metal, giving STACO commutators longer life, increased resistance to corrosion and the capacity to withstand greater overloads (while maintaining a constant contact voltage drop).

### SIMPLE INSTALLATION AND CONNECTION

Mounting and hook-up of STACO units is convenient and easy. Most series units are designed with an adjustable shaft to accommodate either bench or panel mount (adjustable to accommodate varying panel thickness). Terminals are easily accessible: screw, lug, quick-connect or solder design. Connections deliver increasing output voltage with either clockwise or counter-clockwise knob rotation. Manually operated units have standard dials graduated 0-100 (percentage of output voltage).

### LONGER LIFE WITH NEGLIGIBLE MAINTENANCE

Precise design assembly of the brush (at a constant pressure to a smoothly finished and securely bonded commutator surface) provides excellent mechanical performance, long life, and low-driving torque. Brush replacement is seldom needed, but it is easily performed. High safety margins of voltage, current-carrying capacity and dielectric strength are why you can expect longer life from STACO Variable Transformers.

### SMOOTH AND LINEAR VOLTAGE CONTROL

STACO Variable Transformers are designed with a fraction of a volt per turn. Close adjustment of output voltage is easy because the brush always contacts one or more turns. Coil turns are evenly spaced, and output voltage is proportional to angular rotation. Full angular travel is approximately 320 degrees on all Series.

### VOLTAGE DOUBLER (DUAL INPUT)

Most 240-volt models have an additional input voltage tap permitting normal overvoltage output, with half normal input voltage. The output current must be reduced when the output voltage exceeds 125% of the input voltage as shown in Fig. B on page 6.



## TEMPERATURE & RATING

The low loss of STACO Variable Transformers allows operation at full current rating @ ambient temperatures up to 50 degrees C (122 degrees F). In locations above this temperature, the output current must be reduced according to Fig. A on page 6. On single-transient loads and on-off cycled loads, output currents up to 10 times normal may be carried for brief intervals, as shown in Fig. C on page 6.

## MILITARY SPECIFICATIONS

All STACO Variable Transformer models are available on special order to meet certain military specifications. Typical of the requirements which can be met are:

ALTITUDE	PHENOLIC PARTS
CONNECTING WIRE	SHOCK
CORROSION	VIBRATION
HUMIDITY	

## RUGGED MECHANICAL CONSTRUCTION

STACO Variable Transformers are precision built to exacting mechanical tolerances using the finest materials available. Quality assurance inspections are performed to insure that the high designed-in quality is maintained throughout the manufacturing cycle. A STACO Variable Transformer provides accurate, reliable and lasting voltage control for a broad variety of applications.

## General Definitions

The following words or phrases are commonly used to describe characteristics of STACO Variable Transformers.

**INPUT VOLTAGE:** The supply voltage to which a STACO Variable Transformer is connected.

**FREQUENCY:** All units in this catalog operate in the range of 50 to 60 HERTZ unless otherwise noted. These units may be used on higher frequencies within the limits shown in the tabulations in the section "Operation at Higher Frequency," page 5.

**OUTPUT VOLTAGE:** The range of voltage available at the output terminals.

**CURRENT RATING TERMINOLOGY:** To permit maximum utilization of STACO Variable Transformers, output ratings are given for both constant current and constant impedance loads.

**CONSTANT CURRENT RATING:** Output current that can be carried regardless of output voltage setting. (Reduce, for output above 125% of input voltage, on voltage doubler connection.)

**CONSTANT IMPEDANCE RATING:** Output current that can be carried with loads such as incandescent lamps or resistance heaters in which the current drawn is approximately proportional to the applied voltage, increasing to maximum current at line voltage. This rating applies only to applications where maximum output voltage is limited to line voltage.

**KVA RATING:** The maximum output current at maximum output line voltage multiplied by that maximum voltage and

divided by 1000 for single phase. Divide by 577 for three phase ( $1000/\sqrt{3}$ ).

**OVERVOLTAGE CONNECTION:** Output voltage from zero to 17% above line voltage (10% for 171 through 291 Series).

**LINE VOLTAGE CONNECTION:** Output voltage from zero to line voltage.

**VOLTAGE DOUBLER CONNECTION:** Unit gives full over-voltage output with half normal input voltage. Available on most 240- and 480-volt units. Reduce output current when output voltage exceeds 125% of input voltage.

**REGULATION:**

$$\frac{VNL - VFL}{VNL} \times 100 \text{ (percent)}$$

VNL = Output Volts No Load  
VFL = Output Volts Full Load

**DRIVING TORQUE:** Torque required to turn the STACO Variable Transformer shaft.

**ROTATION:** Rotation of STACO Variable Transformer shaft gives increase in output voltage (as viewed from referenced end).

**SINGLE UNIT TAP AND TERMINAL DIAGRAM:** Input connection is shown for normal overvoltage output. Optional line voltage and voltage doubler input are indicated. Winding section voltages are for a normal overvoltage (or voltage doubler) connection at input voltage shown. Line voltage connections give 85% of these voltages (90% on 171 through 291 Series). Cased units with line cord may omit several coil taps.

**CONNECTION — SINGLE PHASE UNIT:** Terminals are provided on most models for zero to 117% of input voltage (over-voltage connection) and zero to 100% of input voltage (line voltage connection).

**CONNECTION — SINGLE PHASE PARALLEL:** Up to nine units on the same shaft may be paralleled by using suitable chokes and circuits to multiply the current and KVA rating. Parallel operation of smaller ganged units is not recommended because it is usually more economical to handle rated loads with the capacity of larger single units. (See specification charts in each transformer series section.)

**CONNECTION — SINGLE PHASE SERIES:** By jumpering the common connections, two equal single units (or two equal groups of paralleled units) driven by the same shaft may be used at double voltage (line-to-line) in single phase series with external connection only to the input and output terminals. The load must be grounded. If an input neutral is connected to the common, an output neutral may be used. Transformer or loads need not be balanced to neutral.

**CONNECTION — THREE PHASE OPEN DELTA:** By jumpering the common connections, two equal single units (or two equal groups of paralleled units) driven by the same shaft may be used at normal voltages (line-to-line) in three phase open delta. One power line, identical on input and output, connects to the common. The other input lines connect to the two input terminals, and the two output terminals feed the other output lines. (This connection is the same as single phase series with neutral, except that here voltages on all input line pairs are equal and out of phase.)



# Product Design & Engineering Data

**CONNECTION — THREE PHASE WYE:** By jumpering the common connections, three equal single units (or three equal groups of paralleled units) driven by the same shaft may be used at double voltages (line-to-line) in three phase wye. The load must be ungrounded. Input lines connect to the three input terminals, and the three output terminals feed the output lines. If ganged units are used in a system that ordinarily has a common neutral or ground between source and load, then the neutral or ground must also be connected to the common point of the ganged variable transformer assembly. If the system has no neutral, then the loads must be balanced. Because of the 115.5% voltage on the individual single units, there are 50 HERTZ restrictions. See specifications for each Series.

**BENCH MOUNTING:** Mounting of STACO Variable Transformers on floor, bench, or wall where the knob and brush rotors of single units (and most multiple units) are at the same end of the coils.



**CASED MODELS:** All 1010B to 6020 Series models are available in cased designs (identified by the suffix "C," "CT" or "E" in the type number). "C" styles enclose only the coil, while "CT" models provide protective housing for both coil and terminal board. Knockouts are provided in the terminal board housing to accommodate conduit or cable connections. "E" styles include our NEMA 1, drip-proof, fully front accessible enclosures for our 5000/6000 Series.



**BACK OF PANEL MOUNTING:** Mounting of STACO Variable Transformers with shaft passing through a panel. The knob and brush rotors of single units (and most multiple units) are at opposite ends of the coils.

**ISOLATED VARIABLE TRANSFORMERS:** An Isolated Variable Transformer consists of two (primary and secondary) magnet wire windings on a toroidal core. The primary winding is electrically isolated from the secondary winding. The input winding has 82% of the turns of the output winding so the output voltage can be varied from 0-122% of the input voltage.

**UNCASED (OPEN CONSTRUCTION) MODELS:** The basic models of all series are uncased designs. The type number contains no prefix or suffix letter. These models do not have a protective housing for coil or terminal board. Adjustable shaft design on most manually operated models permits back-of-panel or bench mounting.



**PORTABLE CORD & PLUG MODELS:** Cased plug-in models have a ventilated steel case, line cord, receptacle, illuminated on/off switch and fuse. A three-conductor (3PN prefix) line cord and matching receptacle are available on these units. Plug-in models are connected for output voltage in a clockwise rotation and are available in each Series through the 2510/2520 units.



**L SERIES:** A selected grouping of variable transformers packaged in a deluxe aluminum enclosure, three-conductor line cord, plug, matching receptacle, pilot light, switch and fuse. An ammeter and voltmeter are available on the 10 amp model.



## General Design Specifications

The table below lists general design values for each standard unit on a per coil basis. The DC resistance is as measured from start to finish of coil winding, no load losses are actual core losses, and the torque values are the driving torque required to move the rotor and brush assembly. Using per coil values listed, total DC resistance and core losses can be calculated for parallel or series connected ganged units, and total torque requirements can be determined.

Type	Coil DC Res. (Ohms)	Per Coil Value No Load 60 Hz Losses (Watts)	Driving Torque (oz-in)
171	23.6	1.5	6 max
201	23.8	1.5	6 max
221-B	14.5	1.8	6 max
252	115	2.0	6 max
291	8.0	2.2	6 max
501-B	4.4	3.0	10-30
511	4.4	3.0	10-30
1010B	1.2	5.4	15-35
1020B	11.4	5.2	15-35
1210B	0.6	6.4	15-35
1220B	4.4	6.4	15-35
1510	0.3	13.2	15-35
1520	1.4	18.0	15-35
2510	0.21	14.7	60 max
2520	1.7	14.5	60 max
5011	0.090	28.0	105-160
5021	0.353	28.0	105-160
6011	0.144	7.5	105-160
6020	0.478	7.5	105-160

### OPERATION AT HIGHER FREQUENCY

All STACO standard Variable Transformers are designed to operate within a frequency range of 50 to 60 Hertz unless otherwise noted. While designed to operate at 50/60 Hz, Staco Variables can be operated at frequencies up to 2000 Hz. The table below lists unit maximum output current rating at 50/60, 400, 1500, and 2000 HZ.

Type	Maximum Output Current (Amperes)							
	50/60 Hz		400 Hz		1500 Hz		2000 Hz	
	Constant		Constant		Constant		Constant	
	I	Z	I	Z	I	Z	I	Z
171	1.75	2.2	1.75	2.2	1.75	2.2	1.75	2.2
201	2.0	2.5	2.0	2.5	2.0	2.5	2.0	2.5
221-B	2.5	3.2	2.5	3.2	2.5	3.2	2.5	3.2
252	0.8	1.0	0.8	1.0	0.8	1.0	0.8	1.0
291	3.0	3.5	3.0	3.5	3.0	3.5	3.0	3.5
501-B	5.0	7.0	5.0	7.0	5.0	7.0	5.0	7.0
511	5.0	7.0	5.0	7.0	5.0	7.0	5.0	7.0
1010B	10.0	13.0	10.0	13.0	9.0	11.7	9.0	11.7
1020B	3.5	5.0	3.5	5.0	3.5	5.0	3.5	5.0
1210B	12.0*	15.0*	12.0	15.0	3.2	4.5	3.2	4.5
1220B	5.0*	7.0*	5.0	7.0	4.5	6.3	4.5	6.3
1510	15.0	20.0	12.5	17.0	5.0	7.0	5.0	7.0
1520	7.5	10.0	7.5	10.0	3.5	4.3	3.5	4.3
2510	25.0	30.0	18.6	30.0	9.0	11.5	9.0	11.5
2520	10.0	13.0	9.3	13.0	3.3	5.0	3.3	5.0
5011	50.0	—	22.5	22.5	—	—	—	—
5021	28.0	—	14.0	14.0	—	—	—	—
6011	60.0	—	25.0	25.0	—	—	—	—
6020	35.0	—	17.0	17.0	—	—	—	—

\* 60 Hz only

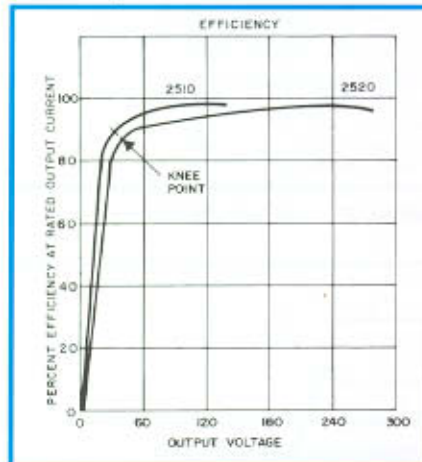
## EFFICIENCY

Efficiency curves are available from STACO or can be drawn similar to the efficiency curve shown below for any units by starting at zero, passing through the knee point, and reaching 98% efficiency at rated voltage.

### Knee Point Data

Model Number	% Efficiency	Volts
171	62	23
201	67	24
221-B	73	23
252	65	50
291	67	24
501-B	77	18
1010B/1210B	80	30
1020B/1220B	80	17
1510	86	10
1520	83	20
2510	90	30
2520	87	40
5011	82	27
5021	75	40
6011	87	30
6020	82	38

### Efficiency





## OUTPUT CURRENT LIMITS

Continuous brush output current of STACO Variable Transformers, at normal ambient temperatures, must be limited to the rated amperes. The constant current rating may be drawn at any brush position except in voltage doubler circuits.

For satisfactory life, the brush output current of STACO Variable transformers operated in hot enclosures, or other locations of high ambient temperature, must be limited as shown in Fig. A. Close exposure to radiant heat should be avoided or loading should be reduced accordingly.

For voltage doubler connections (at output voltages above 125 percent of the input voltage) the continuous brush output current must be progressively limited (as shown in Fig. B) down to 44 percent of rated amperes at maximum output voltage. Protection of this type of usage may be approximated with a dual-element lag fuse in the lead to the the input terminal and with either a quick or slow blow fuse in the brush output lead.

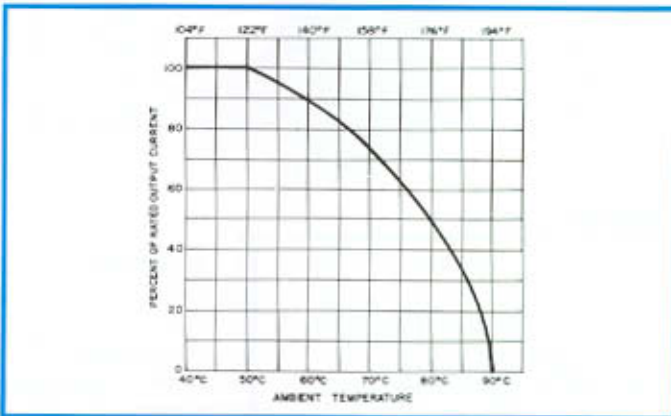


Figure A. Max output current for high temperature

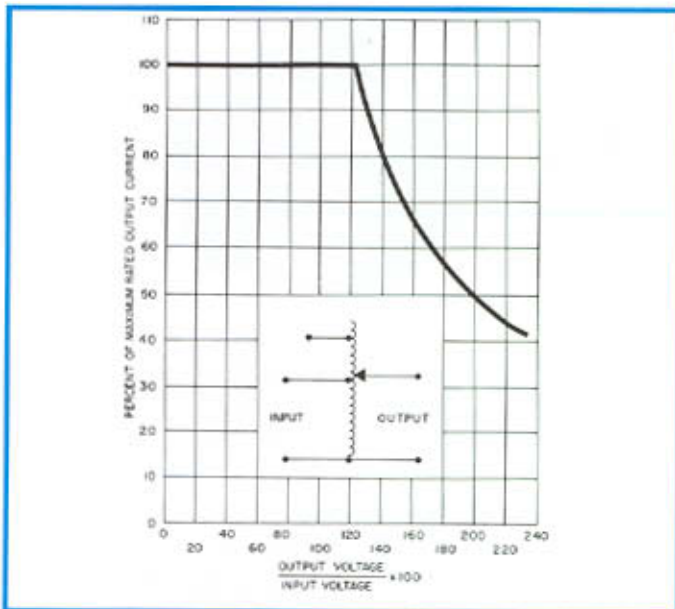


Figure B. Max Output Current — Dual Voltage

## SHORT-TIME CURRENT OVERLOAD

Although STACO Variable Transformers are small and light weight for the large power ratings which they handle, brush currents up to 10 times normal may be drawn for a brief time. The maximum on time curve of Fig. C shows the duration of surge on transient currents which may be absorbed by a cold unit on motor starting or similar service. Protection for this level of service may be approximated by hydraulic-magnetic circuit breakers with trip coil in the brush output lead. If the unit is hot from previous loading, such as repetitive overloads, it must also be allowed sufficient off time as indicated on the minimum off time curve of Fig. C to prevent excessive temperatures. If the time on is less than allowed by the "on" curve, the minimum time off may be reduced in accordance with the following equation:

$$\frac{\text{OFF TIME}}{\text{ON TIME}} = \left( \frac{\text{OVERLOAD CURRENT}}{\text{RATED CURRENT}} \right)^2 - 1$$

Protection for this level of service may be approximated by a dual-element lag fuse in the brush output lead.

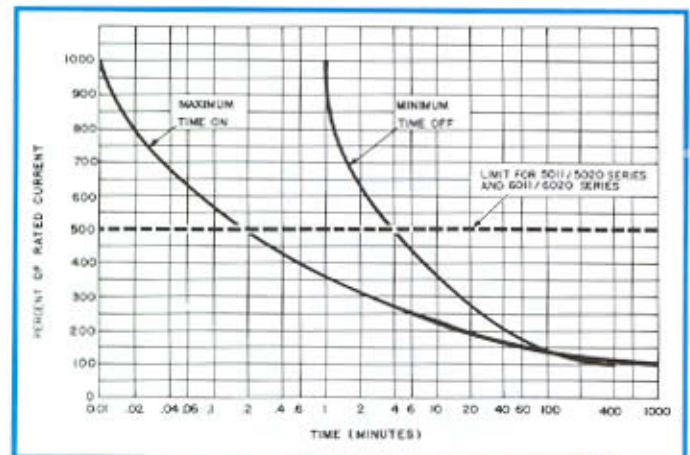


Figure C. Max On Time and Min Off Time for Various Overload Current Conditions

## MOTOR-DRIVEN VARIABLE TRANSFORMERS

Motor-driven models permit remote control of large amounts of power. A STACO motor-driven Variable Transformer can be installed in any out-of-the-way space and the control station placed where desired. Extreme flexibility in system design is possible because the control location does not have to accommodate the variable transformer assembly. Motor-driven units have the same electrical ratings as their corresponding manually-operated types.

The motor drive is a compact integral unit mounted on top of the assembly. On cased models, the motor-drive assembly is enclosed and is provided with knock-outs for cable or conduit connections. The permanent magnet synchronous motor operates on 120 volt, 50/60 Hertz single phase lines. Because synchronous motors are frequency sensitive, they operate slightly slower at 50 Hertz.





Standard motor-driven models are available in speeds of 5, 15, 30 and 60 seconds at 60 Hertz for full range travel from zero to maximum output voltage. A smooth, quiet planetary gear unit is used for proper speed reduction from the motor to

the STACO Variable Transformer shaft. Limit switch control at the lower and upper limits of travel prevents overtravel. The limit switches may be adjusted if desired. Additional limit switches may be added for operation and control of auxiliary circuits as required, STACO Auxiliary Switch Kit P/N 964-0057 (available separately).

To specify, prefix the desired time of travel in seconds, and the letter "M" for motor-drive to the Type number. For example: 5 seconds speed travel = 5M1010B.

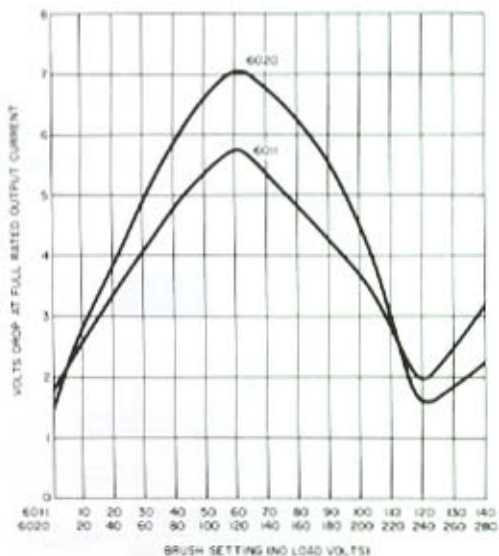
Normally, one switch is used to operate each Motor-Driven STACO Variable Transformer. Any momentary contact switch, whether lever action or push button, may be used. If desired, additional switches can be provided to permit control from any of several locations. Master control of two or more motor-driven units is also possible using relays or multiple-pole switches.

### TYPE FRC-20 AND MP CONTROLLERS

For our Motor Operated Variable Transformers, we offer the FRC-20 and MP Controllers, which both position and regulate the variable transformer. For complete information refer to section on controller types, pages 38 and 39.

### Regulation

These tables provide the voltage drop at selected points at the corresponding model's regulation curve. This is the variation in the output voltage from no-load to full-load current. A sample regulation curve for the 6000 Series is illustrated below.



### 120 Volts - Voltage Drop At Full Rated Output Current

Type	Brush Setting (No Load Volts)						
	0	20	40	60	80	100	120
171	0.2	4.2	7.1	8.5	7.0	4.0	0.2
201	0.2	4.9	7.8	9.0	7.5	4.2	0.3
221-B	0.3	3.0	5.1	6.0	5.0	2.9	0.3
291	0.4	2.5	4.1	5.2	4.2	2.3	0.4
501-B	0.3	3.9	5.2	5.8	5.2	4.0	0.3
511	0.3	3.9	5.2	5.8	5.2	4.0	0.3
1010B	0.2	2.8	4.2	4.5	4.2	3.0	0.8
1210B	0.2	1.3	1.8	2.0	1.8	1.4	0.4
1510	0.1	0.8	1.4	1.7	1.5	0.9	0.2
2510	0.5	1.8	2.2	2.5	2.2	1.9	0.1
5011	3.0	4.2	4.8	5.4	5.2	4.1	3.0
6011	1.9	2.5	3.3	5.7	4.8	3.7	2.0

### 240 Volts - Voltage Drop At Full Rated Output Current

Type	Brush Setting (No Load Volts)						
	0	40	80	120	160	200	240
252	1.0	13.0	17.5	20.6	17.0	12.5	1.4
1020B	0.2	5.4	6.7	7.0	6.5	5.0	0.4
1220B	0.2	4.5	5.8	6.1	5.6	4.3	0.4
1520	0.2	2.2	3.6	4.0	3.3	2.1	0.3
2520	0.5	4.2	5.2	5.5	5.2	4.2	0.4
5021	2.5	4.2	5.8	7.0	6.6	4.6	2.6
6020	1.4	3.9	5.9	7.0	6.2	4.5	1.6

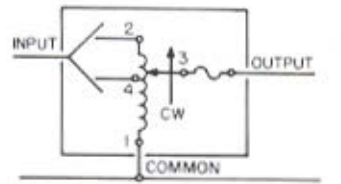


# Schematics and Wiring Diagrams

## General Wiring Information

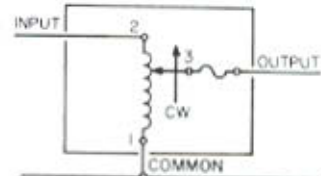
Common is used as the third leg in a three phase open delta or as neutral in a three wire single phase series and four wire, three phase wye connection. It is not used in two wire series or three wire wye connection.

If ganged units are used in a system that ordinarily has a common neutral or ground between source and load, the neutral or ground must be connected to the common terminals of the variable transformer assembly. If the system has no neutral, the load must be balanced or the transformers will be damaged.



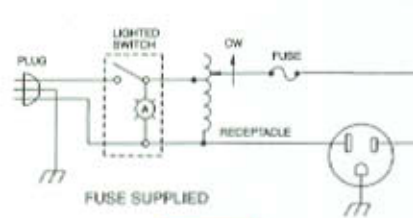
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1



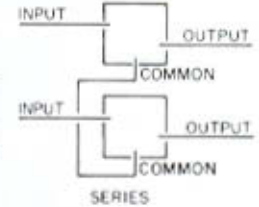
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2



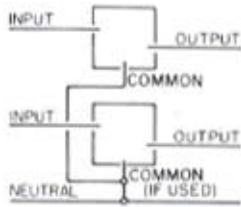
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3



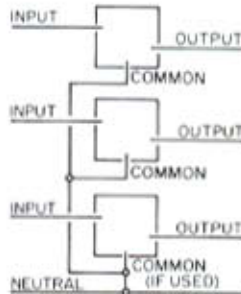
SERIES

4



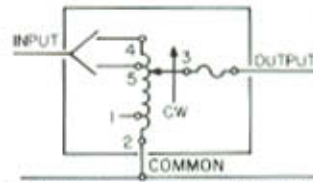
THREE PHASE OPEN DELTA

5



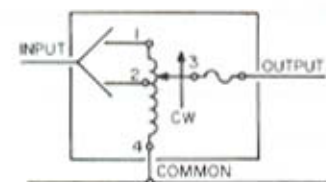
THREE PHASE WYE

6



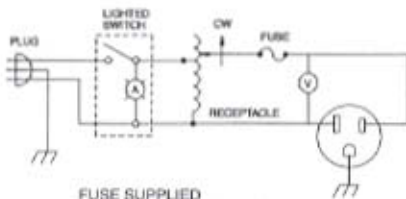
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7



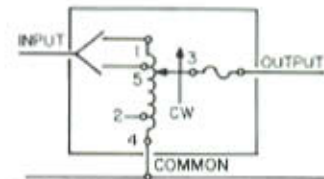
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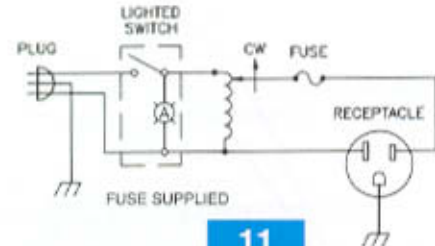
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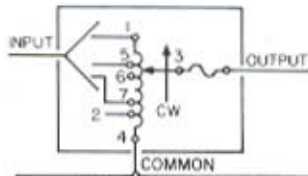
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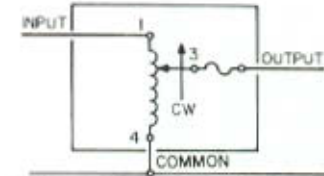
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11



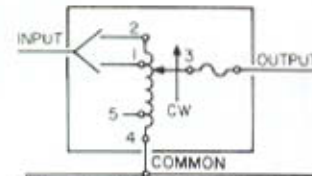
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12



FUSE RECOMMENDED BUT NOT SUPPLIED.

13

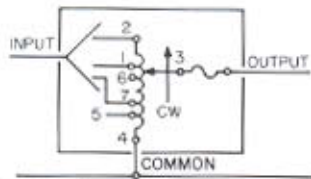


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14

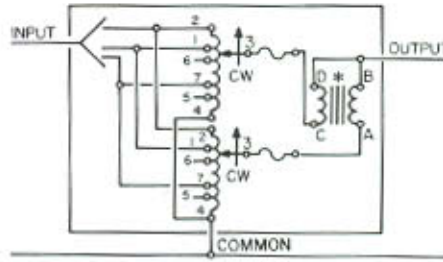


# Schematics and Wiring Diagrams



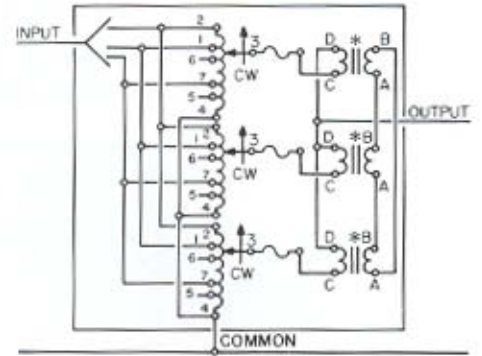
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**15**



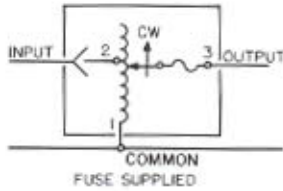
\* PARALLELING CHOKE FOR 2510-51LAC  
 \* PARALLELING CHOKE FOR 2520-52LAC  
 TERMINALS #6 AND #7 OMITTED ON 2510  
 FUSE RECOMMENDED BUT NOT SUPPLIED.

**16**



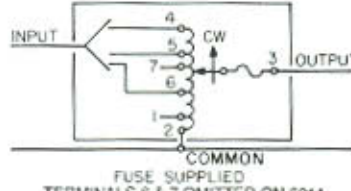
\* PARALLELING CHOKE FOR 2510-51LAC  
 \* PARALLELING CHOKE FOR 2520-52LAC  
 TERMINALS #6 AND #7 OMITTED ON 2510  
 FUSE RECOMMENDED BUT NOT SUPPLIED.

**17**



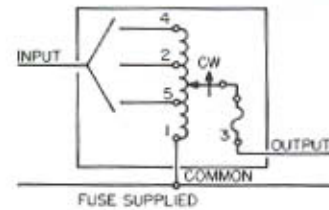
FUSE SUPPLIED

**18**



FUSE SUPPLIED  
 TERMINALS 6 & 7 OMITTED ON 6011.

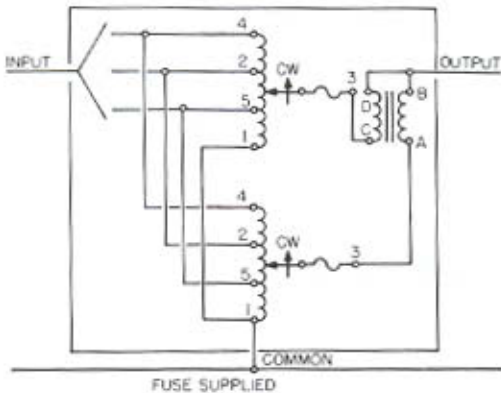
**19**



FUSE SUPPLIED

Terminals 4 and 5 omitted on 5011 Series  
 Terminal 5 omitted on 6011 Series

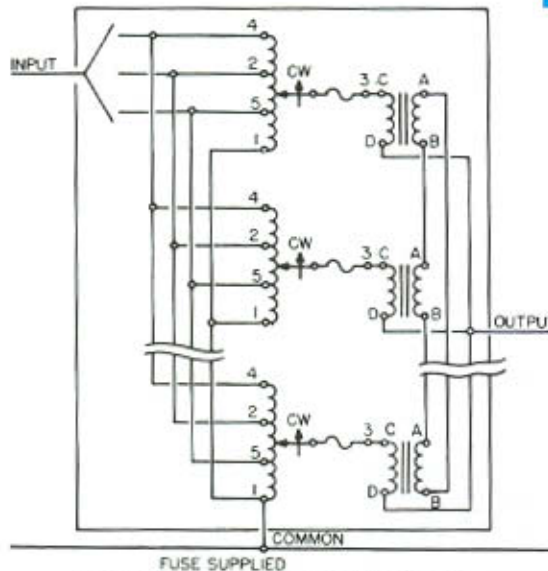
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FUSE SUPPLIED

Terminals 4 and 5 omitted on 5011 Series  
 Terminal 5 omitted on 6011 Series

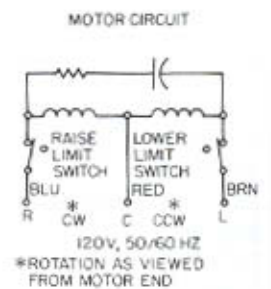
**21**



FUSE SUPPLIED

Terminals 4 and 5 omitted on 5011 Series  
 Terminal 5 omitted on 6011 Series

**22**



**23**



# 100/200 Series

These manually operated panel mounted units are available in single and three phase models from 0.8 to 3.0 amperes. The 171, 201, 221-B and 291 units operate from 120 volt input, while the 252 unit operates from a 240 volt input. STACO's coil tapping arrangement permits an output voltage from 0 to line

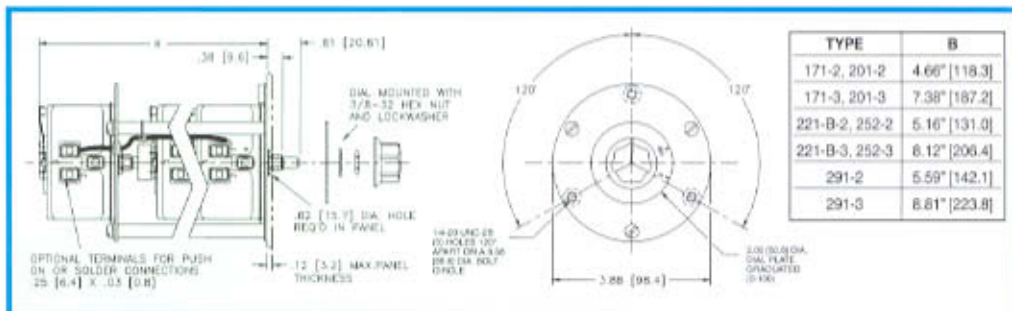
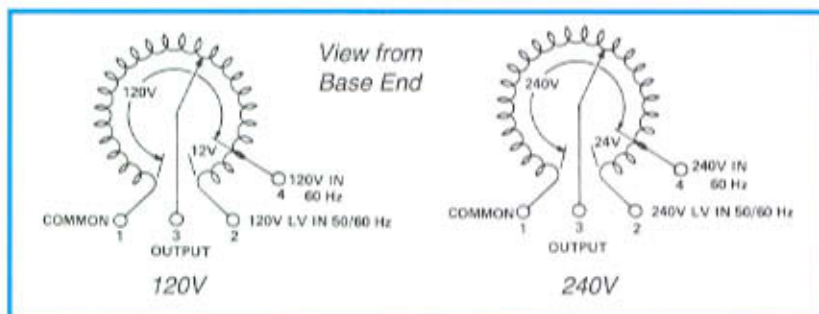
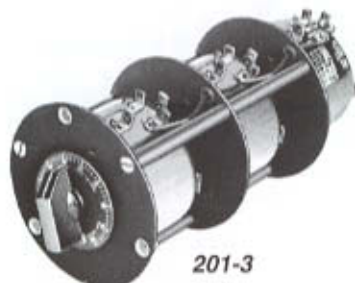
voltage in either the clockwise or counterclockwise direction and from 0 to 10% above line voltage in the clockwise direction. Two and three ganged, manually operated units are available for increased single phase voltage ratings and for three phase applications.

PART NO.	WIRING	INPUT		OUTPUT				SHAFT ROTATION FOR VOLTAGE INCREASE	TERMINAL CONNECTIONS (For increasing Voltage) As Viewed from Base End			SCHE-MATIC (Pg 8 & 9)	NET WT. LBS.	
		VOLTS	HERTZ	VOLTS	CONSTANT CURRENT LOAD		CONSTANT IMPEDANCE LOAD		Input	Jumper*	Output			
					MAX AMPS	MAX KVA	MAX AMPS							MAX KVA
171	Single Phase	120	50/60	0-120	1.75	0.21	2.2	0.26	CW	1-2	—	1-3	1	2
			60	0-132	1.75	0.23	—	—	CCW	1-2	—	2-3		
171-2	Single Phase Series	240	50/60	0-240	1.75	0.42	2.2	0.53	CW	2-2	1-1	3-3	1 & 4	4 1/4
			60	0-264	1.75	0.46	—	—	CCW	1-1	2-2	3-3		
	Three Phase Open Delta $\pi$	120++	50/60	0-120	1.75	0.36	2.2	0.46	CW	2-1-2	1-1	3-1-3	1 & 5	4 1/4
			60	0-132	1.75	0.40	—	—	CCW	1-2-1	2-2	3-2-3		
171-3	Three Phase Wye $\pi$	240++	60	0-240	1.75	0.73	2.2	0.92	CW	2-2-2	1-1-1	3-3-3	1 & 6	6 1/2
									CCW	1-1-1	2-2-2	3-3-3		
201	Single Phase	120	50/60	0-120	2.0	0.24	2.5	0.30	CW	1-2	—	1-3	1	2
			60	0-132	2.0	0.26	—	—	CCW	1-2	—	2-3		
201-2	Single Phase Series	240	50/60	0-240	2.0	0.48	2.5	0.60	CW	2-2	1-1	3-3	1 & 4	4 1/4
			60	0-264	2.0	0.53	—	—	CCW	1-1	2-2	3-3		
	Three Phase Open Delta $\pi$	120++	50/60	0-120	2.0	0.42	2.5	0.52	CW	2-1-2	1-1	3-1-3	1 & 5	4 1/4
			60	0-132	2.0	0.46	—	—	CCW	1-2-1	2-2	3-2-3		
201-3	Three Phase Wye $\pi$	240++	60	0-240	2.0	0.83	2.5	1.04	CW	2-2-2	1-1-1	3-3-3	1 & 6	6 1/2
									CCW	1-1-1	2-2-2	3-3-3		
221-B	Single Phase	120	50/60	0-120	2.5	0.30	3.2	0.38	CW	1-2	—	1-3	1	2 1/2
			60	0-132	2.5	0.33	—	—	CCW	1-2	—	2-3		
221-B-2	Single Phase Series	240	50/60	0-240	2.5	0.60	3.2	0.77	CW	2-2	1-1	3-3	1 & 4	5 1/2
			60	0-264	2.5	0.66	—	—	CCW	1-1	2-2	3-3		
	Three Phase Open Delta $\pi$	120++	50/60	0-120	2.5	0.52	3.2	0.67	CW	2-1-2	1-1	3-1-3	1 & 5	5 1/2
			60	0-132	2.5	0.57	—	—	CCW	1-2-1	2-2	3-2-3		
221-B-3	Three Phase Wye $\pi$	240++	60	0-240	2.5	1.04	3.2	1.33	CW	2-2-2	1-1-1	3-3-3	1 & 6	8 1/4
									CCW	1-1-1	2-2-2	3-3-3		
3PN221B	Single Phase	120	60	0-132	2.50	0.33	—	—	CW	LINE CORD & RECEPTACLE			3	3
252	Single Phase	240	50/60	0-240	0.8	0.19	1.0	0.24	CW	1-2	—	1-3	1	2 1/2
			60	0-264	0.8	0.21	—	—	CCW	1-2	—	2-3		
252-2	Single Phase Series	480	50/60	0-480	0.8	0.38	1.0	0.48	CW	2-2	1-1	3-3	1 & 4	5 1/2
			60	0-528	0.8	0.42	—	—	CCW	1-1	2-2	3-3		
	Three Phase Open Delta $\pi$	240++	50/60	0-240	0.8	0.33	1.0	0.42	CW	2-1-2	1-1	3-1-3	1 & 5	5 1/2
			60	0-264	0.8	0.37	—	—	CCW	1-2-1	2-2	3-2-3		
252-3	Three Phase Wye $\pi$	480++	50/60	0-480	0.8	0.67	1.0	0.83	CW	2-2-2	1-1-1	3-3-3	1 & 6	8 1/4
			60	0-528	0.8	0.73	—	—	CCW	1-1-1	2-2-2	3-3-3		
									CW	4-4-4	1-1-1	3-3-3		

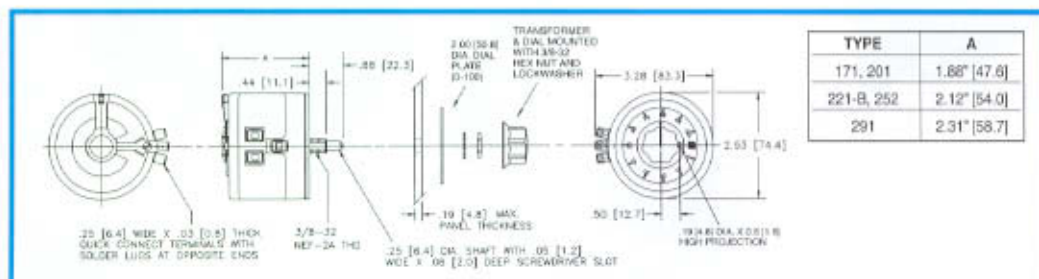


PART NO.	WIRING	INPUT		OUTPUT				SHAFT ROTATION FOR VOLTAGE INCREASE	TERMINAL CONNECTIONS (For increasing Voltage) As Viewed from Base End			SCHE-MATIC (Pg 8 & 9)	NET WT. LBS.	
		VOLTS	HERTZ	VOLTS	CONSTANT CURRENT LOAD		CONSTANT IMPEDANCE LOAD		Input	Jumper*	Output			
					MAX AMPS	MAX KVA	MAX AMPS							MAX KVA
291	Single Phase	120	50/60	0-120	3.0	0.36	3.5	0.42	CW	1-2	—	1-3	1	2 1/2
			60	0-132	3.0	0.40	—	—	CCW	1-2	—	2-3		
										CW	1-4	—		
291-2	Single Phase Series	240	50/60	0-240	3.0	0.72	3.5	0.84	CW	2-2	1-1	3-3	1 & 4	5 1/2
			60	0-264	3.0	0.79	—	—	CCW	1-1	2-2	3-3		
										CW	4-4	1-1		
	Three Phase Open Delta π	120++	50/60	0-120	3.0	0.62	3.5	0.73	CW	2-1-2	1-1	3-1-3	1 & 5	5 1/2
			60	0-132	3.0	0.69	—	—	CCW	1-2-1	2-2	3-2-3		
										CW	4-1-4	1-1		
291-3	Three Phase Wye π	240++	60	0-240	3.0	1.25	3.5	1.45	CW	2-2-2	1-1-1	3-3-3	1 & 6	8 1/4
									CCW	1-1-1	2-2-2	3-3-3		

- Jumper provided in the standard common position and should be moved or removed as required.
- ++ Line to line voltage
- π If ganged units are used in a system that ordinarily has a common neutral or ground between source and load, the neutral or ground must be connected to the common terminals of the variable transformer assembly. If the system has no neutral, the load must be balanced or the transformers will be damaged.



**Two and Three Gang Units**



**Single Unit**



# 500 Series

Versatility, compactness and durability are included in the many designed-in features of the STACO 501-B Series Variable Transformers. These transformers operate from 120 volt input lines and are rated at 5 amperes for constant current loads and 7 amperes for constant impedance loads at line voltage. The coil tapping arrangement permits output voltage of 0 to line voltage or 17% above line voltage on constant current line conditions. This unit's Faston® terminals are easily converted to screw connections with the terminal adapter kits supplied with each unit.

The STACO 511 is ideal for OEM applications with its panel mount, fixed shaft design and even smaller envelope than the

501-B. It can be single point or four point mounted. The four point mounting is the same as the 501-B.

Either unit can be operated from 50-2000 hertz without derating.

Motor driven units are available and identified by the prefix "M" in the type number. The synchronous motor is designed for operation on 120 volt, 50/60 Hertz single phase lines and draws approximately 0.3 amperes. If a motor driven model is ordered, be sure to prefix the part number with the desired travel time from 0 to maximum of 5, 15, 30, or 60 seconds.

PART NO.	WIRING	INPUT		OUTPUT				SHAFT ROTATION FOR VOLTAGE INCREASE	TERMINAL CONNECTIONS (For increasing Voltage) As Viewed from Base End			SCHE-MATIC (Pg 8 & 9)	NET WT. LBS.	(Max) MOTOR DRIVEN	
		VOLTS	HERTZ	VOLTS	CONSTANT CURRENT LOAD		CONSTANT IMPEDANCE LOAD		Input	Jumper*	Output				
					MAX AMPS	MAX KVA	MAX AMPS								MAX KVA
501-B M501-B+	Single Phase	120	50/60	0-120	5.0	0.60	7.0	0.84	CW	1-4	—	4-3	10	5 1/4	12
				0-140	5.0	0.70	—	—	CCW	1-4	—	1-3			
									CW	4-5	—	4-3			
									CCW	1-2	—	1-3			
501-B-2 M501-B-2+	Single Phase Series	240	50/60	0-240	5.0	1.2	7.0	1.68	CW	1-1	4-4	3-3	10 & 4	11 1/2	20
				0-280	5.0	1.4	—	—	CCW	4-4	1-1	3-3			
									CW	5-5	4-4	3-3			
									CCW	2-2	1-1	3-3			
	Three Phase Open Delta	120 ++	50/60	0-120	5.0	1.04	7.0	1.46	CW	1-4-1	4-4	3-4-3	10 & 5	11 1/2	20
				0-140	5.0	1-21	—	—	CCW	4-1-4	1-1	3-1-3			
									CW	5-4-5	4-4	3-4-3			
									CCW	2-1-2	1-1	3-1-3			
501-B-3 M501-B-3+	Three Phase Wyezt	240 ++	50/60	0-240	5.0	2.08	7.0	2.91	CW	1-1-1	4-4-4	3-3-3	10 & 6	15 1/2	26
			60	0-280	5.0	2.43	—	—	CCW	4-4-4	1-1-1	3-3-3			
								CW	5-5-5	4-4-4	3-3-3				
								CCW	2-2-2	1-1-1	3-3-3				
3PN501B	Single Phase	120	50/60	0-140	5.0 ‡	0.70	—	—	CW	LINE CORD & RECEPTACLE			3	7 3/4	
511	Single Phase	120	50/60	0-120	5.0	0.60	7.0	0.84	CW	1-4	—	4-3	8	4 1/2	
				0-140	5.0	0.70	—	—	CCW	4-2	—	4-4			

‡ Unit is fused for the constant current rating at the factory.

\* Jumper provided in the standard common position and should be moved or removed as required.

++ Line to line voltage

π If ganged units are used in a system that ordinarily has a common neutral or ground between source and load, the neutral or ground must be connected to the common terminals of the variable transformer assembly. If the system has no neutral, the load must be balanced or the transformers will be damaged.

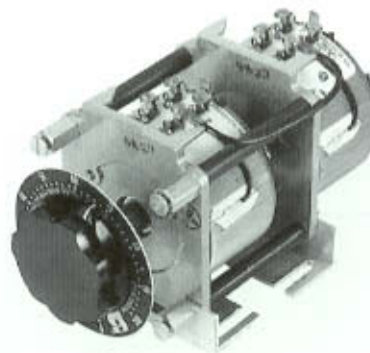
+ Motor driven units use terminal connections for CCW increasing voltage as viewed from the base end. See figure 23 on page 9 for motor wiring.



501-B



511

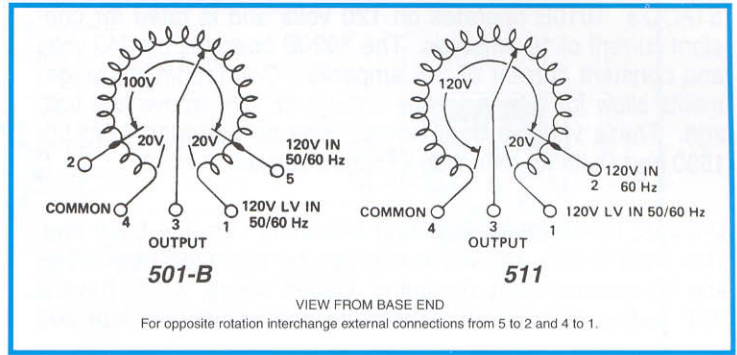
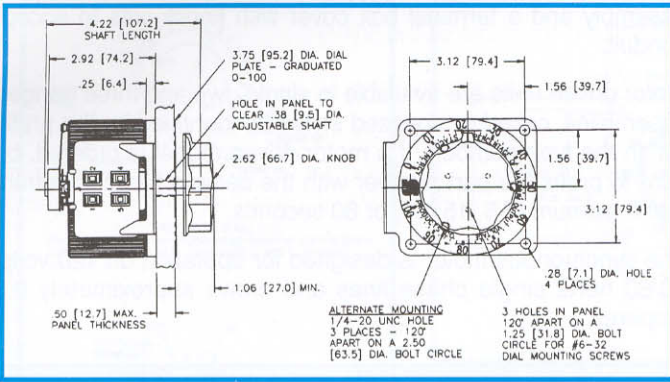


501-B-2

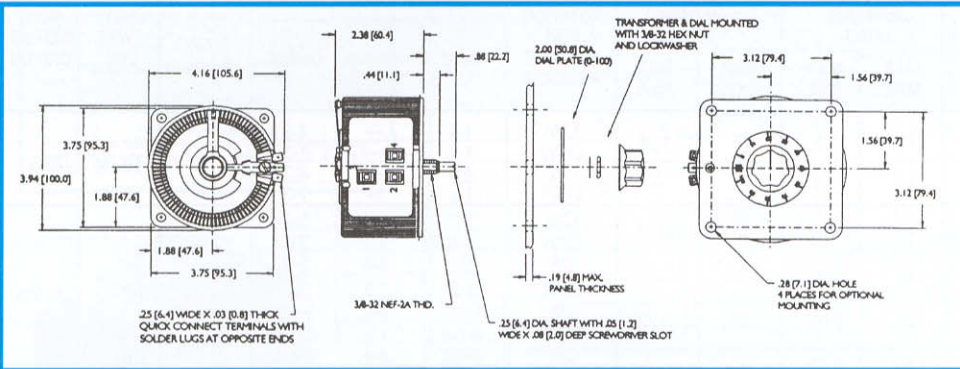


5M501-B

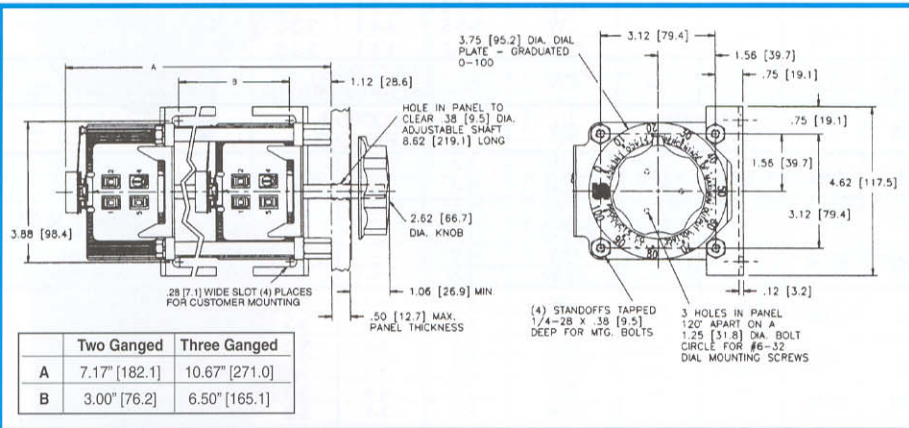
# 500 Series



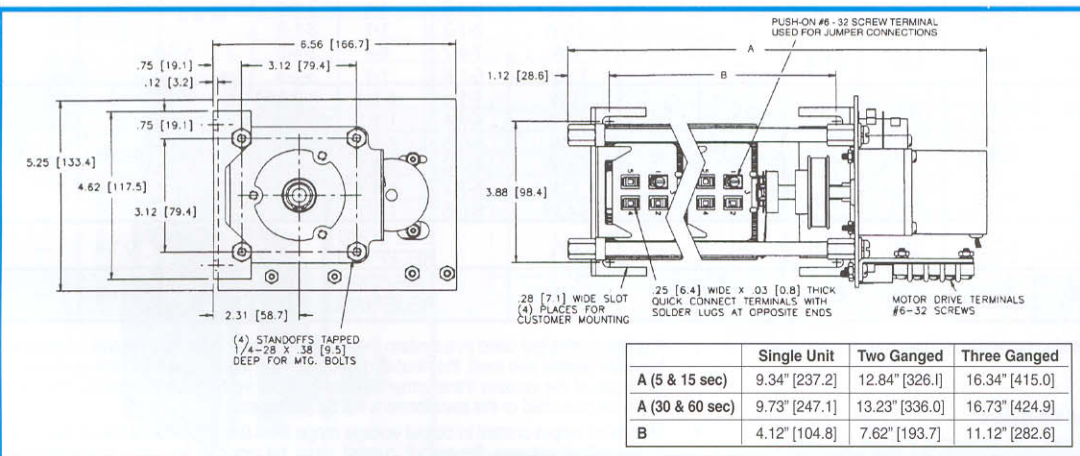
**501-B Single Unit**



**511 Single Unit**



**Two and Three Ganged, Manual**



**Motorized Single, Two and Three Ganged**



# 1000 Series

STACO's 1010B operates on 120 volts and is rated for constant current of 10 amperes. The 1020B operates on 240 volts and constant current of 3.5 amperes. Coil tapping arrangements allow for 0 to input line voltage or 17% above line voltage. These variable transformers may be operated from 50-1500 hertz with no reduction in output current.

Uncased models have the shaft extending from the base end. This shaft is fully adjustable and can be extended from either end for general utility mounting. Cased styles, which have a "CT" suffix, feature the protective screening over the coil

assembly and a terminal box cover with knock-outs to accept conduit.

Motor driven units are available in single, two and three ganged assemblies; cased or uncased styles as identified by the prefix "M" in the type number. If a motor driven model is ordered, be sure to prefix the part number with the desired travel time from 0 to maximum of 5, 15, 30, or 60 seconds.

The synchronous motor is designed for operation on 120 volts, 50/60 hertz single phase lines and draws approximately 0.3 amperes.

PART NO.	WIRING	INPUT		OUTPUT				SHAFT ROTATION FOR VOLTAGE INCREASE	TERMINAL CONNECTIONS (For increasing Voltage) As Viewed from Base End			SCHE-MATIC (Pg 8 & 9)	NET WT. LBS.	(Max) MOTOR DRIVEN				
		VOLTS	HERTZ	VOLTS	CONSTANT CURRENT LOAD		CONSTANT IMPEDANCE LOAD		Input	Jumper*	Output							
					MAX AMPS	MAX KVA	MAX AMPS								MAX KVA			
1010B 1010BCT M1010B† M1010BCT†	Single Phase	120	50/60	0-120	10	1.2	13	1.56	CW	1-4	—	4-3	10	10 1/4	16 3/4			
				0-140	10	1.4	—	—	CCW	1-4	—	1-3						
									CW	4-5	—	4-3						
									CCW	1-2	—	1-3						
1010B-2 1010BCT-2 M1010B-2† M1010BCT-2†	Single Phase Series	240	50/60	0-240	10	2.4	13	3.12	CW	1-1	4-4	3-3	10 & 4	22 1/2	30 7/8			
				0-280	10	2.8	—	—	CCW	4-4	1-1	3-3						
									CW	5-5	4-4	3-3						
									CCW	2-2	1-1	3-3						
	Three Phase Open Delta	120++	50/60	0-120	10	2.08	13	2.70	CW	1-4-1	4-4	3-4-3	10 & 5					
				0-140	10	2.42	—	—	CCW	4-1-4	1-1	3-1-3						
									CW	5-4-5	4-4	3-4-3						
									CCW	2-1-2	1-1	3-1-3						
1010B-3 1010BCT-3 M1010B-3† M1010BCT-3†	Three Phase Wye	240++	50/60	0-240	10	4.16	13	5.4	CW	1-1-1	4-4-4	3-3-3	10 & 6	34 1/2	42 1/2			
			60	0-280	10	4.85	—	—	CCW	4-4-4	1-1-1	3-3-3						
								CW	5-5-5	4-4-4	3-3-3							
								CCW	2-2-2	1-1-1	3-3-3							
3PN1010B	Single Phase	120	50/60	0-140	10‡	1.4	—	—	CW	LINE CORD & RECEPTACLE			3	10 1/4	—			
3PN1010BA 3PN1010BV	Single Phase	120	50/60	0-140	10‡	1.4	w/Ammeter w/Voltmeter		CW	LINE CORD & RECEPTACLE			9	10 1/4	—			
1020B 1020BCT M1020B† M1020BCT†	Single Phase	240	50/60	0-240	3.5	0.84	5.0	1.20	CW	1-4	—	4-3	12	10 1/4	16 3/4			
				0-280	3.5	0.98	—	—	CCW	1-4	—	1-3						
									CW	4-5	—	4-3						
									CCW	1-2	—	1-3						
			120	50/60	0-280	3.5#	0.42§	—	—	CW	4-7	—	4-3					
										CCW	1-6	—	1-3					
		1020B-2 1020BCT-2 M1020B-2+ M1020BCT-2+	Single Phase Series	480	50/60	0-480	3.5	1.68	5.0	2.4	CW	1-1	4-4	3-2	12 & 4	22 1/2	30 3/4	
						0-560	3.5	1.96	—	—	CCW	4-4	1-1	3-3				
									CW	5-5	4-4	3-3						
									CCW	2-2	1-1	3-3						
Three Phase Open Delta π	240		50/60	0-560	3.5#	0.84§	—	—	CW	7-7	4-4	3-3	12 & 5					
				0-240	3.5	1.45	5.0	2.08	CCW	6-6	1-1	3-3						
				0-280	3.5	1.70	—	—	CW	1-4-1	4-4	3-4-3						
				0-280	3.5	1.70	—	—	CCW	4-1-4	1-1	3-1-3						
	120++	50/60	0-280	3.5#	0.73§	—	—	CW	5-4-5	4-4	3-4-3							
								CCW	2-1-2	1-1	3-1-3							
								CW	7-4-7	4-4	3-4-3							
								CCW	6-1-6	1-1	3-1-3							
1020B-3 1020BCT-3 M1020B-3 M1020BCT-3	Three Phase Wye π	480++	50/60	0-480	3.5	2.91	5.0	4.16	CW	1-1-1	4-4-4	3-3-3	12 & 6	34 1/2	42 1/4			
			60	0-560	3.5	3.40	—	—	CCW	4-4-4	1-1-1	3-3-3						
		240++	60	0-560	3.5#	1.46§	—	—	CW	5-5-5	4-4-4	3-3-3						
									CCW	2-2-2	1-1-1	3-3-3						
									CW	7-7-7	4-4-4	3-3-3						
									CCW	6-6-6	1-1-1	3-3-3						
3PN1020B	Single Phase	240	50/60	0-280	3.5‡	0.98	—	—	CW	LINE CORD & RECEPTACLE			3	10 1/4	—			
3PN1020BA 3PN1020BV	Single Phase	240	50/60	0-280	3.5‡	0.98	w/Ammeter w/Voltmeter		CW	LINE CORD & RECEPTACLE			9	10 1/4	—			

\* Jumper provided in the standard common position and should be moved or removed as required.

++ Line to line voltage

‡ Unit is fused for the constant current rating at the factory.

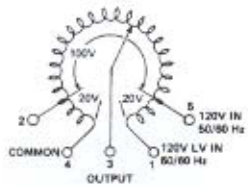
† Motor driven units use terminal connections for CCW increasing voltage, as viewed from the base end. See Fig 23 on page 9 for motor wiring.

§ Maximum KVA at maximum output voltage and corresponding derated output current. Maximum KVA for lower voltages may be calculated from derating curve Figure B, page 6.

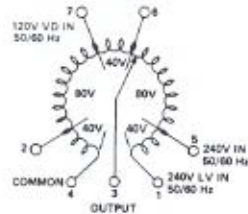
π If ganged units are used in a system that ordinarily has a common neutral or ground between source and load, the neutral or ground must be connected to the common terminals of the variable transformer assembly. If the system has no neutral, the load must be balanced or the transformers will be damaged.

# Maximum output current in output voltage range from 0 to 25% above line voltage. At higher output voltages, the output current must be reduced according to the derating curve. Figure B, page 6.

# 1000/1200 Series



VIEW FROM BASE END  
For opposite rotation interchange external connections from 5 to 2 and 4 to 1. Terminals 2 and 5 omitted on 1210.



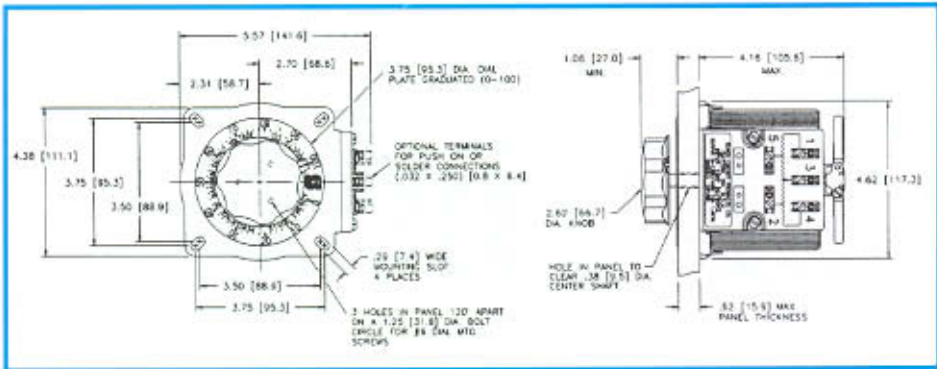
VIEW FROM BASE END  
For opposite rotation interchange external connections from 5 to 2, 4 to 1 and 7 to 6. Terminals 2, 5, 6 and 7 omitted on 1220.



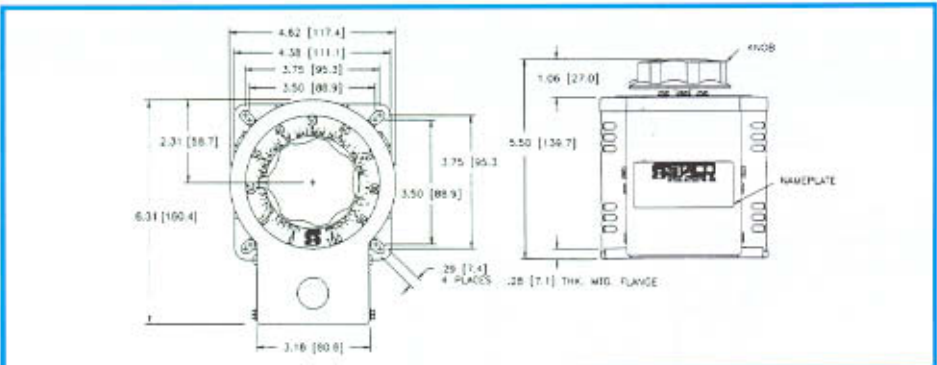
1010B



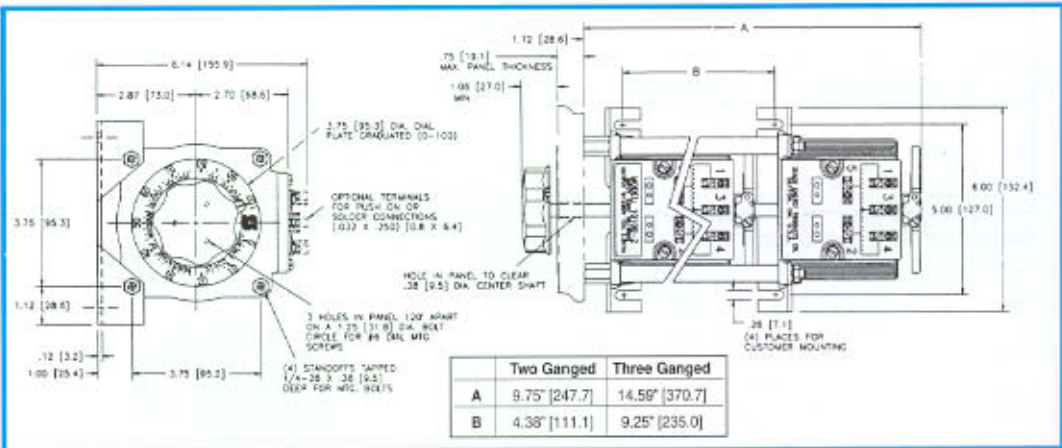
1210BCT



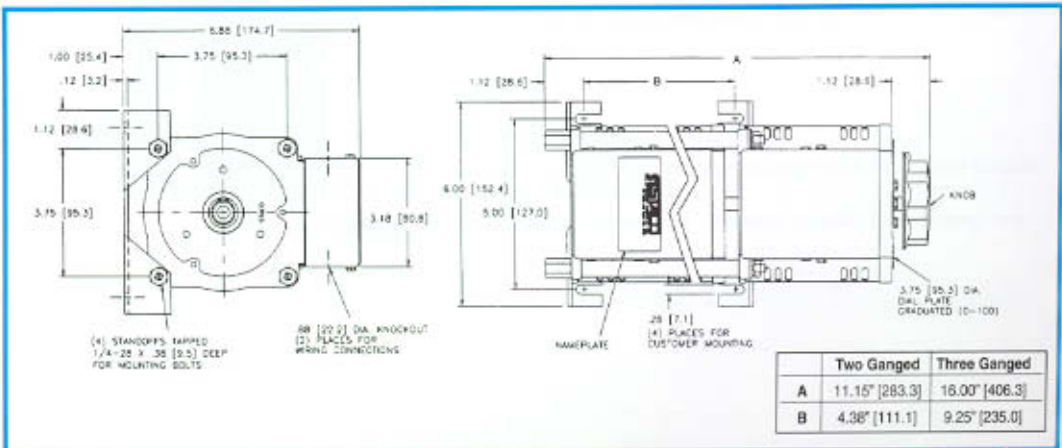
Single Unit, Uncased



Single Unit, Cased



Two and Three Ganged, Uncased



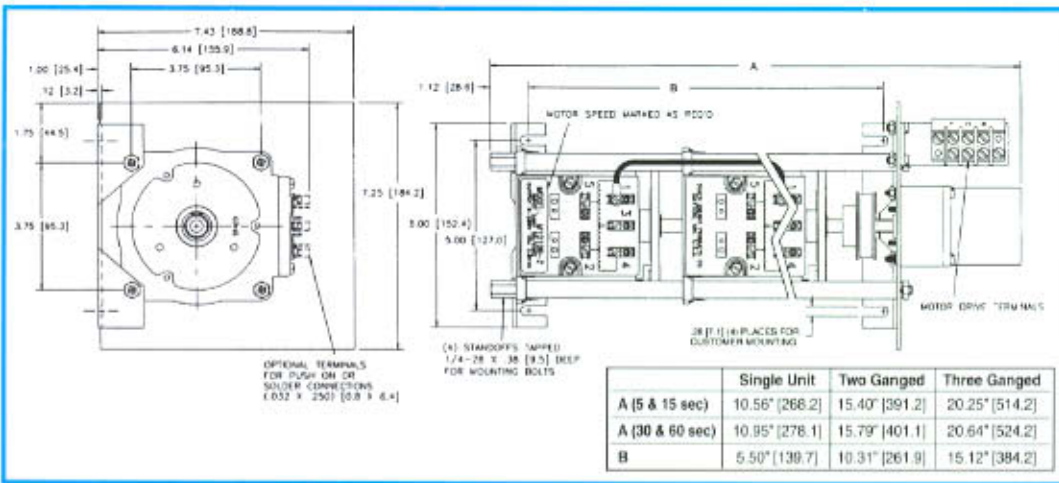
Two and Three Ganged, Cased



30M1010B

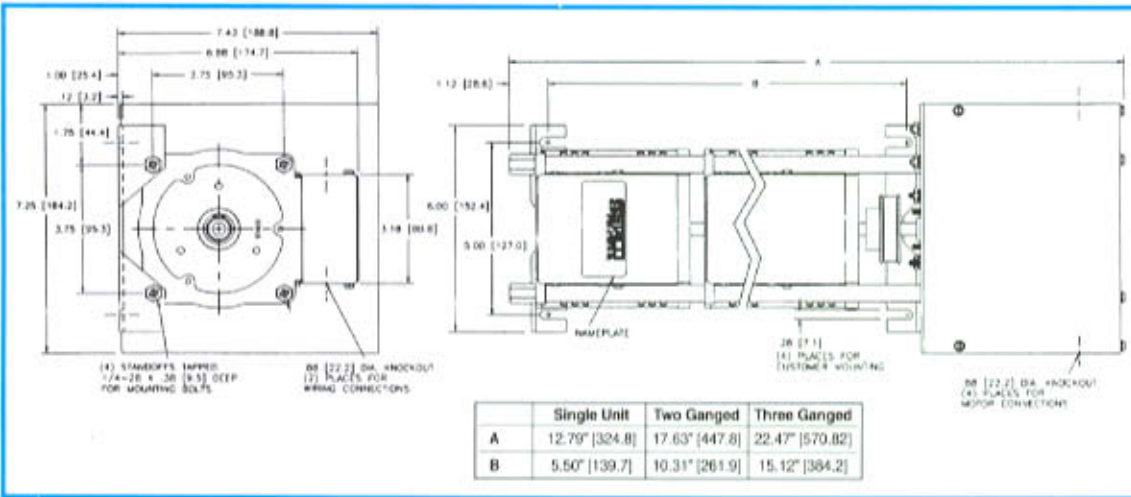


# 1000/1200 Series



**1210B**  
Front View

**Motorized Single, Two and Three Ganged, Uncased**



**1210B**  
Rear View

**Motorized Single, Two and Three Ganged, Cased**



**1220BCT-2**



**15M1010B-2**

# 1200 Series

The 1210B operates on 120 volts and is rated for constant current of 12 amperes. The 1220B operates on 240 volts and constant current of 5 amperes. The 1210B and 1220B operate from 0 to line voltage only. There is no reduction in allowable output current up to 1500 hertz.

Uncased models have the shaft extending from the base end. This shaft is fully adjustable and can be extended from either end for general utility mounting. Cased styles, which have a "CT" suffix, feature the protective screening over the coil assembly and a terminal box cover with knock-outs to

accept conduit.

Motor driven units are available in single, two and three ganged assemblies; cased or uncased styles as identified by the prefix "M" in the type number. If a motor driven model is ordered, be sure to prefix the part number with the desired travel time from 0 to maximum of 5, 15, 30, or 60 seconds.

The synchronous motor is designed for operation on 120 volts, 50/60 hertz single phase lines and draws approximately 0.3 amperes.

PART NO.	WIRING	INPUT		OUTPUT				SHAFT ROTATION FOR VOLTAGE INCREASE	TERMINAL CONNECTIONS (For increasing Voltage) As Viewed from Base End			SCHE-MATIC (Pg 8 & 9)	NET WT. LBS.	(Max) MOTOR DRIVEN	
		VOLTS	HERTZ	VOLTS	CONSTANT CURRENT LOAD		CONSTANT IMPEDANCE LOAD		Input	Jumper*	Output				
					MAX AMPS	MAX KVA	MAX AMPS								MAX KVA
1210B 1210BCT M1210B† M1210BCT†	Single Phase	120	60	0-120	12	1.44	15	1.80	CW	1-4	—	4-3	13	10 1/4	16 3/4
									CCW	1-4	—	1-3			
1210B-2 1210BCT-2 M1210B-2† M1210BCT-2†	Single Phase Series	240	60	0-240	12	2.88	15	3.60	CW	1-1	4-4	3-3	13 & 4	22 1/2	30 3/4
									CCW	4-4	1-1	3-3			
	Three Phase Open Delta π	120++	60	0-120	12	2.49	15	3.12	CW	1-4-1	4-4	3-4-3	13 & 5		
									CCW	4-1-4	1-1	3-1-3			
1210B-3 1210BCT-3 M1210B-3† M1210BCT-3†	Three Phase Wye π	240++	60	0-240	12	4.96	15	6.24	CW	1-1-1	4-4-4	3-3-3	13 & 6	34 1/2	42 1/4
									CCW	4-4-4	1-1-1	3-3-3			
3PN1210B	Single Phase	120	60	0-120	12‡	1.44	15	1.80	CW	LINE CORD & RECEPTACLE			11	10 1/4	—
1220B 1220BCT M1220B† M1220BCT†	Single Phase	240	60	0-240	5.0	1.20	7.0	1.68	CW	1-4	—	4-3	13	10 1/4	16 3/4
									CCW	1-4	—	1-3			
1220B-2 1220BCT-2 M1220B-2† M1220BCT-2†	Single Phase Series	480	60	0-480	5.0	2.40	7.0	3.36	CW	1-1	4-4	3-3	13 & 4	22 1/2	30 3/4
									CCW	4-4	1-1	3-3			
	Three Phase Open Delta π	240++	60	0-240	5.0	2.08	7.0	2.91	CW	1-4-1	4-4	3-4-3	13 & 5		
									CCW	4-1-4	1-1	3-1-3			
1220B-3 1220BCT-3 M1220B-3† M1220BCT-3†	Three Phase Wye π	480++	60	0-480	5.0	4.16	7.0	5.82	CW	1-1-1	4-4-4	3-3-3	13 & 6	34 1/2	42 1/4
									CCW	4-4-4	1-1-1	3-3-3			
3PN1220B	Single Phase	240	60	0-240	5.0‡	1.20	7.0	1.68	CW	LINE CORD & RECEPTACLE			11	10 1/4	—

\* Jumper provided in the standard common position and should be moved or removed as required.

++ Line to line voltage

‡ Unit is fused for the constant current rating at the factory.

† Motor driven units use terminal connections for CCW increasing voltage, as viewed from the base end. See Figure 23 on page 9 for motor wiring.

π If ganged units are used in a system that ordinarily has a common neutral or ground between source and load, the neutral or ground must be connected to the common terminals of the variable transformer assembly. If the system has no neutral, the load must be balanced or the transformers will be damaged.

# Maximum output current in output voltage range from 0 to 25% above line voltage. At higher output voltages, the output current must be reduced according to the derating curve, Figure B, page 6.



# 1500 Series

The 1510/1520 Series Variable Transformers are highly reliable, dependable and accurate AC control devices. The 1510, 120 volt unit is rated at 15 amperes for constant current loads; while the 1520, 240 volt unit is rated at 9.5 amperes for constant current loads. Constant impedance ratings are listed in the specifications. They can be operated at frequencies between 50 and 2000 hertz with derating at higher than rated frequency.

Uncased models have the shaft extending from the base end. This shaft is fully adjustable and can be extended from either end for general utility mounting. Cased styles are available in either "C" style (featuring protective screening over the coil assembly

only) or the "CT" style (which also includes a terminal box cover with knock-outs to accept conduit).

Motor driven units are available in single, two and three ganged assemblies; cased or uncased styles as identified by the prefix "M" in the type number. If a motor driven model is ordered, be sure to prefix the part number with the desired travel time from 0 to maximum of 5, 15, 30, or 60 seconds.

The synchronous motor is designed for operation on 120 volts, 50/60 hertz single phase lines and draws approximately 0.3 amperes.

PART NUMBER		WIRING	INPUT		OUTPUT				SHAFT ROTATION FOR VOLTAGE INCREASE	TERMINAL CONNECTIONS (FOR INCREASING VOLTAGE) AS VIEWED FROM BASE END			SCHEMATIC (Pg 8 & 9)	NET WEIGHT LBS. MAX.								
MANUALLY OPERATED	MOTOR DRIVEN		VOLTS	HERTZ	VOLTS	CONSTANT CURRENT LOAD		CONSTANT IMPEDANCE LOAD		INPUT	JUMPER	OUTPUT		MANUAL	MOTOR DRIVEN							
						MAX AMPS	MAX KVA	MAX AMPS								MAX KVA						
1510 1510C 1510CT	M1510+ M1510C+ M1510CT+	Single Phase	120	50/60	0-120	15	1.80	20	2.40	CW	2-4	—	4-3	14	15 3/4	26						
					0-140	15	2.10	—	—	CCW	2-4	—	2-3									
										CW	1-4	—	4-3				CCW	5-2	—	2-3		
1510-2 1510C-2 1510CT-2	M1510-2+ M1510C-2+ M1510CT-2+	Single Phase Series	240	50/60	0-240	15	3.60	20	4.80	CW	2-2	4-4	3-3	14 & 4	35 1/4	45 1/2						
					0-280	15	4.20	—	—	CCW	4-4	2-2	3-3									
										CW	1-1	4-4	3-3				CCW	5-5	2-2	3-3		
		Three Phase Open Deltax	120++	50/60	0-120	15	3.12	20	4.15	CW	2-4-2	4-4	3-4-3	14 & 5								
					0-140	15	3.64	—	—	CCW	4-2-4	2-2	3-2-3									
										CW	1-4-1	4-4	3-4-3				CCW	5-2-5	2-2	3-2-3		
1510-3 1510C-3 1510CT-3	M1510-3+ M1510C-3+ M1510CT-3+	Three Phase Wye	240++	50/60	0-240	15	6.22	20	8.30	CW	2-2-2	4-4-4	3-3-3	14 & 6	55 1/2	65 3/4						
					0-280	15	7.26	—	—	CCW	4-4-4	2-2-2	3-3-3									
				60	CW	1-1-1	4-4-4	3-3-3	CCW	5-5-5	2-2-2	3-3-3										
3PN1510B	—	Single Phase	120	50/60	0-140	15‡	2.10	—	—	CW	LINE CORD & RECEPTACLE			3	18	—						
3PN1510BA 3PN1510BV	—	Single Phase	120	50/60	0-140	15‡	2.10	—	—	CW	LINE CORD & RECEPTACLE			9	18	—						
1520 1520C 1520CT	M1520+ M1520C+ M1520CT+	Single Phase	240	50/60	0-240	9.5	2.28	12	2.88	CW	2-4	—	4-3	15	19 1/4	29 1/2						
					0-280	9.5	2.66	—	—	CCW	2-4	—	2-3									
										CW	1-4	—	4-3				CCW	5-2	—	2-3		
										CW	7-4	—	4-3				CCW	6-2	—	2-3		
1520-2 1520C-2 1520CT-2	M1520-2+ M1520C-2+ M1520CT-2+	Single Phase Series	480	50/60	0-480	9.5	4.56	12	5.76	CW	2-2	4-4	3-3	15 & 4	42 1/4	52 1/2						
					0-560	9.5	5.32	—	—	CCW	4-4	2-2	3-3									
										CW	1-1	4-4	3-3				CCW	5-5	2-2	3-3		
										CW	7-7	4-4	3-3				CCW	6-6	2-2	3-3		
					Three Phase Open Deltax	240++	50/60	0-240	9.5	3.95	12	5.0	CW				2-4-2	4-4	3-4-3	15 & 5		
								0-280	9.5	4.61	—	—	CCW				4-2-4	2-2	3-2-3			
										CW	1-4-1	4-4	3-4-3	CCW			5-2-5	2-2	3-2-3			
										CW	7-4-7	4-4	3-4-3	CCW			6-2-6	2-2	3-2-3			
		1520-3 1520C-3 1520CT-3	M1520-3+ M1520C-3+ M1520CT-3+	Three Phase Wye	480++	50/60	0-480	9.5	7.90	12	10	CW	2-2-2	4-4-4			3-3-3	15 & 6	66	76 1/4		
							0-560	9.5	9.21	—	—	CCW	4-4-4	2-2-2			3-3-3					
										CW	1-1-1	4-4-4	3-3-3	CCW	5-5-5	2-2-2	3-3-3					
										CW	7-7-7	4-4-4	3-3-3	CCW	6-6-6	2-2-2	3-3-3					
3PN1520B	—	Single Phase	240	50/60	0-280	9.5‡	2.66	—	—	CW	LINE CORD & RECEPTACLE			3	22	—						

\* "A" suffix includes Ammeter, "V" suffix includes Voltmeter

+ Motor driven units use terminal connections for CCW increasing voltage, as viewed from the base end. See Fig 23 on page 9 for motor wiring.

• Jumper provided in the standard common position and should be moved or removed as required.

++ Line to line voltage

‡ Unit is fused for the constant current rating at the factory.

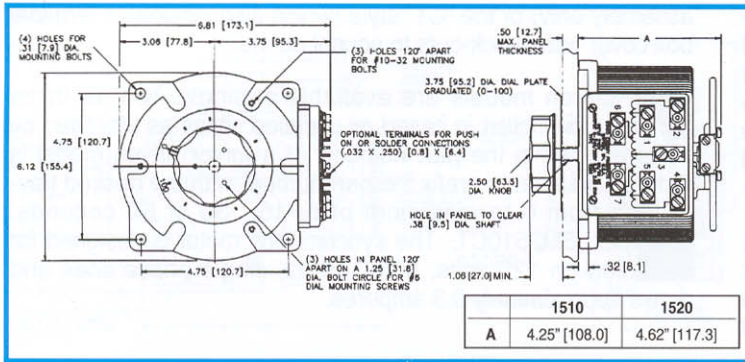
§ Maximum KVA at maximum output voltage and corresponding derated output current. Maximum KVA for lower voltages may be calculated from derating curve Figure B, page 6.

z If ganged units are used in a system that ordinarily has a common neutral or ground between source and load, the neutral or ground must be connected to the common terminals of the variable transformer assembly. If the system has no neutral, the load must be balanced or the transformers will be damaged.

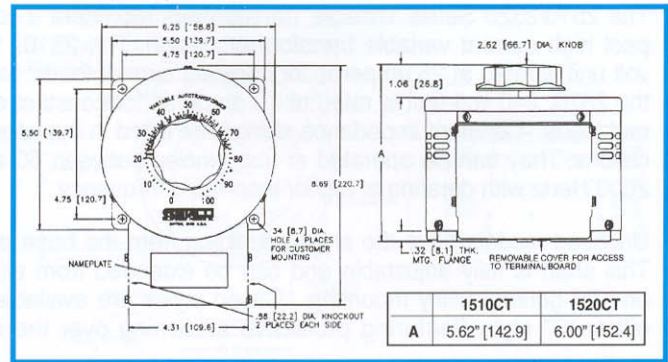
# Maximum output current in output voltage range from 0 to 25% above line voltage. At higher output voltages, the output current must be reduced according to the derating curve, Figure B, page 6.



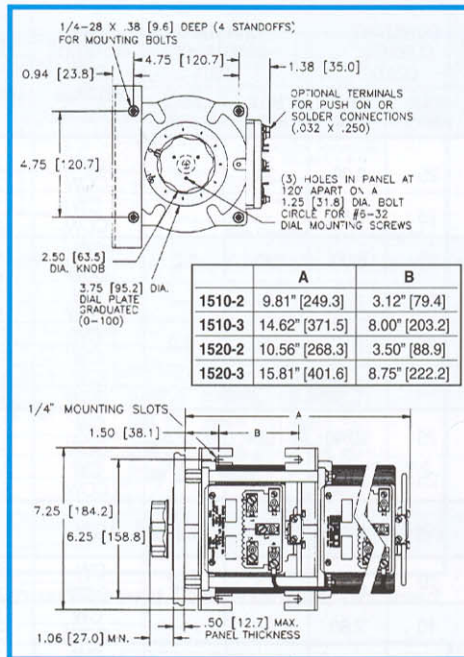
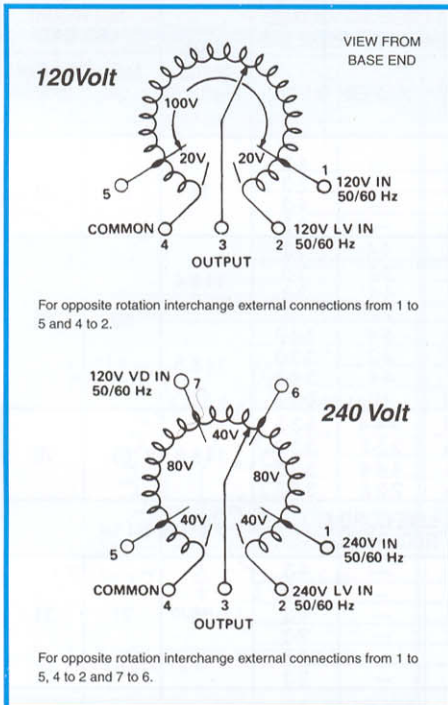
# 1500 Series



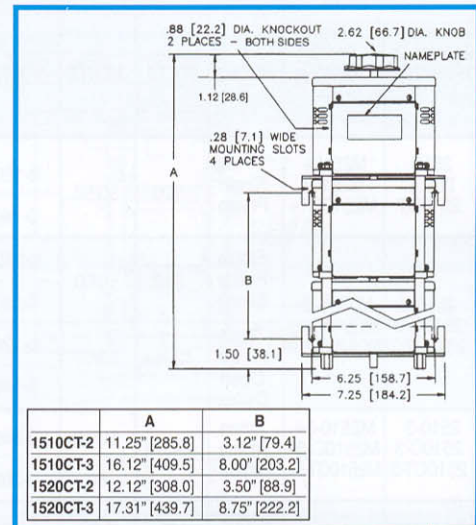
Manual Single, Uncased



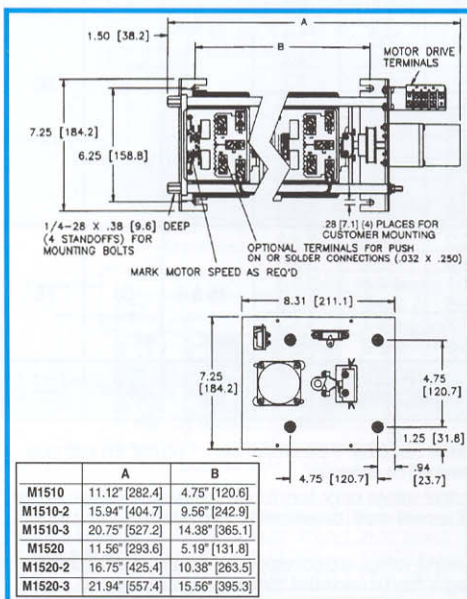
Manual Single, Cased



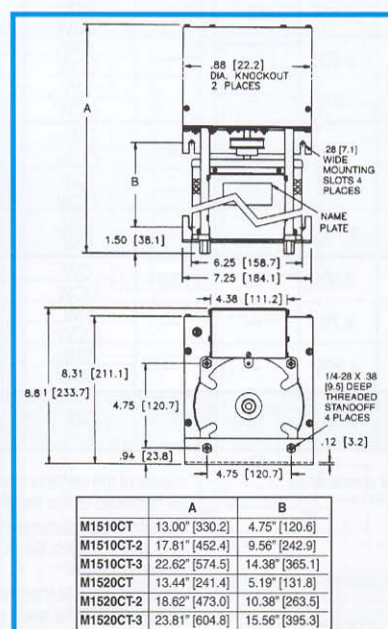
Manual Two- and Three-Ganged, Uncased



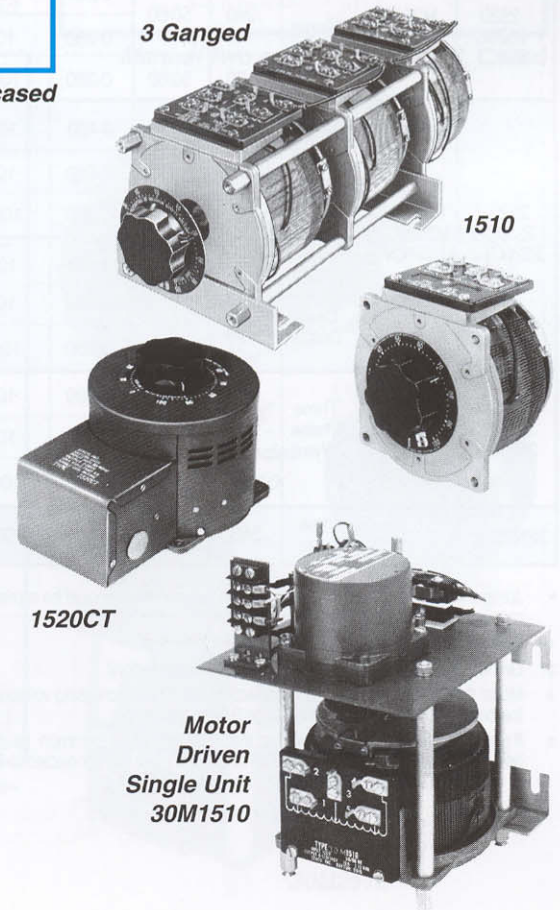
Manual Two- and Three-Ganged, Cased



Motor-Driven Single, Two and Three-Ganged, Uncased



Motor-Driven Single, Two and Three-Ganged, Cased





# 2500 Series

The 2510/2520 Series Variable Transformers represent a compact high current variable transformer design. The 2510, 120 volt unit is rated at 25 amperes for constant current loads; while the 2520, 240 volt unit is rated at 10 amperes for constant current loads. Constant impedance ratings are listed in the specifications. They can be operated at frequencies between 50 and 2000 Hertz with derating at higher than rated frequency.

Uncased models have the shaft extending from the base end. This shaft is fully adjustable and can be extended from either end for general utility mounting. Cased styles are available in either "C" style (featuring protective screening over the coil

assembly only) or the "CT" style (which also includes a terminal box cover with knock-outs to accept conduit).

Motor-driven models are available in single, two, or three ganged assemblies in cased or uncased styles as identified by the prefix "M" in the part number. If a motor driven model is ordered, be sure to prefix the part number with the desired travel time from 0 to maximum of 5, 15, 30 or 60 seconds. Example: 5M2510CT. The synchronous motor is designed for operation on 120 volts, 50/60 Hertz, single phase lines and draws approximately 0.3 amperes.

PART NUMBER		WIRING	INPUT		OUTPUT				SHAFT ROTATION FOR VOLTAGE INCREASE	TERMINAL CONNECTIONS (FOR INCREASING VOLTAGE) AS VIEWED FROM BASE END			SCHE-MATIC (Pg 8 & 9)	NET WEIGHT LBS. MAX.		
MANUALLY OPERATED	MOTOR DRIVEN		VOLTS	HERTZ	VOLTS	CONSTANT CURRENT LOAD		CONSTANT IMPEDANCE LOAD		INPUT	JUMPER*	OUTPUT		MAN-UAL	MOTOR DRIVEN	
						MAX AMPS	MAX KVA	MAX AMPS								MAX KVA
2510 2510C 2510CT	M2510+ M2510+ M2510CT+	Single Phase	120	50/60	0-120	25	3.00	30	3.6	CW	2-4	—	4-3	14	21	31
					0-140	25	3.50	—	—	CCW	2-4	—	2-3			
										CW	1-4	—	4-3			
										CCW	2-5	—	2-3			
2510-2 2510C-2 2510CT-2	M2510-2+ M2510C-2+ M2510CT-2+	Single Phase Series	240	50/60	0-240	25	6.00	30	7.2	CW	2-2	4-4	3-3	14 & 4	50	60
					0-280	25	7.00	—	—	CCW	4-4	2-2	3-3			
										CW	1-1	4-4	3-3			
		Three Phase Open Delta	120++	50/60	0-120	25	5.20	30	6.2	CW	2-4-2	4-4	3-4-3	14 & 5		
					0-140	25	6.06	—	—	CW	4-2-4	2-2	3-2-3			
										CW	1-4-1	4-4	3-4-3			
2510-3 2510C-3 2510CT-3	M2510-3+ M2510C-3+ M2510CT-3+	Three Phase Wye	240++	50/60	0-240	25	10.40	30	12.5	CW	2-2-2	4-4-4	3-3-3	14 & 6	68	78
				60	0-280	25	12.10	—	—	CCW	4-4-4	2-2-2	3-3-3			
								CW	1-1-1	4-4-4	3-3-3					
								CCW	5-5-5	2-2-2	3-3-3					
3PN2210B		Single Phase	120	50/60	0-140	22‡	3.08	—	—	CW	LINE CORD & RECEPTACLE			3	24 1/4	—
2520 2520C 520CT	M2520+ M2520C+ M2520CT+	Single Phase	240	50/60	0-240	10	2.40	13	3.12	CW	2-4	—	4-3	15	21	31
					0-280	10	2.80	—	—	CCW	2-4	—	2-3			
			120	50/60	0-280	10#	1.20§	—	—	CW	1-4	—	4-3			
										CCW	2-5	—	2-3			
										CW	7-4	—	4-3			
										CCW	6-2	—	2-3			
2520-2 2520C-2 2520CT-2	M2520-2+ M2520C-2+ M2520CT-2+	Single Phase Series	480	50/60	0-480	10	4.80	13	6.24	CW	2-2	4-4	3-3	15 & 4	50	60
					0-560	10	5.60	—	—	CCW	4-4	2-2	3-3			
			240	50/60	0-560	10#	2.40§	—	—	CW	1-1	4-4	3-3			
										CCW	5-5	2-2	3-3			
		Three Phase Open Delta	240++	50/60	0-240	10	4.20	13	5.40	CW	2-4-2	4-4	3-4-3	15 & 5		
					0-280	10	4.85	—	—	CCW	4-2-4	2-2	3-2-3			
										CW	1-4-1	4-4	3-4-3			
			120++	50/60	0-280	10#	2.10§	—	—	CCW	5-2-5	2-2	3-2-3			
										CW	7-4-7	4-4	3-4-3			
										CW	6-2-6	2-2	3-2-3			
2520-3 2520C-3 2520CT-3	M2520-3+ M2520C-3+ M2520CT-3+	Three Phase Wye	480++	50/60	0-480	10	8.30	13	10.81	CW	2-2-2	4-4-4	3-3-3	15 & 6	68	78
				60	0-560	10	9.70	—	—	CCW	4-4-4	2-2-2	3-3-3			
			240++	60	0-560	10#	4.20§	—	—	CW	1-1-1	4-4-4	3-3-3			
										CCW	5-5-5	2-2-2	3-3-3			
										CW	7-7-7	4-4-4	3-3-3			
										CCW	6-6-6	2-2-2	3-3-3			
3PN2520B		Single Phase	240	50/60	0-280	10‡	2.80	—	—	CW	LINE CORD & RECEPTACLE			3	24 1/4	—

\* Jumper provided in the standard common position and should be moved or removed as required.

++ Line to line voltage

‡ Unit is fused for the constant current rating at the factory.

+ Motor driven units use terminal connections for CCW increasing voltage, as viewed from the base end. See Figure 23 on page 9 for motor wiring.

± If ganged units are used in a system that ordinarily has a common neutral or ground between source and load, the neutral or ground must be connected to the common ter-

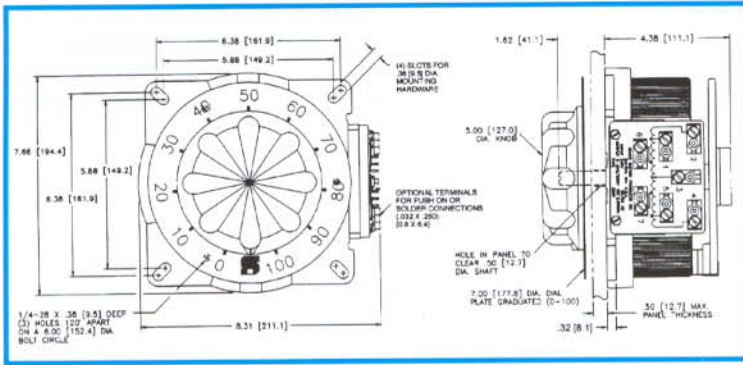
minals of the variable transformer assembly. If the system has no neutral, the load must be balanced or the transformers will be damaged.

# Maximum output current in output voltage range from 0 to 25% above line voltage. At higher output voltages, the output current must be reduced according to the derating curve, Figure B, page 6.

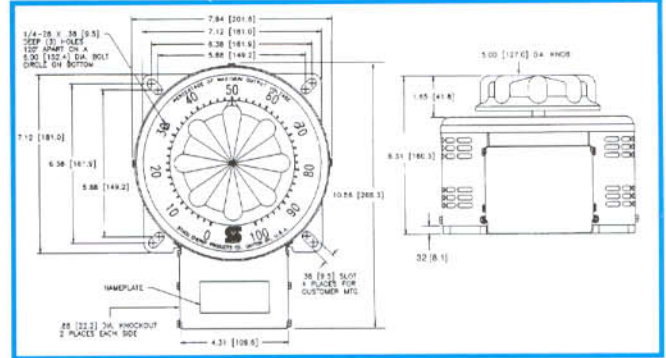
§ Maximum KVA at maximum output voltage and corresponding derated output current. Maximum KVA for lower voltages may be calculated from derating curve Figure B, page 6.



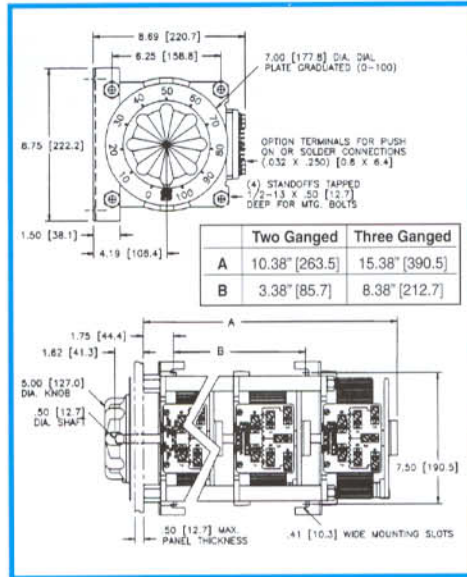
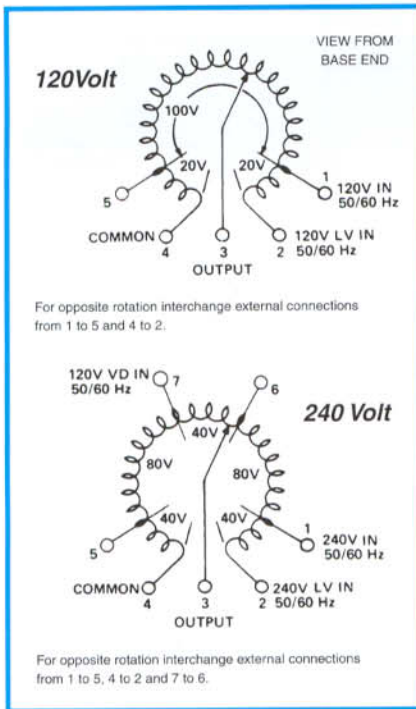
# 2500 Series



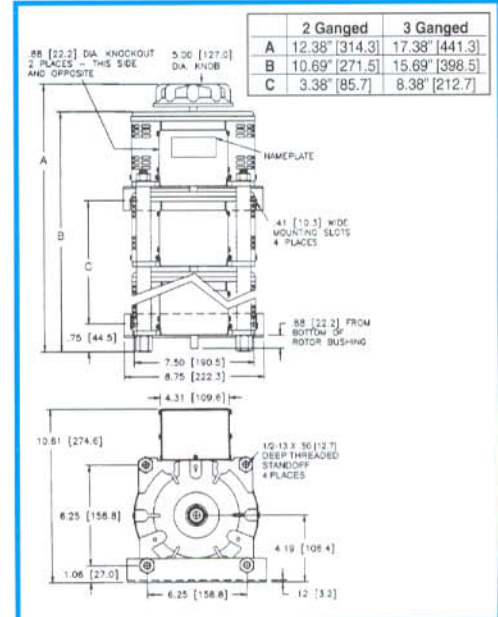
**Manual Single, Uncased**



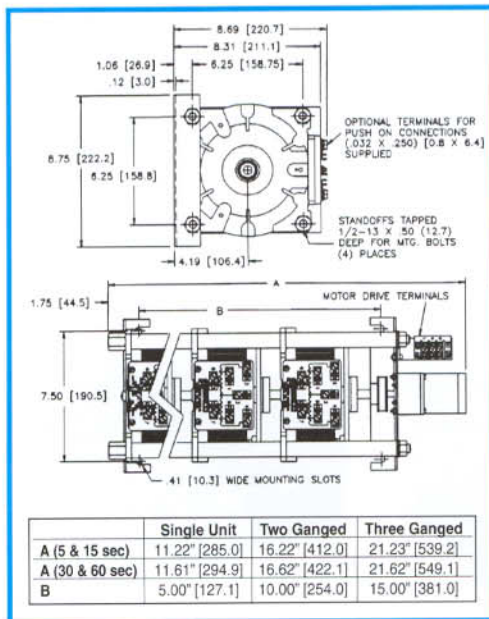
**Manual Single, Cased**



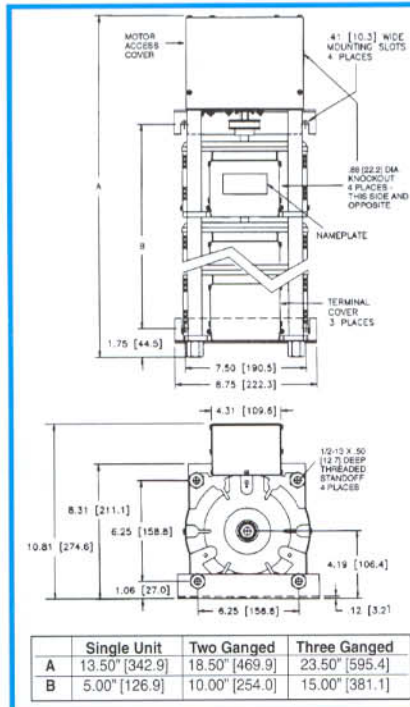
**Manual Two and Three-Ganged, Uncased**



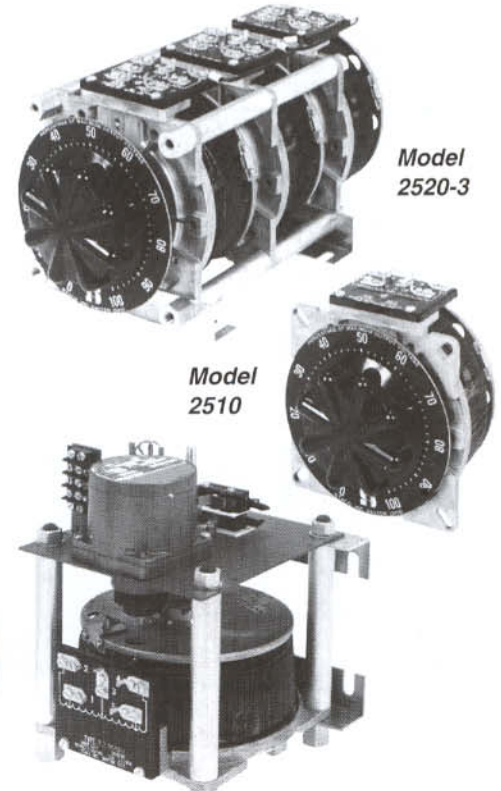
**Manual Two and Three-Ganged, Cased**



**Motor-Driven Single, Two and Three-Ganged, Uncased**



**Motor-Driven Single, Two and Three-Ganged, Cased**





# 5000 Series

The 5011/5021 Series Variable transformers are designed to control large KVA requirements. The 5011 operates on 120 volts and is rated for constant current of 50 amperes. The 5021 operates on 240 volts and constant current of 28 amperes. The 5011 Series units have coil tapping arrangements allowing output voltage from 0-117% of line voltage, while the 5021 Series allows output voltage from 0 to line voltage or 17% above line voltage. They can be operated at frequencies between 50 and 400 Hertz with a rating at higher than rated frequency.

Adjustable shaft design on manually operated models permits back-of-panel or bench mounting. Terminals are 1/4" screw type. For single and two ganged units, case styles are available in either "C" style, which encloses only the coil, or the "CT" style,

which provides protective housing for both the coil and terminal board. Knockouts are provided in the terminal board housing to accommodate conduit or cable connections. For three ganged and above, we offer our Nema 1, dripproof, fully front accessible "E" enclosure.

Motor-driven models are available from single thru 27 ganged assemblies; cased or uncased (identified with the prefix "M" in the part number). The synchronous motor is designed for operation on 120 volt, 50/60 Hertz, single phase lines and draws approximately 0.3 amperes. To meet a wide range of application requirements, standard motor speeds of 5, 15, 30 and 60 seconds are available depending upon the size of the variable transformer.

PART NUMBER		WIRING	INPUT		OUTPUT			SHAFT ROTATION FOR VOLTAGE INCREASE	TERMINAL CONNECTIONS For Increasing Voltage As Viewed from Rotor End		SCHE-MATIC (Pg 8 & 9)	NET WEIGHT IN LBS. (MAX)				
MANUALLY OPERATED	MOTOR DRIVEN		VOLTS	HERTZ	VOLTS	MAX AMPS	MAX KVA		INPUT	OUTPUT		MAN-UAL	MOTOR DRIVEN			
5011 5011C 5011CT	M5011 M5011C M5011CT	Single Phase	120	50/60	0-140	50	7.0	CW	1-2	1-3	18	57	78			
5021 5021C 5021CT	M5021 M5021C M5021CT	Single Phase	240	50/60	0-240	28	6.7	CW	2-4	2-3	19	57	78			
					0-280	28	7.8	CW	4-2	4-3						
			120	50/60	0-280	28 <sup>+</sup> 12 VD	3.4 <sup>†</sup>	CCW	2-5	2-3				4-1	4-3	
5011-2D 5011C-2D 5011CT-2D		M5011-2D M5011C-2D M5011CT-2D	Three Phase Open Delta	120	50/60	0-140	50	12.1	CW	2-1-2	3-1-3	20 & 5	134	155		
5011-2P 5011C-2P 5011CT-2P		M5011-2P M5011C-2P M5011CT-2P	Single Phase Parallel	120	50/60	0-140	100	14.0	CW	1-2	1-B	21	136	157		
5011-2S 5011C-2S 5011CT-2S		M5011-2S M5011C-2S M5011CT-2S	Single Phase Series	240	50/60	0-280	50	14.0	CW	2-2	3-3	20 & 4	134	155		
5021-2D 5021C-2D 5021CT-2D		M5021-2D M5021C-2D M5021CT-2D		Three Phase Open Delta		240	50/60	0-240	28	11.6	CW	4-1-4	3-1-3	20 & 5	134	155
						0-280	28	13.6	CW	2-1-2	3-1-3					
5021-2P 5021C-2P 5021CT-2P		M5021-2P M5021C-2P M5021CT-2P		Single Phase Parallel		240	50/60	0-240	56	13.4	CW	1-4	1-B	21	136	157
						0-280	56	15.7	CW	1-2	1-B					
5021-2S 5021C-2S 5021CT-2S		M5021-2S M5021C-2S M5021CT-2S		Single Phase Series		480	50/60	0-480	28	13.5	CW	4-4	3-3	20 & 4	134	155
						0-560	28	15.7	CW	2-2	3-3					
5011-3P 5011E-3P		M5011-3P M5011E-3P	Single Phase Parallel	120	50/60	0-140	150	21.0	CW	1-2	1-D	22	216	237		
5011-3Y 5011E-3Y		M5011-3Y M5011E-3Y	Three Phase Wye	240	60	0-280	50	24.2	CW	2-2-2	3-3-3	20 & 6	212	233		



5011



5021



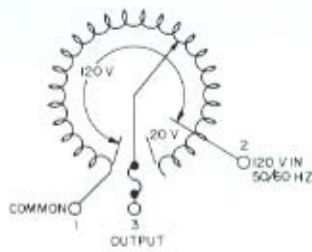
5021CT-2



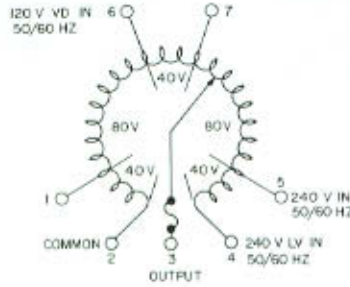
5011C

# 5000 Series

VIEW FROM ROTOR END

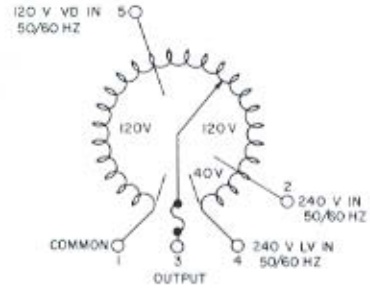


**5011**



For opposite rotation interchange external connections from 5 to 1, 2 to 4 and 6 to 7.

**5021 Single Unit**



**5021 Ganged Unit**

PART NUMBER		WIRING	INPUT		OUTPUT			SHAFT ROTATION FOR VOLTAGE INCREASE	TERMINAL CONNECTIONS For increasing Voltage As Viewed from Rotor End		SCHEMATIC (Pg 8 & 9)	NET WEIGHT IN LBS. (MAX)	
MANUALLY OPERATED	MOTOR DRIVEN		VOLTS	HERTZ	VOLTS	MAX AMPS	MAX KVA		INPUT	OUTPUT		MANUAL	MOTOR DRIVEN
5021-3P 5021E-3P	M5021-3P M5021E-3P	Single Phase Parallel	240	50/60	0-240	84	20.2	CW	1-4	1-D	22	216	237
			120	50/60	0-280	84 <sup>*</sup> 36 V.D.	10.2‡	CW	1-5	1-D			
5021-3Y 5021E-3Y	M5021-3Y M5021E-3Y	Three Phase Wye	480	50/60	0-480	28	23.3	CW	4-4-4	3-3-3	20 & 6	212	233
			240	60	0-560	28 <sup>*</sup> 12 V.D.	11.8‡	CW	2-2-2	3-3-3			
5011-4D 5011E-4D	M5011-4D M5011E-4D	Three Phase Open Delta	120	50/60	0-140	100	24.2	CW	2-1-2	B-1-B	21 & 5	314	335
5011-4P 5011E-4P	M5011-4P M5011E-4P	Single Phase Parallel	120	50/60	0-140	200	28.0	CW	1-2	1-D	22	316	337
5011-4PS 5011E-4PS	M5011-4PS M5011E-4PS	Single Phase Series Parallel	240	50/60	0-280	100	28.0	CW	2-2	B-B	21 & 4	314	335
5021-4D 5021E-4D	M5021-4D M5021E-4D	Three Phase Open Delta	240	50/60	0-240	56	23.3	CW	4-1-4	B-1-B	21 & 5	314	335
			120	50/60	0-280	56 <sup>*</sup> 24 V.D.	11.8‡	CW	2-1-2	B-1-B			
5021-4P 5021E-4P	M5021-4P M5021E-4P	Single Phase Parallel	240	50/60	0-240	112	26.9	CW	1-4	1-D	22	316	337
			120	50/60	0-280	112	31.4	CW	1-2	1-D			
5021-4PS 5021E-4PS	M5021-4PS M5021E-4PS	Single Phase Series	480	50/60	0-480	56	26.9	CW	4-4	B-B	21 & 4	314	335
			240	50/60	0-560	56 <sup>*</sup> 24 V.D.	13.5‡	CW	2-2	B-B			
5011-5P 5011E-5P	M5011-5P M5011E-5P	Single Phase Parallel	120	50/60	0-140	250	35.0	CW	1-2	1-D	22	400	420
5011-6D 5011E-6D	M5011-6D M5011E-6D	Three Phase Open Delta	120	50/60	0-140	150	36.4	CW	2-1-2	D-1-D	22 & 5	481	502
5011-6P 5011E-6P	M5011-6P M5011E-6P	Single Phase Parallel	120	50/60	0-140	300	42.0	CW	1-2	1-D	22	483	504
5011-6PS 5011E-6PS	M5011-6PS M5011E-6PS	Single Phase Series Parallel	240	50/60	0-280	150	42.0	CW	2-2	D-D	22 & 4	481	502
5011-6Y 5011E-6Y	M5011-6Y M5011E-6Y	Three Phase Wye	240	60	0-280	100	48.5	CW	2-2-2	B-B-B	21 & 6	479	500