

ELGAR

AC POWER SOURCE

**MODEL
1001SLE/1751SLE**

OPERATION MANUAL

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August 16, 1997

Document No. M071076-01 Rev A

ELGAR TWO-YEAR WARRANTY

Elgar Electronics Corporation (hereinafter referred to as Elgar) warrants its products to be free from defects in material and workmanship. This warranty is effective for two years from the date of shipment of the product to the original purchaser. Liability of Elgar under this warranty shall exist provided that:

- the Buyer exposes the product to normal use and service and provides normal maintenance on the product;
- Elgar is promptly notified of defects by the Buyer and that notification occurs within the warranty period;
- the Buyer receives a Return Material Authorization (RMA) number from Elgar's Repair Department prior to the return of the product to Elgar for repair, phone 800-73-ELGAR (800-733-5427), ext. 2295;
- the Buyer returns the defective product in the original, or equivalent, shipping container;
- if, upon examination of such product by Elgar it is disclosed that, in fact, a defect in materials and/or workmanship does exist, that the defect in the product was not caused by improper conditions, misuse, or negligence; and,
- that Elgar QA seal and nameplates have not been altered or removed and the equipment has not been repaired or modified by anyone other than Elgar authorized personnel.

This warranty is exclusive and in lieu of all other warranties, expressed or implied, including, but not limited to, implied warranties of merchantability and fitness of the product to a particular purpose. Elgar, its agents, or representatives shall in no circumstance be liable for any direct, indirect, special, penal, or consequential loss or damage of any nature resulting from the malfunction of the product. Remedies under this warranty are expressly limited to repair or replacement of the product.

CONDITIONS OF WARRANTY

- To return a defective product, contact an Elgar representative or the Elgar factory for an RMA number. Unauthorized returns will not be accepted and will be returned at the shipper's expense.
- For Elgar products found to be defective within thirty days of receipt by the original purchaser, Elgar will absorb all ground freight charges for the repair. Products found defective within the warranty period, but beyond the initial thirty-day period, should be returned prepaid to Elgar for repair. Elgar will repair the unit and return it by ground freight pre-paid.
- Normal warranty service is performed at Elgar during the weekday hours of 7:30 am to 4:30 pm Pacific time. Warranty repair work requested to be accomplished outside of normal working hours will be subject to Elgar non-warranty service rates.
- Warranty field service is available on an emergency basis. Travel expenses (travel time, per diem expense, and related air fare) are the responsibility of the Buyer. A Buyer purchase order is required by Elgar prior to scheduling.
- A returned product found, upon inspection by Elgar, to be in specification is subject to an inspection fee and applicable freight charges.
- Equipment purchased in the United States carries only a United States warranty for which repair must be accomplished at the Elgar factory.

ELGAR

Committed to Quality...Striving for Excellence

SAFETY NOTICE

BEFORE APPLYING POWER to the System, verify that the Model 1001SLE/1751SLE AC Power Source is properly configured for the user's particular application.

WARNING



HAZARDOUS VOLTAGES IN EXCESS OF 260 VRMS, 370V PEAK MAY BE PRESENT WHEN COVERS ARE REMOVED. QUALIFIED PERSONNEL MUST USE EXTREME CAUTION WHEN SERVICING THIS EQUIPMENT. CIRCUIT BOARDS, TEST POINTS AND OUTPUT VOLTAGES MAY ALSO BE FLOATING ABOVE (BELOW) CHASSIS GROUND. INTERNALLY, IN ADDITION TO THE VOLTAGES MENTIONED ABOVE, DC POWER SUPPLY VOLTAGES OF ± 60 VDC ARE PRESENT. THESE DC VOLTAGES ARE CAPABLE OF SHORT CIRCUIT CURRENTS OF UP TO SEVERAL HUNDRED AMPERES.

Installation and servicing must be performed by QUALIFIED PERSONNEL who are aware of properly dealing with attendant hazards.

CAUTION



*Ensure that the AC power line ground is properly connected to the Model 1001SLE/1751SLE AC Power Source input terminal block. Similarly, other power ground lines, including those to application and maintenance equipment, **MUST** be properly grounded for both personnel and equipment safety.*

CAUTION



Always ensure that facility AC input power is de-energized prior to connecting or disconnecting the power cable(s) and/or installing or removing the Plug-In oscillator module from the Model 1001SLE/1751SLE AC Power Source. Similarly, the Model 1001SLE/1751SLE AC Power Source circuit breaker must be switched OFF (O) prior to connecting or disconnecting input and/or output power cable(s) and/or installing or removing the Plug-In oscillator module from the Model 1001SLE/1751SLE AC Power Source.

In normal operation, the operator does not have access to hazardous voltages within the chassis. However, depending on the user's application configuration, **HIGH VOLTAGES HAZARDOUS TO HUMAN SAFETY** may be normally generated on the output terminals. The Customer/User must ensure that the output power (and sense) lines be properly labeled as to the SAFETY hazards and any that inadvertent contact with hazardous voltages is eliminated.

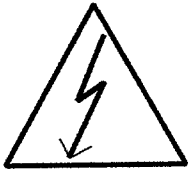
Guard against risks of electrical shock during open cover checks by NOT TOUCHING any portion of the electrical circuits. Even when power is OFF, capacitors may retain an electrical charge. Use SAFETY GLASSES during open cover checks to avoid personal injury by any sudden component failure.

Some circuits are live even with the front panel circuit breaker of the Model 1001SLE/1751SLE AC Power Source turned off (O). Servicing and fuse verification, as well as connecting wiring to the chassis, must be accomplished with the power removed via external means. Some components that can hold a charge for a period of time after power has been removed (such as storage capacitors) are used in this equipment. These components have discharging devices connected to them to provide a means for the discharge of voltages when the power is removed. Wait at least **two minutes** after removal of power to allow the discharging of these parts.

This equipment is designed to be operated in the manner specified by the manufacturer for both personnel and equipment safety. Operating this equipment in a manner **NOT** specified by the manufacturer may cause the protection provided by the equipment to be impaired.

The warning label attached to the top cover of the SLE AC Power Source is a warning of the hazards associated with this equipment. In addition, please review this entire SAFETY NOTICE for all requirements for proper operation to ensure both personnel and equipment safety.

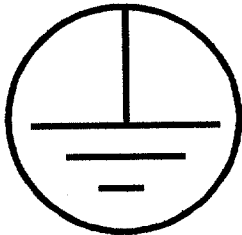
SAFETY SYMBOLS



WARNING
Risk of Electrical Shock



CAUTION
Risk of Damage to Equipment/
Refer to Accompanying Document



Protective Conductor Terminal



OFF (Supply)



ON (Supply)



Alternating Current



Direct Current

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SECTION I

GENERAL DESCRIPTION

1.1 INTRODUCTION

This manual describes the Elgar Model 1001SLE and Model 1751SLE AC Power Sources. This series of solid-state frequency changers are small and lightweight in design, saving critical panel space and money because they can provide up to 50% more power density and weigh nearly one-third less than most competitive models. This model series is ideal for general purpose test applications, as well as ATE systems and avionics testing. Some of the features include:

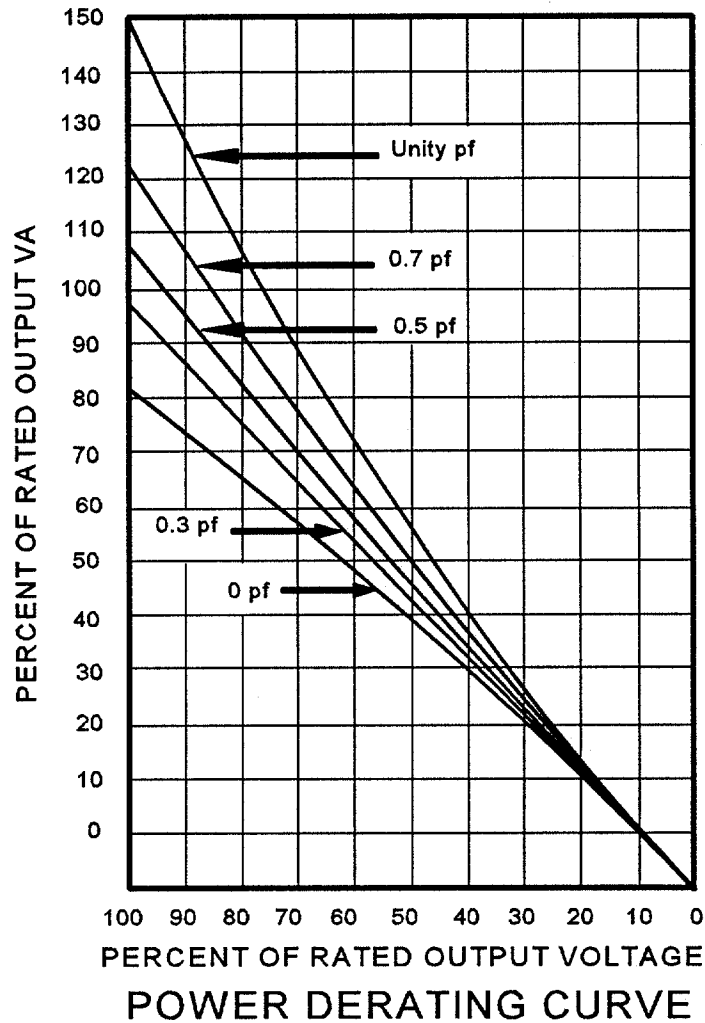
- Compact, Lightweight
- Programmable via the IEEE 488 General Purpose Interface Bus (GPIB)
- Programmable Current Limit – Automatic Shutdown and Reporting
- Continuous Duty at 150% of Rated Capacity
- Overload and Over-Temperature Protection
- Three Output Voltage Ranges
- Available in 9 Models – 1, 2, and 3 Phase

Each unit allows incorporation of custom functions without resorting to special designs. These power sources provide AC power at precise frequencies for testing, motor operation, and frequency conversion. The basic power source consists of two DC supplies and a direct coupled amplifier which drives a tapped output transformer.

The output voltage ranges are:

- 0 to 65 VAC;
- 0 to 130 VAC; and,
- 0 to 260 VAC.

Output power at full and at less than full rated voltage is depicted in the derating chart illustrated in Figure 1-1. Figure 1-2 represents a typical harmonic distortion curve. The Model 1001SLE/1751SLE AC Power Sources are configured for a 230 VAC, $\pm 10\%$, 47-63 Hz, single-phase input power only. There are no other standard input voltages available.



Typical Output VA for Elgar
SL/SX Series AC Power Sources

Conditions

Fout = Midband (200 Hz to 500 Hz)

Output Distortion $\leq 0.5\%$

Simultaneous Loading of All Phases
for Multiphase Units.

Input Line = Nominal Value

Figure 1-1. Power Output Derating

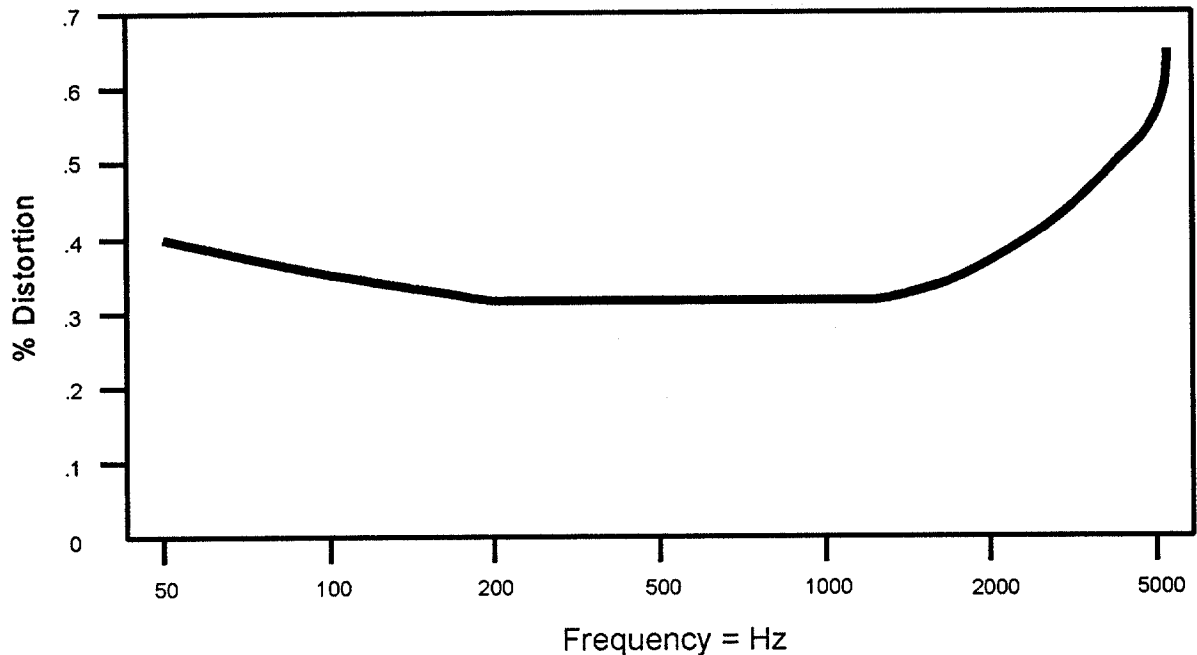


Figure 1-2. Typical Harmonic Distortion

Output voltage, frequency, current, phase angle, and other parameters are controlled by Elgar's fixed, variable, or plug-in programmable (PIP) oscillators. The output frequency range for these units is 45 Hz to 5 kHz. The basic power output is single phase. However, multi-phase outputs may be obtained by stacking two or three power sources, all driven by one multi-phase plug-in oscillator (refer to paragraph 1.3).

Each power source is rack mountable. The front panel includes:

- A meter for output voltage monitoring;
- A power ON indicator lamp;
- A voltage amplitude control; and,
- A power circuit breaker.

Cooling air for the power amplifier is drawn through side panel grills and is exhausted at the rear of the enclosure. The enclosure contains heatsink assemblies and includes a two section power amplifier. Control circuitry is mounted on a plug-in circuit board with test points and an adjustment control for output voltage regulation. The output voltage can be monitored at either the rear panel terminal block or the front panel binding posts.

This series of power sources are programmable via the IEEE-488 GPIB and meet all requirements of MATE-STD-280673, including built-in TMA for CIIL/ATLAS interfacing.

1.2 SINGLE PHASE UNIT IDENTIFICATION

Figure 1-3 provides an illustration of the SLE Series single phase unit model identification information, including the various available options (refer to Section II for specific option information).

1.3 SYSTEM CONFIGURATIONS

Figure 1-4 and Table 1-1 provide an illustration of the SLE Series identification information when used in a system configuration in order to provide two or three output phases with a variety of total output power configurations. Refer to Section II, paragraph 2.7, for further information.

Table 1-1. Multi-Phase System Configurations

System Series	Number of Phases	Configuration
2000	2	Two Model 1001SLEs in 2Ø at 90°; one 400SR; one signal cable (refer to Section II for further information).
3000	3	Three Model 1001SLEs in a 4-wire Y; two 400SRs; one signal cable (refer to Section II for further information).
3500	2	Two Model 1751SLEs in 2Ø at 90°; one 400SR; one signal cable (refer to Section II for further information).
5250	3	Three Model 1751SLEs in a 4-wire Y; two 400SRs; one signal cable (refer to Section II for further information).

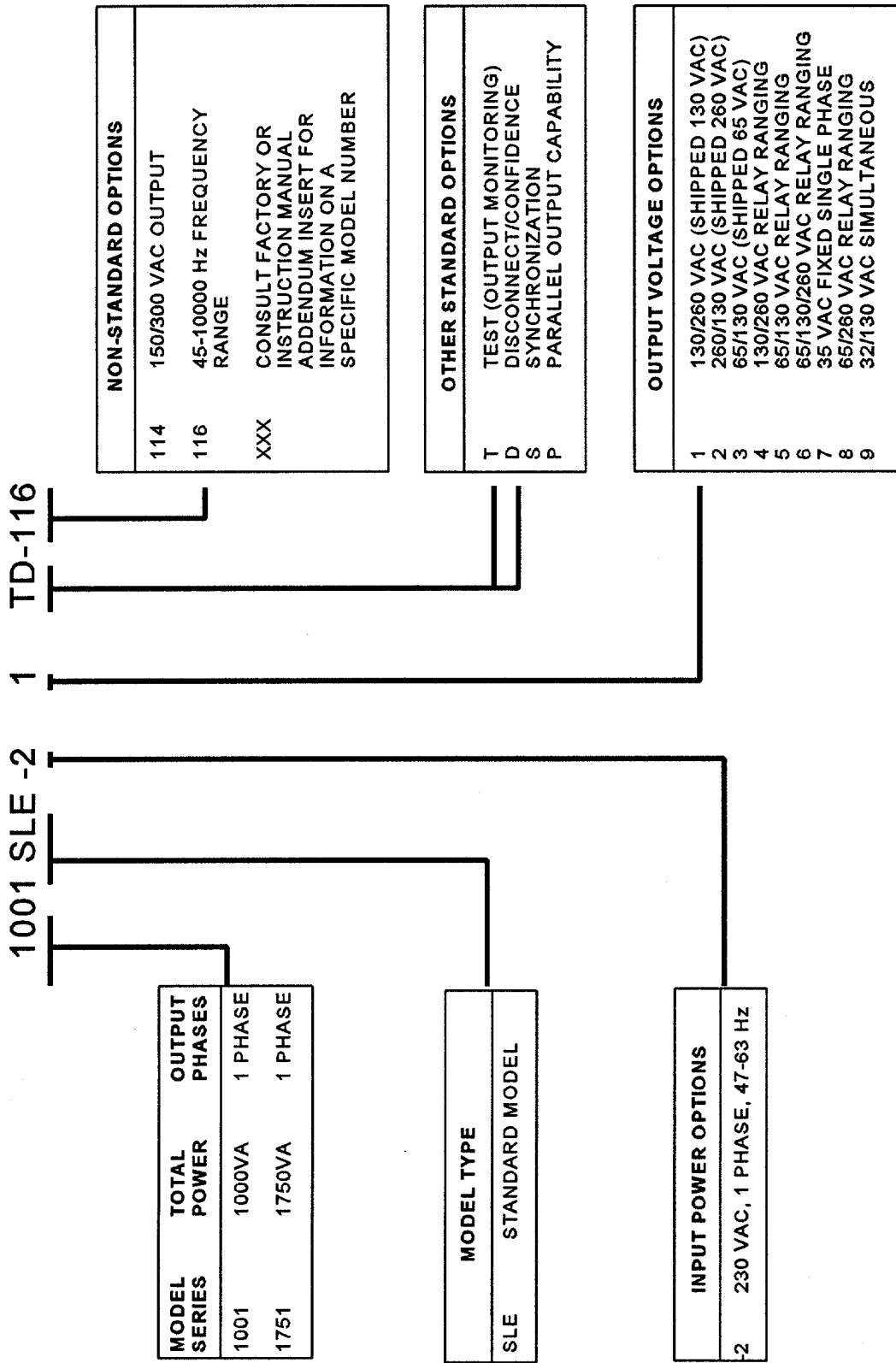


Figure 1-3. SLE Series Single-Phase Model Identification Information

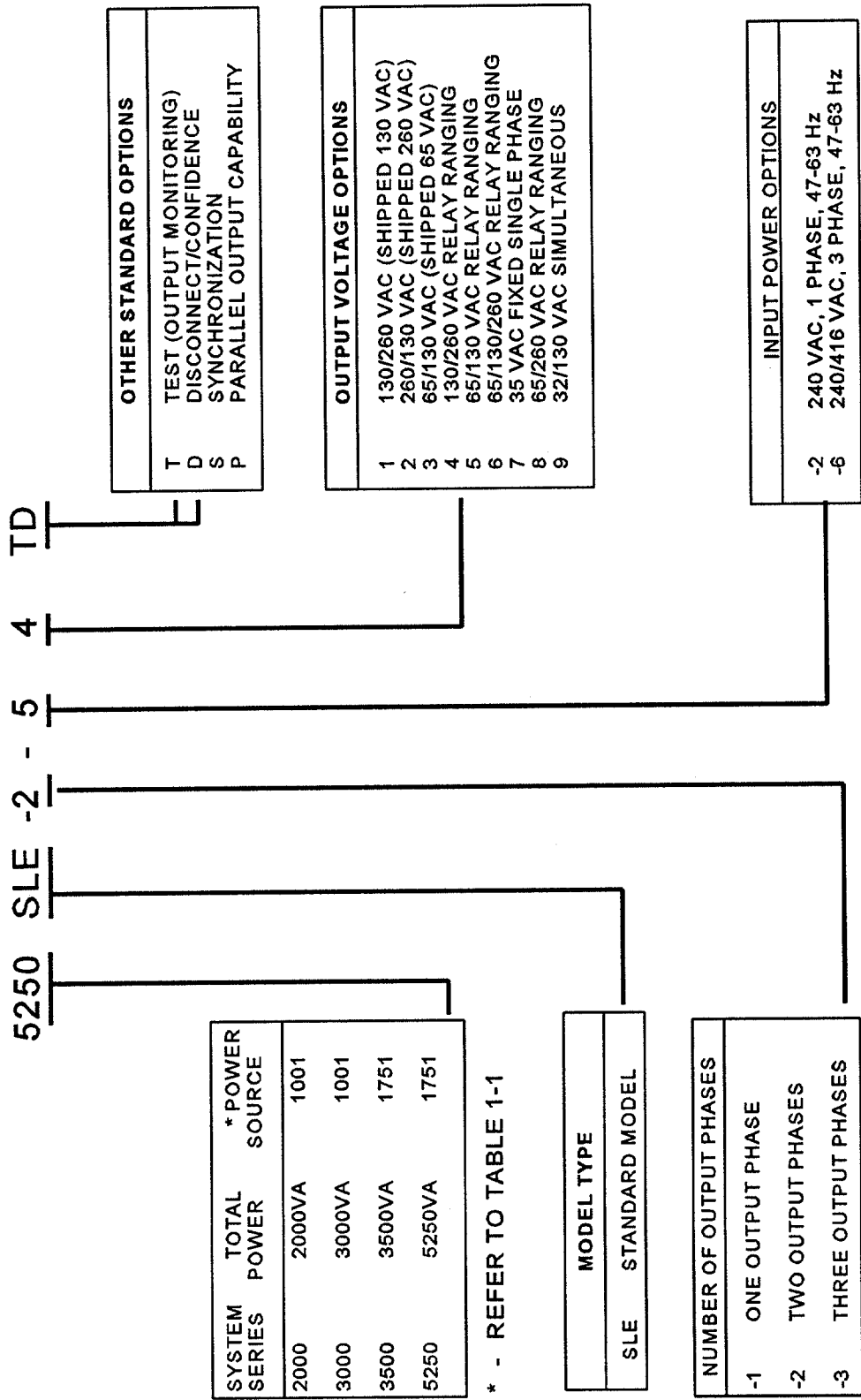


Figure 1-4. SLE System Multi-Phase Model Identification Information

1.4 SPECIFICATIONS

The performance specifications listed in Sections 1.4.1 and 1.4.2 provide baseline information for the particular model.

1.4.1 Model 1001SLE Specifications

1.4.1.1 Output Characteristics

Output Power: A minimum of 1000 VA from 55–65 VAC, 110–130 VAC, or 220–260 VAC, with a power factor (PF) from unity to ± 0.7 PF, over $\pm 10\%$ of the input line (refer to Figure 1–1 for the power derating curve).

Output Voltage Range, Standard Output Transformer:

0–65 VRMS; 0–130 VRMS; or 0–260 VRMS. The rear panel and internal jumpers provide either 0–65/130 VAC or 0–130/260 VAC voltage ranges.

Output Voltage Range, Optional Output Transformer:

0–32 VAC or 0–130 VAC, simultaneous.

Voltage Monitoring: Available via a meter on the front panel of the unit.

Voltage Control: Adjustable, zero to full scale via a locking front panel potentiometer or optional GPIB remote.

Output Current:

<u>Output Voltage</u>	<u>Maximum RMS Current Per Phase</u>
0–65	23.1
0–130	11.5
0–260	5.8

Output Terminals, Rear Panel: Output power is available via the TB2 Output Power Terminal Block on the rear panel of the chassis. The terminal block is rated for a maximum of 1000V and 20 ARMS per terminal. A Ground terminal is provided. Refer to the Safety Notice on page ii of this manual.

Output Terminals, Front Panel: Output power is available via the binding posts on the front panel of the chassis. The Red binding post (E1) is Output Line, White binding post (E2) is Output Neutral, and Black binding post (E3) is Chassis Ground. The binding posts are rated for a maximum of 1000V and 30 ARMS each. A Ground terminal is provided. Refer to the Safety Notice on page ii of this manual.

Frequency: 45 Hz to 5 kHz at full rated power.

Total Harmonic Distortion (THD): 0.4% maximum from 200 Hz to 1 kHz; 0.6% maximum from 45 Hz to 5 kHz. Refer to Figure 1–2 for typical distortion curve.

Load Regulation: $\pm 1\%$, no load to full load over the full frequency range. Adjustable to 0.1% for specific load conditions. Better than $\pm 0.25\%$ for a fixed frequency output between 45 Hz and 1 kHz.

Line Regulation: $\pm 0.25\%$ at the rated load for a $\pm 10\%$ input range at the full scale output voltage.

Response Time: $< 50 \mu\text{seconds}$.

AC Noise Level: 70 dB below full output voltage with a grounded input.

Gain Stability: $\pm 0.25\%$ for 24 hours at constant line, load and temperature after warm-up.

Overload and Short Circuit Protection: Automatic electronic current limiting senses both excessive load current and/or low power factor. Automatic instantaneous reset occurs when the overload is removed unless the front panel circuit breaker is activated.

Thermal Protection: An automatically resetting thermal sensor removes the output voltage to prevent damage due to excessive overload or heatsink temperature.

1.4.1.2 Input Characteristics

Line Voltage: 230 VAC, $\pm 10\%$, single phase with ground.

Line Frequency: 47–63 Hz continuous (380–420 Hz optional); 45–70 Hz for short term transients.

Efficiency: Up to 50%.

Line Power: 2800 watts, maximum.

Line Volt–Amperes: 4200 VA, maximum.

Line Input: A three–wire input via the TB1 Input Power Terminal Block on the rear of the chassis.

Installation: Installation/Overvoltage Category III.

1.4.1.3 ATE Features

Range Change Relays: An optional oscillator (PIP) allows the optional internal range change relays to switch between 130 VAC and 260 VAC via either front panel control or under special GPIB control. Other voltage ranges are available as special options.

Output Relay: An optional internal output relay can connect the load to the output of the power source under GPIB control.

Remote Sense: Available with a PIP and other selected oscillators.

Current Limit Feedback: An optional internal current transformer will provide current limit feedback to the PIP oscillator.

PIP Sync In/Out: The PIP can be optionally synchronized by an external source. This allows a PIP to synchronize to another PIP.

Built–In–Test–Equipment: Optional with the use of the compatible Elgar PIP 9012AE programmable oscillator. The BIT measures and reports RMS voltage, RMS current, frequency, and true RMS power in watts.

1.4.1.4 General

Operating Temperature Range: 0°C to 55°C (32°F to 131°F).

Operating Humidity Range: Up to 95%, non condensing.

Cabinet Mounting: Standard 19" RETMA rack mounting using 20" rack slides.

Dimensions: 7" (178 mm) high X 19" (483 mm) wide X 21" (533 mm) deep.

Net Weight: 125 pounds (57 kg).

Shipping Weight: 135 pounds (61 kg).

Front Panel Finish: Light gray, color #26408, per FED–STD–595A with black silk screening, color #27038.

Cooling: Single 5.75" (146 mm) fan mounted inside the unit with side air intake and rear air exhaust.

Front Panel Meter: A 0 to 300 VAC voltmeter provides $\pm 3\%$ of full scale accuracy over the 45 Hz to 1 kHz frequency range.

J1 Interface Connector: 15 pin configuration for added flexibility.

1.4.2 Model 1751SLE Specifications

1.4.2.1 Output Characteristics

Output Power: A minimum of 1750 VA from 55–65 VAC, 110–130 VAC, or 220–260 VAC, with a power factor (PF) from unity to ± 0.7 PF, over $\pm 10\%$ of the input line (refer to Figure 1-1 for the power derating curve).

Output Voltage Range, Standard Output Transformer:

0–65 VRMS; 0–130 VRMS; or 0–260 VRMS. The rear panel and internal jumpers provide either 0–65/130 VAC or 0–130/260 VAC voltage ranges.

Output Voltage Range, Optional Output Transformer:

0–32 VAC or 0–130 VAC, simultaneous.

Voltage Monitoring: Available via a meter on the front panel of the unit.

Voltage Control: Adjustable, zero to full scale via a locking front panel potentiometer or optional GPIB remote.

Output Current:

<u>Output Voltage</u>	<u>Maximum RMS Current Per Phase</u>
0–65	40.4
0–130	20.2
0–260	10.1

Output Terminals, Rear Panel: Output power is available via the TB2 Output Power Terminal Block on the rear panel of the chassis. The terminal block is rated for a maximum of 1000V and 30 ARMS per terminal. A Ground terminal is provided. Refer to the Safety Notice on page ii of this manual.

Output Terminals, Front Panel: Output power is available via the binding posts on the front panel of the chassis. The Red binding post (E1) is Output Line, White binding post (E2) is Output Neutral, and Black binding post (E3) is Chassis Ground. The binding posts are rated for a maximum of 1000V and 30 ARMS each. A Ground terminal is provided. Refer to the Safety Notice on page ii of this manual.

Frequency: 45 Hz to 5 kHz at full rated power.

Total Harmonic Distortion (THD): 0.4% maximum from 200 Hz to 1 kHz; 0.6% maximum from 45 Hz to 5 kHz. Refer to Figure 1–2 for typical distortion curve.

Load Regulation: $\pm 1\%$, no load to full load over the full frequency range. Adjustable to 0.1% for specific load conditions. Better than $\pm 0.25\%$ for a fixed frequency output.

Line Regulation: $\pm 0.25\%$ at the rated load for a $\pm 10\%$ input range at the full scale output voltage.

Response Time: $< 50 \mu\text{seconds}$.

AC Noise Level: 70 dB below full output voltage with a grounded input.

Gain Stability: $\pm 0.25\%$ for 24 hours at constant line, load and temperature after warmup.

Overload and Short Circuit Protection: Automatic electronic current limiting senses both excessive load current and/or low power factor. Automatic instantaneous reset occurs when the overload is removed unless the front panel circuit breaker is activated.

Thermal Protection: An automatically resetting thermal sensor removes the output voltage to prevent damage due to excessive overload or heatsink temperature.

1.4.2.2 Input Characteristics

Line Voltage: 230 VAC, $\pm 10\%$, single phase with ground.

Line Frequency: 47–63 Hz continuous (380–420 Hz optional); 45–70 Hz for short term transients.

Efficiency: Up to 50%.

Line Power: 5000 watts, maximum.

Line Volt–Amperes: 7500 VA, maximum.

Line Input: A three-wire input via the TB1 Input Power Terminal Block on the rear of the chassis.

Installation: Installation/Overvoltage Category III.

1.4.2.3 ATE Features

Range Change Relays: An optional oscillator (PIP) allows the optional internal range change relays to switch between 130 VAC and 260 VAC via either front panel control or under special GPIB control. Other voltage ranges are available as special options.

Output Relay: An optional internal output relay can connect the load to the output of the power source under GPIB control.

Remote Sense: Available with a PIP and other selected oscillators.

Current Limit Feedback: An optional internal current transformer will provide current limit feedback to the PIP oscillator.

PIP Sync In/Out: The PIP can be optionally synchronized by an external source. This allows a PIP to synchronize to another PIP.

Built-In-Test-Equipment: Optional with the use of the compatible Elgar PIP 9012AE programmable oscillator. The BIT measures and reports RMS voltage, RMS current, frequency, and true RMS power in watts.

1.4.2.4 General

Operating Temperature Range: 0°C to 55°C (32°F to 131°F).

Operating Humidity Range: Up to 95%, non condensing.

Cabinet Mounting: Standard 19" RETMA rack mounting using 20" rack slides.

Dimensions: 12.25" (311 mm) high X 19" (483 mm) wide X 21" (533 mm) deep.

Net Weight: 190 pounds (86 kg).

Shipping Weight: 200 pounds (91 kg).

Front Panel Finish: Light gray, color #26408, per FED-STD-595A with black silk screening, color #27038.

Cooling: Two 5.75" (146 mm) fans mounted inside the unit with side air intake and rear air exhaust.

Front Panel Meter: A 0 to 300 VAC voltmeter provides $\pm 3\%$ of full scale accuracy over the 45 Hz to 1 kHz frequency range.

J1 Interface Connector: 15 pin configuration for added flexibility.

**SPECIFICATIONS ARE SUBJECT TO CHANGE
WITHOUT NOTICE**

NOTES

SECTION II

INSTALLATION

2.1 INTRODUCTION

The Model 1001SLE/1751SLE has been configured, calibrated and tested prior to shipment. Therefore, the instrument is ready for immediate use upon receipt. The following initial physical inspections should be conducted to ensure that no damage has been sustained by the instrument during shipment.

WARNING

Hazardous voltages are present when operating this equipment. Read the "SAFETY" notices on page ii before performing installation, operation, or maintenance.

The user should become familiar with the particular model and configuration of the SLE Series AC Power Source (refer to Section I). The following topics should be thoroughly understood before making connections or applying AC input power. To simplify this process, the topics are arranged as follows:

- 2.2 Unpacking
- 2.3 Pre-Installation Inspection
- 2.4 Options
- 2.5 Model 1001SLE Installation
- 2.6 Model 1751SLE Installation
- 2.7 System Interconnection

Appendix A provides recommended guidelines for wire gauge selection. Appendix B contains the Configuration and Functional Verification Checksheet (refer to and copy this appendix as required). This checksheet simplifies the configuration and functional verification process. The checksheet also serves as an ideal reference during application and as a permanent maintenance record.

CAUTION

Do not apply AC input voltage to this instrument nor connect any load(s) without first verifying correct input line voltage and output wiring configuration. This instrument and any external loads or cables may be damaged by improper voltage settings, cable mis-wiring, etc.

2.2 UNPACKING

The instrument has been packed in accordance with industrial standards for safe shipment. Upon receipt of the unit, unpack and inspect the unit as follows:

1. Inspect the shipping container prior to accepting the container from the carrier. If damage to the container is evident, a description of the damage shall be noted on the carrier's receipt, then signed by the carrier's agent.
2. If damage is not apparent until the contents are unpacked, a claim for concealed damage shall be placed with the carrier. The shipping container(s) and filler material shall be saved for subsequent inspection.
3. Forward a report of any damage to the Elgar Service Department. Elgar will provide instructions for repair/replacement of the instrument.
4. If possible, save the container and packing material for subsequent return of the instrument to the factory. Repacking is straight-forward and is essentially the reverse of unpacking. If the instrument needs to be shipped and proper packing material is not available, contact Elgar to provide containers and shipping instructions.

2.3 PRE-INSTALLATION INSPECTION

Perform the following:

1. Inspect the power source for shipping damage such as dents, scratches, distortion, and damaged connectors. There are no mercury relays or other internal components sensitive to chassis tilting for inspection purposes.
2. Check the front panel AMPLITUDE control and power switch for ease of operation.

3. Remove the instrument covers and verify that the circuit boards are securely seated in their respective receptacles. Ensure that individual components are not damaged.
4. Check the rear of the chassis for damage to the connectors.
5. Check the harness and leads for broken insulation, cracks, or broken wiring.

2.4 OPTIONS

The standard options available for the power source include several input and output voltages, automatic range changing, sync access, output monitoring, and different oscillators.

2.4.1 Input Voltages

The input voltages for the SLE Series AC Power Source is single phase 230 VAC, $\pm 10\%$. There are no other input voltage ranges. TB1, the input power terminal block, needs no jumpers or configuration. Ensure that the AC power line ground is properly connected to the Model 1001SLE/1751SLE AC Power Source input terminal block. Similarly, other power ground lines, including those to application and maintenance equipment, **MUST** be properly grounded for both personnel and equipment safety.

2.4.2 Output Voltages

The output voltages available are 0-65 VAC, 0-130 VAC, and 0-260 VAC. These voltages are selectable at terminal blocks TB2, located on the rear panel, and TB3, located within the instrument. Figure 2-1 defines the required jumper connections.

NOTE

Systems using two or more units require interconnect wiring as explained in paragraph 2.7.

2.4.3 Oscillators

The SLE Series AC Power Sources require a plug-in oscillator or an externally applied signal to be a complete power source/frequency converter. A plug-in oscillator module establishes the drive signal for the AC Power Source and determines the output frequency. A variety of fixed and variable frequency oscillator modules are available, covering the range of 45 Hz to 5000 Hz at accuracies of 0.25% to 0.001%. Specialized oscillators are available, such as the Plug-In Programmable (PIP) Series Model PIP 9012E for IEEE-488 controlled operation. Refer to the appropriate oscillator or PIP manual for operating and programming instructions.

WARNING

Always ensure that facility AC power is de-energized prior to connecting or disconnecting the power cable(s) and/or installing or removing the plug-in oscillator module from the Model 1001SLE/1751SLE AC Power Source. Similarly, the Model 1001SLE/1751SLE AC Power Source circuit breaker must be switched OFF (0) prior to connecting or disconnecting input and/or output power cable(s) and/or installing or removing the plug-in oscillator module from the Model 1001SLE/1751SLE AC Power Source.

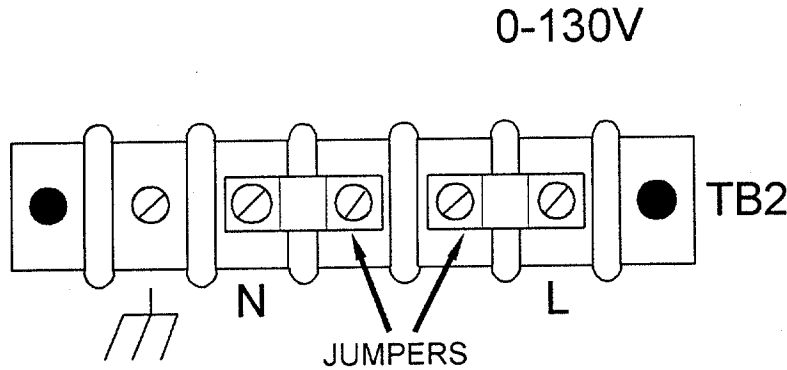
CAUTION

Dangerous voltages may be present inside the oscillator cavity when the oscillator module is removed. Qualified personnel must use extreme caution when servicing this equipment. Circuit boards, test points, and output voltages may also be floating above (below) chassis ground. Internally, in addition to the voltages mentioned above, DC power supply voltages of ± 60 VDC are present. These DC voltages are capable of short circuit currents of up to several hundred amperes.

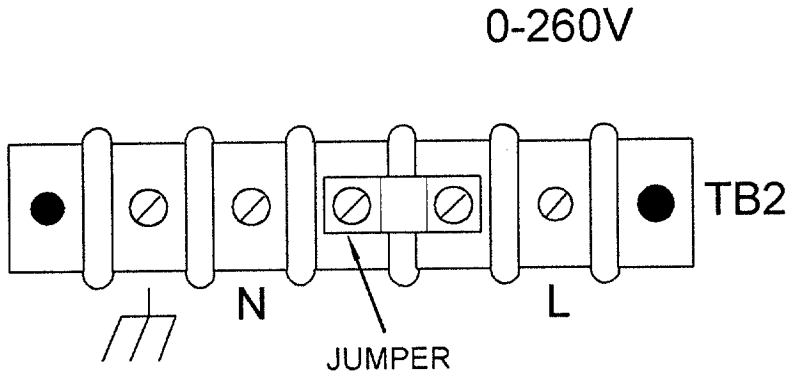
When installing a plug-in oscillator module, exercise care to ensure proper mechanical alignment and snug connector fit (do not bind or pinch any flexible cables during re-installation). Tighten the two front panel captive screws with a flat blade screwdriver so that they cannot be removed by hand.

2.4.4 Other Options

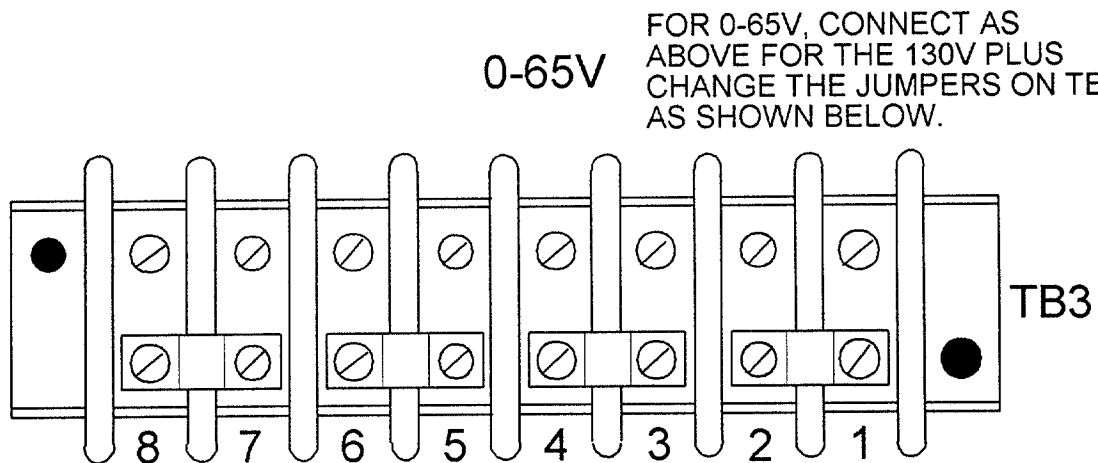
The SLE motherboard has been designed to provide a means to implement special options such as automatic output voltage range changing, output current limit programming, synchronization (sync in/sync out), and output voltage/current/power monitoring. These "specials" are GPIB compatible.



FOR 0-130V, TB3 MUST HAVE TWO JUMPERS ONLY; ONE FROM TB3-2 TO TB3-3, THE OTHER FROM TB3-6 TO TB3-7.



FOR 0-260V, TB3 MUST HAVE TWO JUMPERS ONLY; ONE FROM TB3-2 TO TB3-3, THE OTHER FROM TB3-6 TO TB3-7.



FOR 0-65V, CONNECT AS ABOVE FOR THE 130V PLUS CHANGE THE JUMPERS ON TB3 AS SHOWN BELOW.

(TB3 IS LOCATED ON THE INSIDE OF THE REAR PANEL.)

Figure 2-1. Output Voltage Options

2.4.4.1 "-T" Option

With the addition of a current sense transformer to the power source, true RMS measurement and transmission of voltage, current, frequency, and power information is accomplished via the GPIB interface. The output voltage range will be set at 130V or 260V (refer to the partial schematics provided in Figures 2-2 through 2-6).

2.4.4.2 "-D" Option

The "D" Option (disconnect relay) adds internal disconnect relays for connecting or disconnecting output power from the rear panel terminal block and the front panel binding posts. This is accomplished through the use of the associated Plug-In Programmable (PIP) oscillator module. The relays can be switched in either the local mode of control at the keyboard or the remote GPIB IEEE mode of operation. There is a relay, K5, internally that switches the sense lines with the power relay switching functions. When the power relay is open, output power is disconnected from the rear panel terminal block, the front panel binding posts, and the sense relay switches to an internal sense connection. This ensures that no voltage is applied to the sense lines when the power relay is open.

When the power relay is closed, output power is connected to the rear panel terminal block, the front panel binding posts, and the sense relay switches to the external sense connection to the rear panel J1 connector (refer to the Model 1001SLE/1751SLE Service Manual Schematic No. 6071076, for further information). Refer to the partial schematic in Figure 2-6.

2.4.4.3 "-S" Option

Rear panel BNC connectors are provided for oscillator sync input and/or sync output connections (refer to the Model 1001SLE/1751SLE Service Manual Schematic No. 6071075, for further information). Refer to the partial schematics in Figures 2-3 through 2-6.

2.4.4.4 Range Change Option

Automatic range change between predetermined output voltages (refer to Table 2-1) is enabled via a GPIB interface from the PIP front panel local controls. Refer to the partial schematics illustrated in Figures 2-3 through 2-6.

Table 2-1. Model 1001SLE/1751SLE Options

NOTE

The three columns correspond to the three digits after the dash of the model number on the instrument tag.

Input Voltage		Output Voltage		Standard Options	
"-"	Definition	"-"	Definition	"-"	Definition
-2	230 VAC, 1Ø, 47-63 Hz	-1	130/260 VAC*	-T	Test (Output monitoring and current limit programming via GPIB).****
		-2	260/130 VAC**	-D	Output disconnect relay via GPIB (Confidence Test)
		-3	65/130 VAC*	-S	Synchronization (Sync In/Sync Out)
		-4	130/260 VAC***		
		-5	65/130 VAC***		
		-6	65/130/260 VAC***		
		-7	35 VAC Fixed Single Phase		
		-8	65/260 VAC***		
		-9	32/130 VAC Simultaneous		

- * Standard manual range change on rear output barrier strip.
- ** Standard manual range change on rear output barrier strip, but set up for 0-260VAC at factory.
- *** Automatic range change via GPIB (PIP).
- **** T Option: Requires that the output voltage range be set at 130V or 260V. Internal connections are required to change the range. Output voltage options -4, -5, -6, and -8 can provide relay range change capability.

EXAMPLE: Complete Model designation **1001SLE-22T** would indicate that the unit is configured for 230 VAC input, 0-260 VAC output, and has full T-option capabilities.

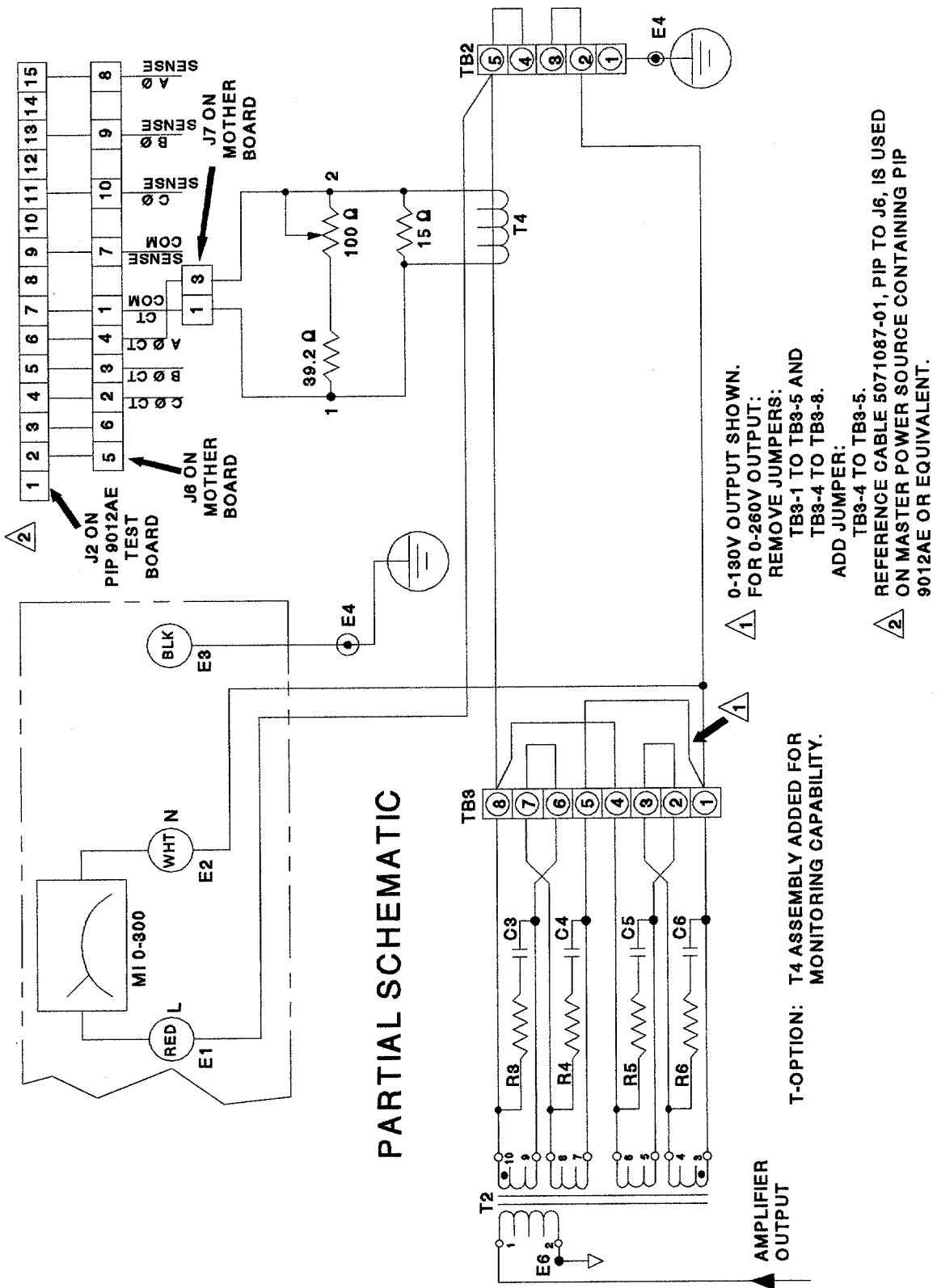


Figure 2-2. Output Monitoring Option

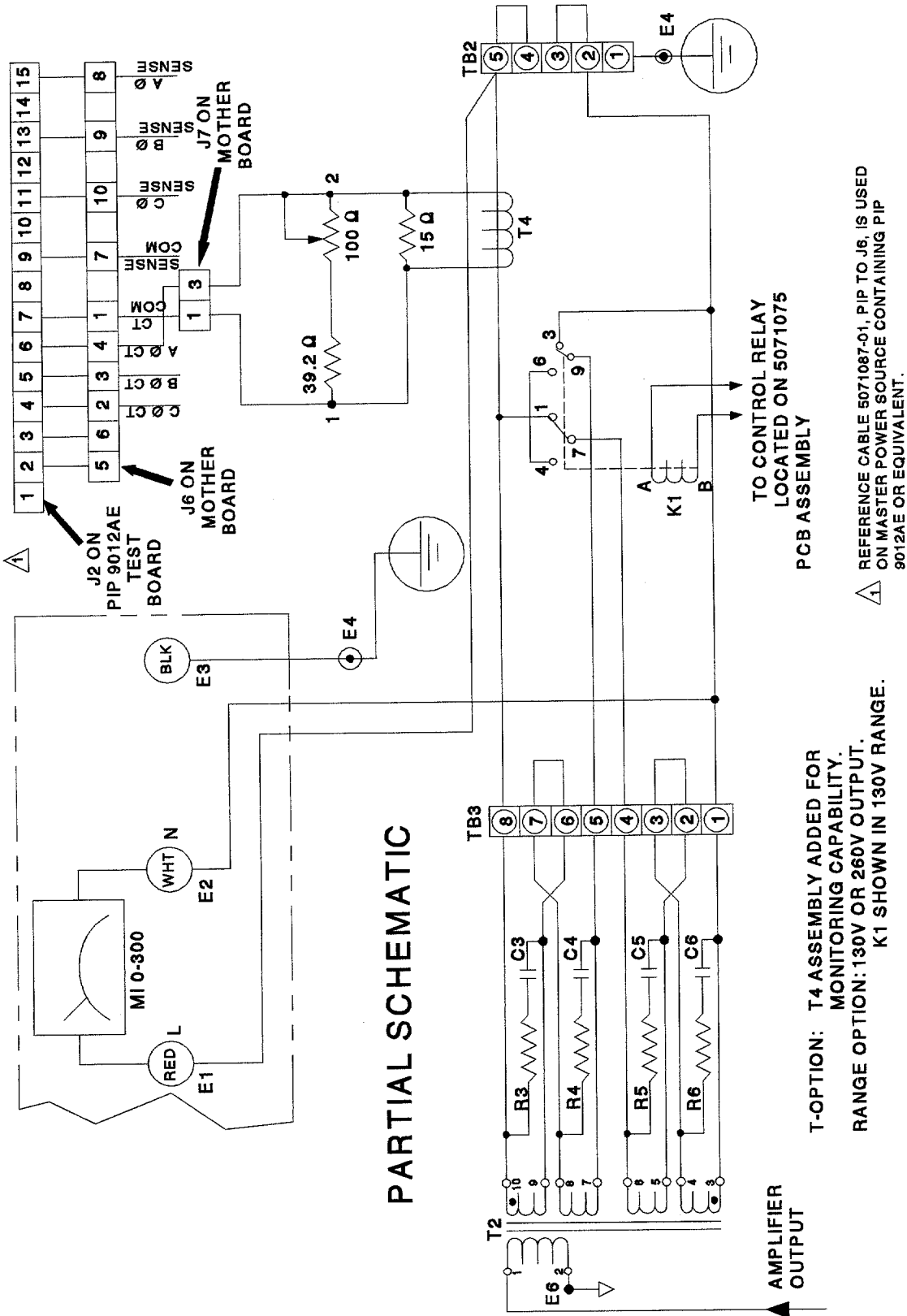


Figure 2-3. Output Monitoring and 130V/260V Ranging Options

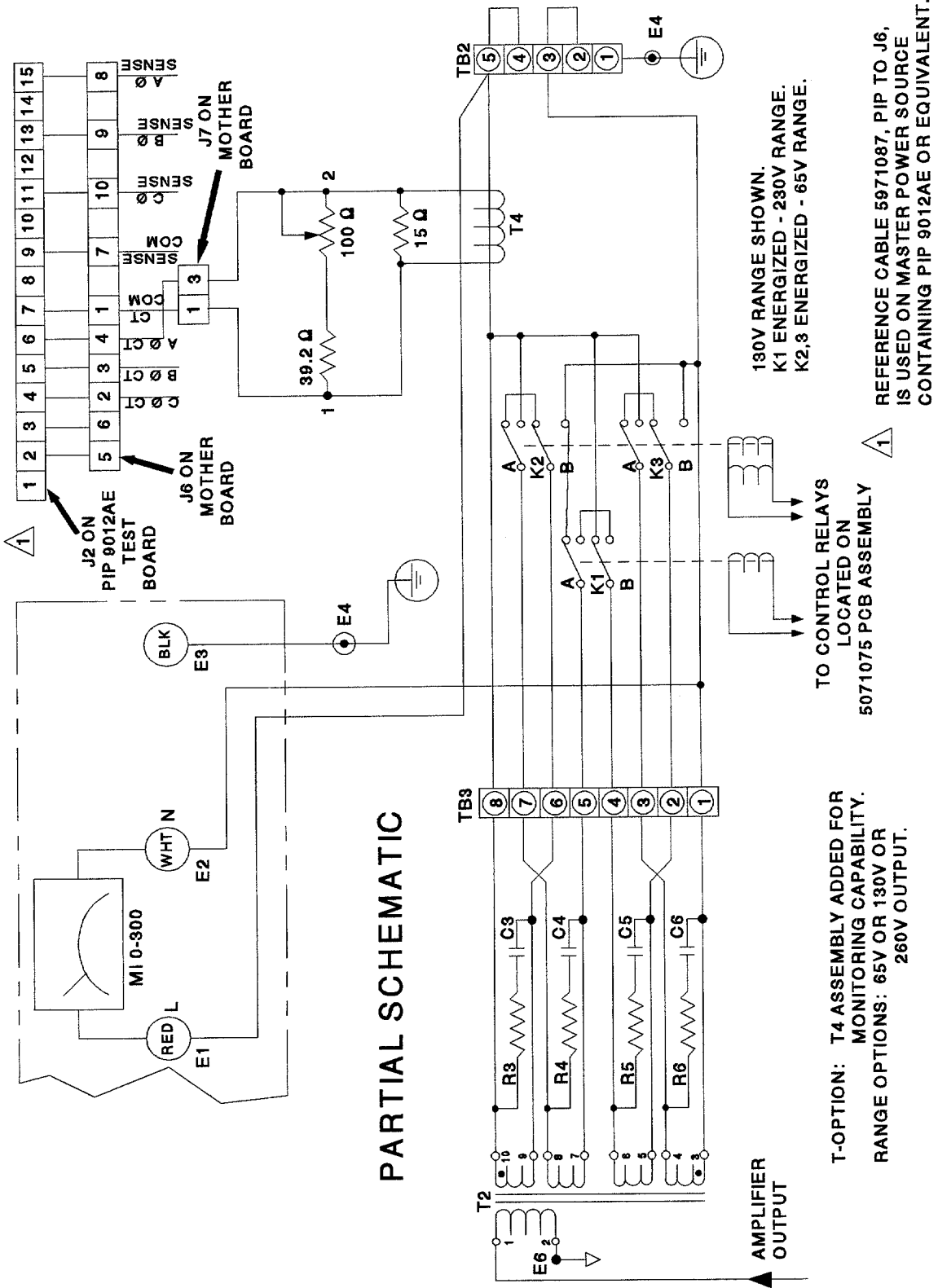
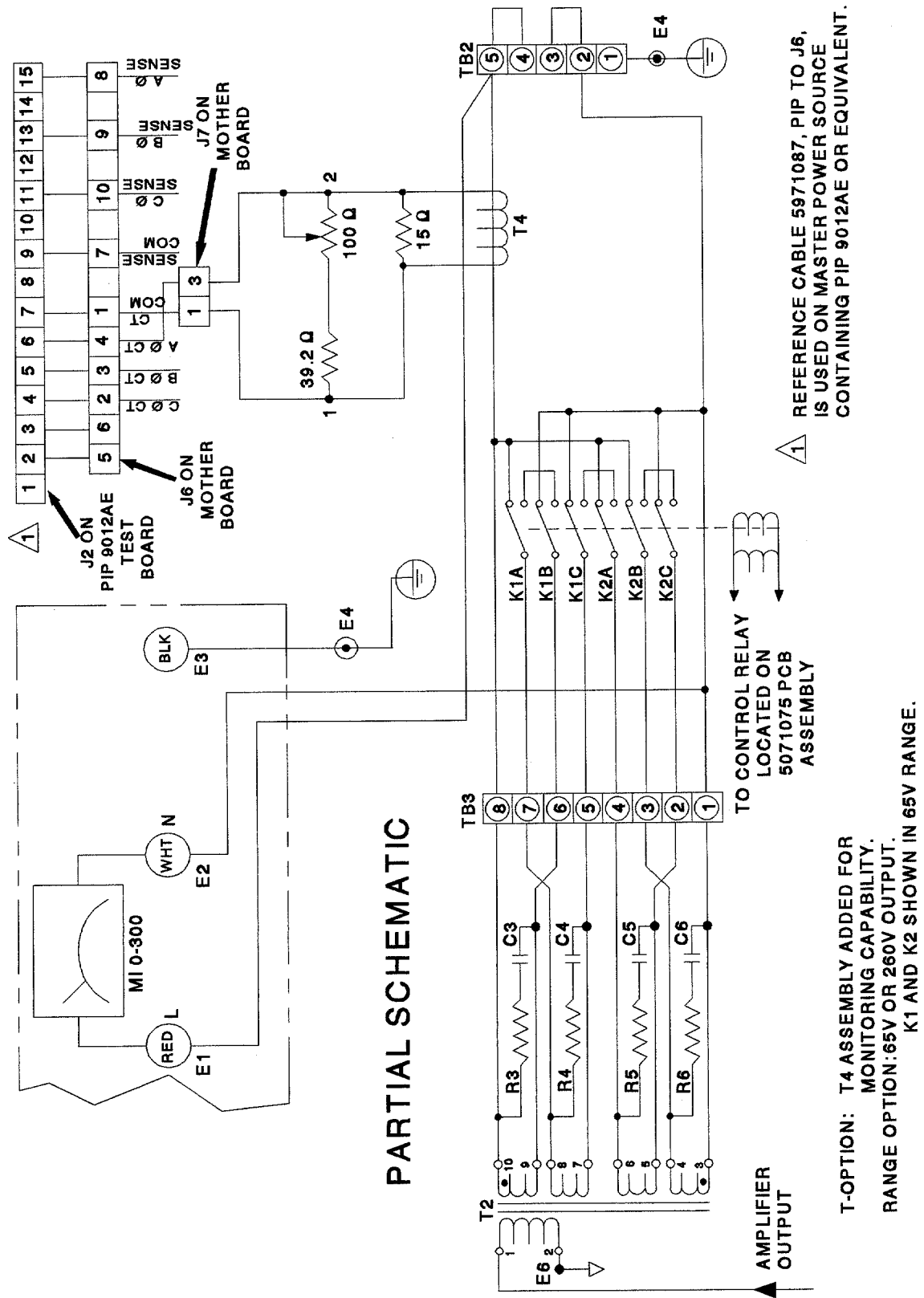


Figure 2-4. Output Monitoring and 65V/130V/260V Ranging Options



REFERENCE CABLE 5971087, PIP TO J6, IS USED ON MASTER POWER SOURCE CONTAINING PIP 9012AE OR EQUIVALENT.

TO CONTROL RELAY LOCATED ON 5071075 PCB ASSEMBLY

T-OPTION: T4 ASSEMBLY ADDED FOR MONITORING CAPABILITY. RANGE OPTION: 65V OR 260V OUTPUT. K1 AND K2 SHOWN IN 65V RANGE.

Figure 2-5. Output Monitoring and 65V/260V Ranging Options

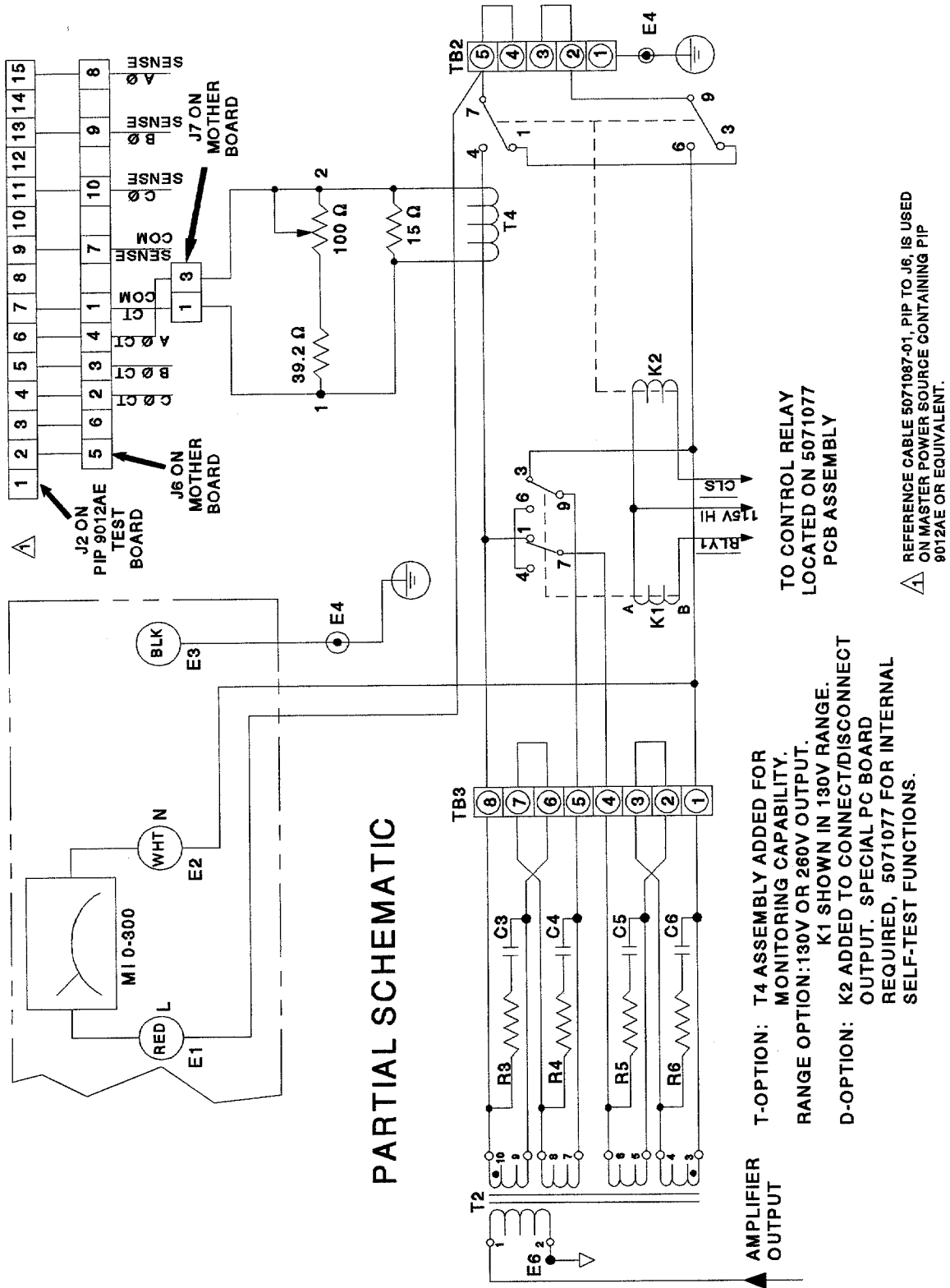


Figure 2-6. Output Monitoring, 130V/260V Ranging, and Output Connect/Disconnect Options

2.5 MODEL 1001SLE INSTALLATION

The Model 1001SLE AC Power Source is designed for installation in a standard 19" (483 mm) instrument rack (refer to Figures 2-7 through 2-9 for outline drawings, mounting dimensions and the location of controls and connectors).

The Model 1001SLE must be installed such that the flow of cooling air into the side panel grills and out the rear panel is not obstructed. For slide out capability, the unit is equipped with threaded inserts located on each side for mounting slides.

2.5.1 Input Power Requirements

The standard Model 1001SLE operates from 230 VAC single phase input power at 47 Hz to 63 Hz. The input power terminal block is located on the rear panel (refer to Figure 2-9 for location).

2.5.2 Output Power Connections

Output power is provided at a terminal block located on the rear panel of the unit (refer to Figure 2-9 for location). A listing of available output power can be found in Table 2-1. Figure 2-2 provides output voltage connection options.

2.5.3 Sync Out BNC Connectors

The Model 1001SLE can be optionally equipped with BNC-type 'Sync' connectors located on the rear panel of the unit (refer to Figure 2-9 for location).

2.5.4 Installing The Model 1001SLE

To install the Model 1001SLE AC Power Source, perform the following:

1. Before installing the power source, verify that the input and output voltage ranges are compatible with the available utility power and the output voltage application. Refer to Figures 2-8 and 2-9, Table 2-1, and the unit serial number tag for model number information.
2. The power source is designed for installation in a standard 19" (483 mm) RETMA electronic equipment rack. Install the power source in the appropriate rack such that the flow of cooling air into and out of the unit is unobstructed. Allow 6" (152 mm) clearance at the rear of the unit.
3. Position the POWER switch-circuit breaker to OFF (down).

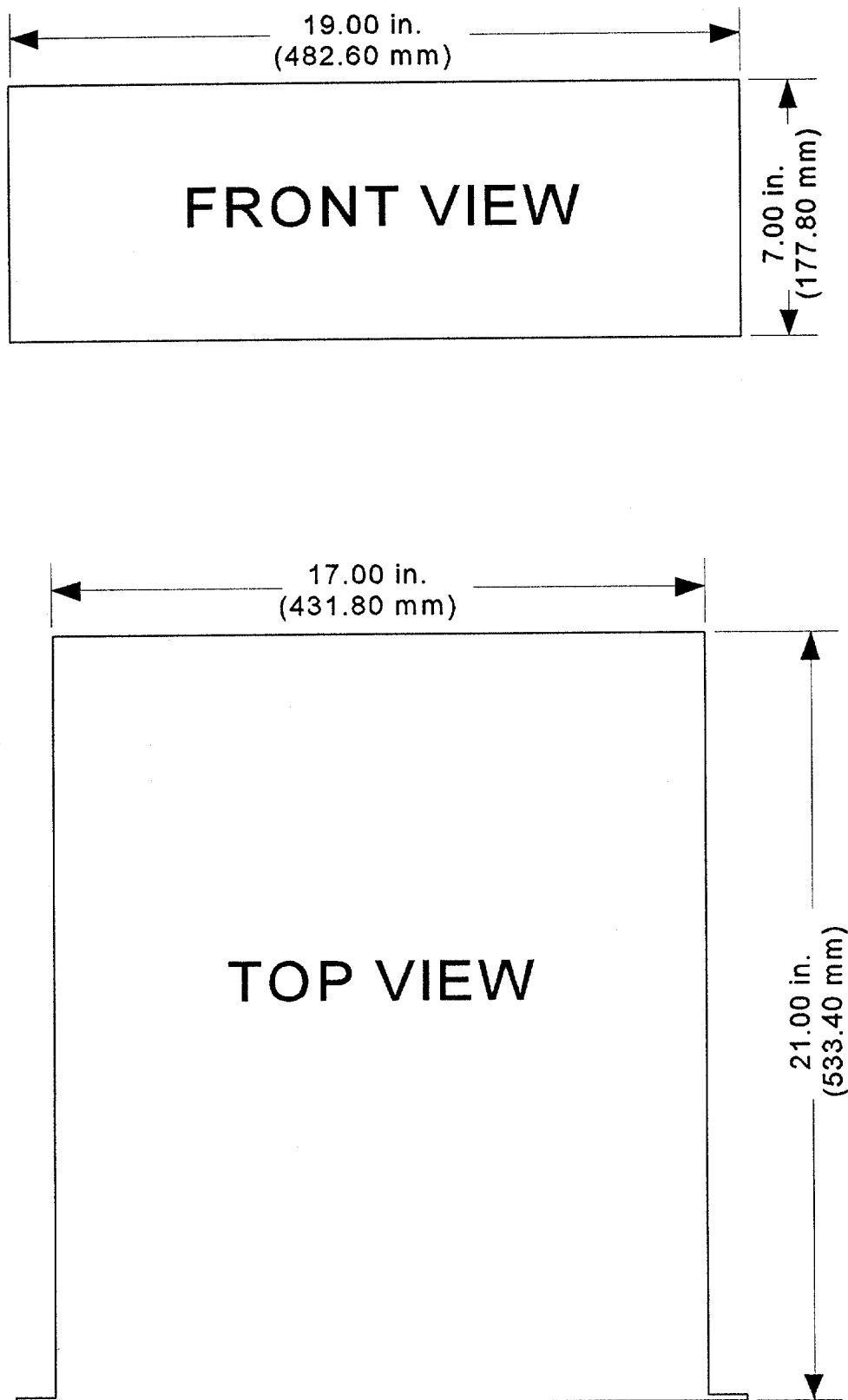


Figure 2-7. Model 1001SLE Installation Dimensions

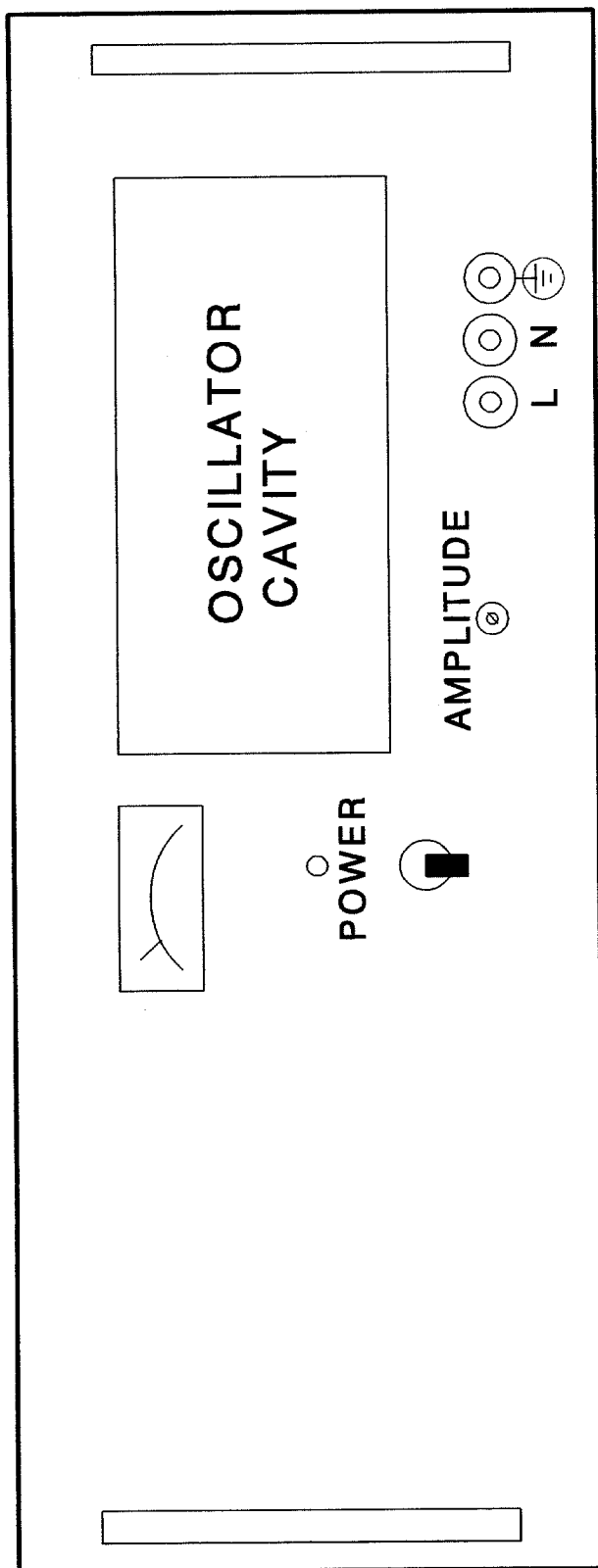


Figure 2-8. Model 1001SLE (Front View)

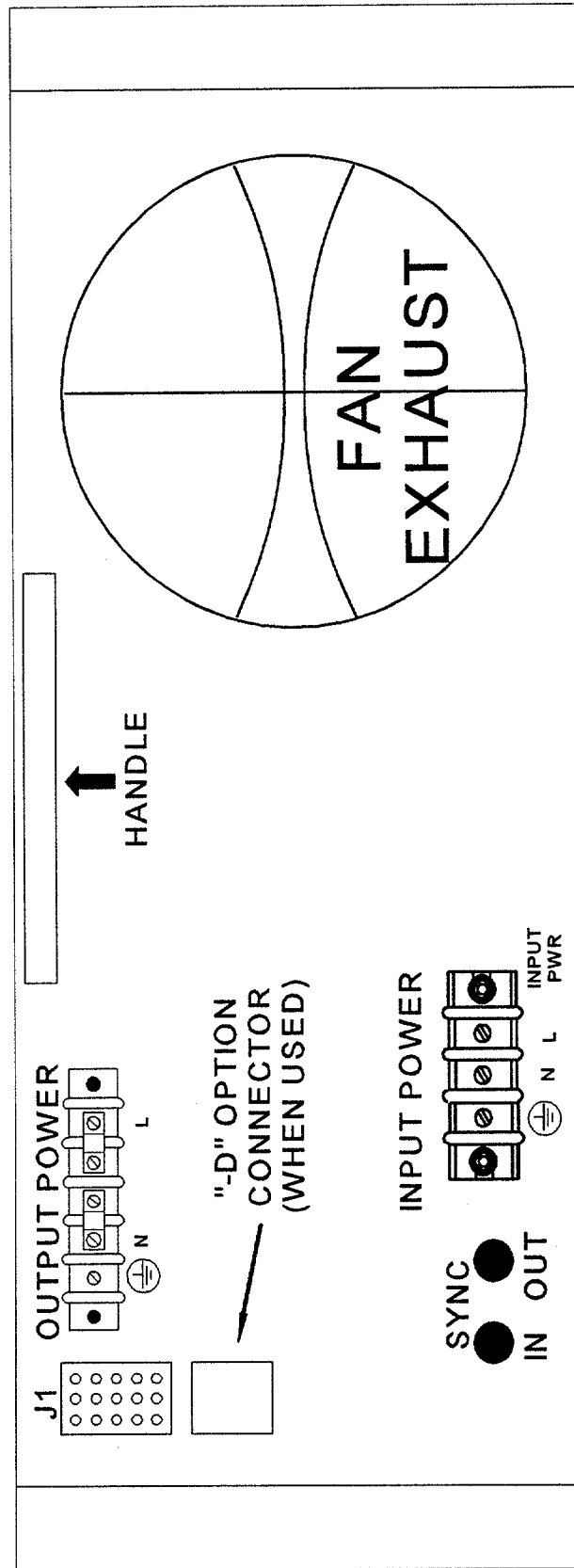


Figure 2-9. Model 1001SLE (Rear View)

2.5.5 Model 1001SLE Preliminary Functional Checkout

To check the Model 1001SLE AC Power Source after initial installation, perform the following:

1. Position the POWER switch-circuit breaker to ON (up). Observe that the POWER On indicator is illuminated (green).
2. Ensure that the fan is exhausting air through the rear panel grill.
3. Set the Elgar oscillator to the desired amplitude and frequency (refer to the oscillator's Operating Manual for specific instructions).
4. Position the POWER switch-circuit breaker to OFF (down). Observe that the Power On indicator is no longer illuminated and that the fan turns off.

2.6 MODEL 1751SLE INSTALLATION

The Model 1751SLE AC Power Source is designed for installation in a standard 19" (483 mm) instrument rack (refer to Figures 2-10 through 2-12 for outline drawings, mounting dimensions and the location of controls and connectors).

The Model 1751SLE must be installed such that the flow of cooling air into the side panel grills and out the rear panel is not obstructed. For slide out capability, the unit is equipped with threaded inserts located on each side for mounting slides.

2.6.1 Input Power Requirements

The standard Model 1751SLE operates from 230 VAC single phase input power at 47 Hz to 63 Hz. The input power terminal block is located on the rear panel (refer to Figure 2-12 for location).

2.6.2 Output Power Connections

Output power is provided at a terminal block located on the rear panel of the unit (refer to Figure 2-12 for location). A listing of available output power can be found in Table 2-1. Figure 2-1 provides output voltage connection options.

2.6.3 Sync Out BNC Connectors

The Model 1751SLE can be optionally equipped with BNC-type 'Sync' connectors located on the rear panel of the unit (refer to Figure 2-12 for location).

2.6.4 Installing The Model 1751SLE

To install the Model 1751SLE AC Power Source, perform the following:

1. Before installing the power source, verify that the input and output voltage ranges are compatible with the available utility power and the output voltage application. Refer to Figures 2-10 and 2-11, Table 2-1, and the unit serial number tag for model number information.
2. The power source is designed for installation in a standard 19" (483 mm) RETMA electronic equipment rack. Install the power source in the appropriate rack such that the flow of cooling air into and out of the unit is unobstructed. Allow 6" (152 mm) clearance at the rear of the unit.
3. Position the POWER switch-circuit breaker to OFF (down).
4. Insert the appropriate Elgar plug-in oscillator, which provides control over output voltages and frequencies, into the front panel cavity of the SLE Series AC Power Source. The oscillator is installed by carefully connecting and attaching any loose cables. The oscillator module is aligned so its Main Board card edge connector fits into the recessed AC Power Source motherboard connector (do not bind or pinch the flexible cables during installation). When installing a plug-in oscillator module, exercise care to ensure proper mechanical alignment and snug connector fit. When this connection is firmly seated, the oscillator is secured to the AC Power Source chassis by two front panel captive screws. Tighten the two front panel captive screws with a flat blade screwdriver so that they cannot be removed by hand.

WARNING



Always ensure that facility AC power is de-energized prior to connecting or disconnecting the power cable(s) and/or installing or removing the plug-in oscillator module from the Model 1001SLE/1751SLE AC Power Source. Similarly, the Model 1001SLE/1751SLE AC Power Source circuit breaker must be switched OFF (0) prior to connecting or disconnecting input and/or output power cable(s) and/or installing or removing the plug-in oscillator module from the Model 1001SLE/1751SLE AC Power Source.

CAUTION

Dangerous voltages may be present inside the oscillator cavity when the oscillator module is removed. Qualified personnel must use extreme caution when servicing this equipment.

5. Connect the output load to the rear panel output terminal block (TB2). For initial installation, a dummy load should be used until the unit is completely checked out and verified as operational.
6. Connect the input power to the rear panel input power terminal block, TB1 (refer to Figure 2-12 for location).

2.6.5 Model 1751SLE Preliminary Functional Checkout

To check the Model 1751SLE AC Power Source after initial installation, perform the following:

1. Position the POWER switch-circuit breaker to ON (up). Observe that the POWER On indicator is illuminated (green).
2. Ensure that the fans are exhausting air through the rear panel grill.
3. Set the Elgar oscillator to the desired amplitude and frequency (refer to the oscillator's Operating Manual for specific instructions).
4. Position the POWER switch-circuit breaker to OFF (down). Observe that the Power On indicator is no longer illuminated and that the fans turn off.

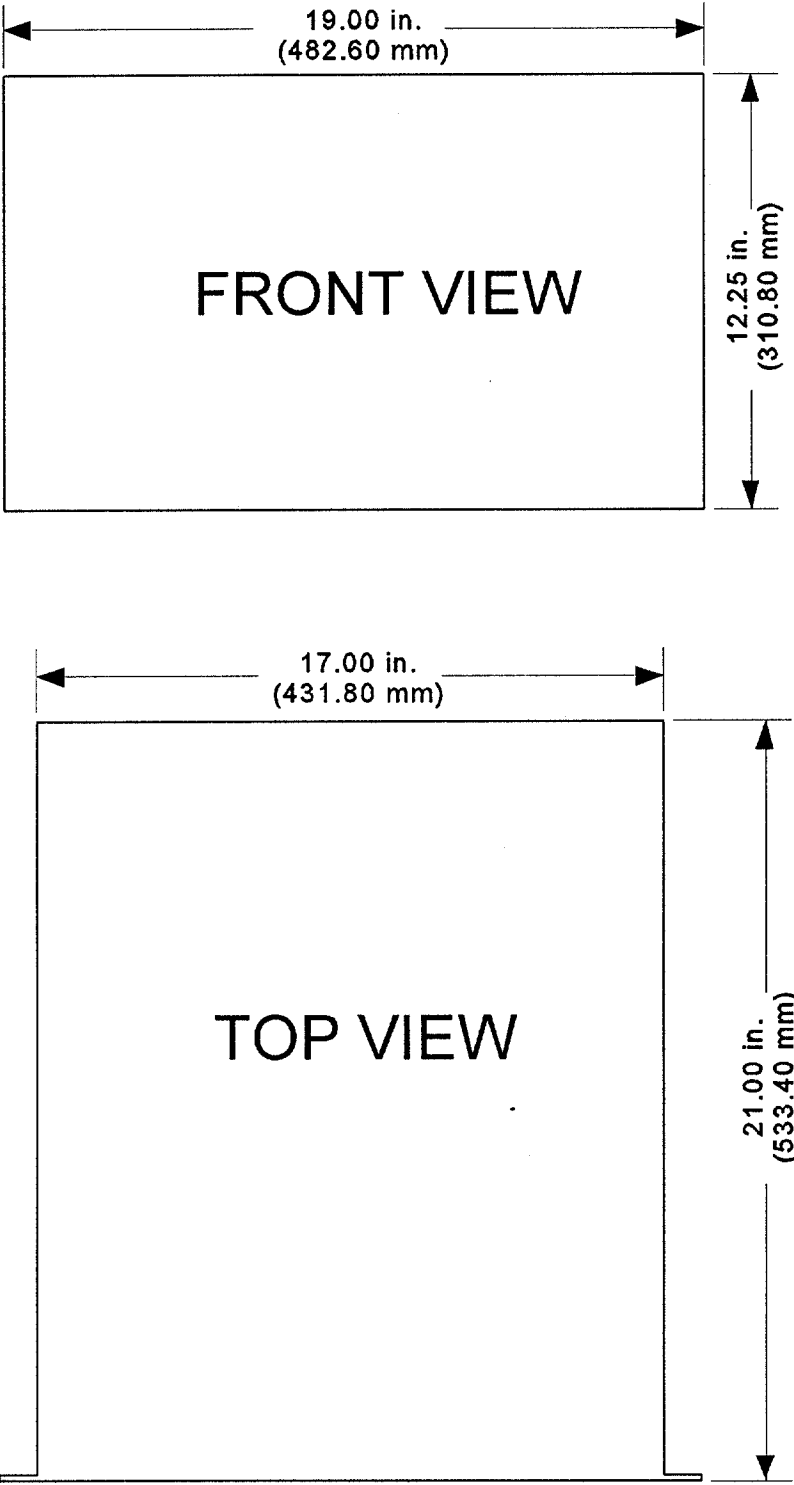


Figure 2-10. Model 1751SLE Installation Dimensions

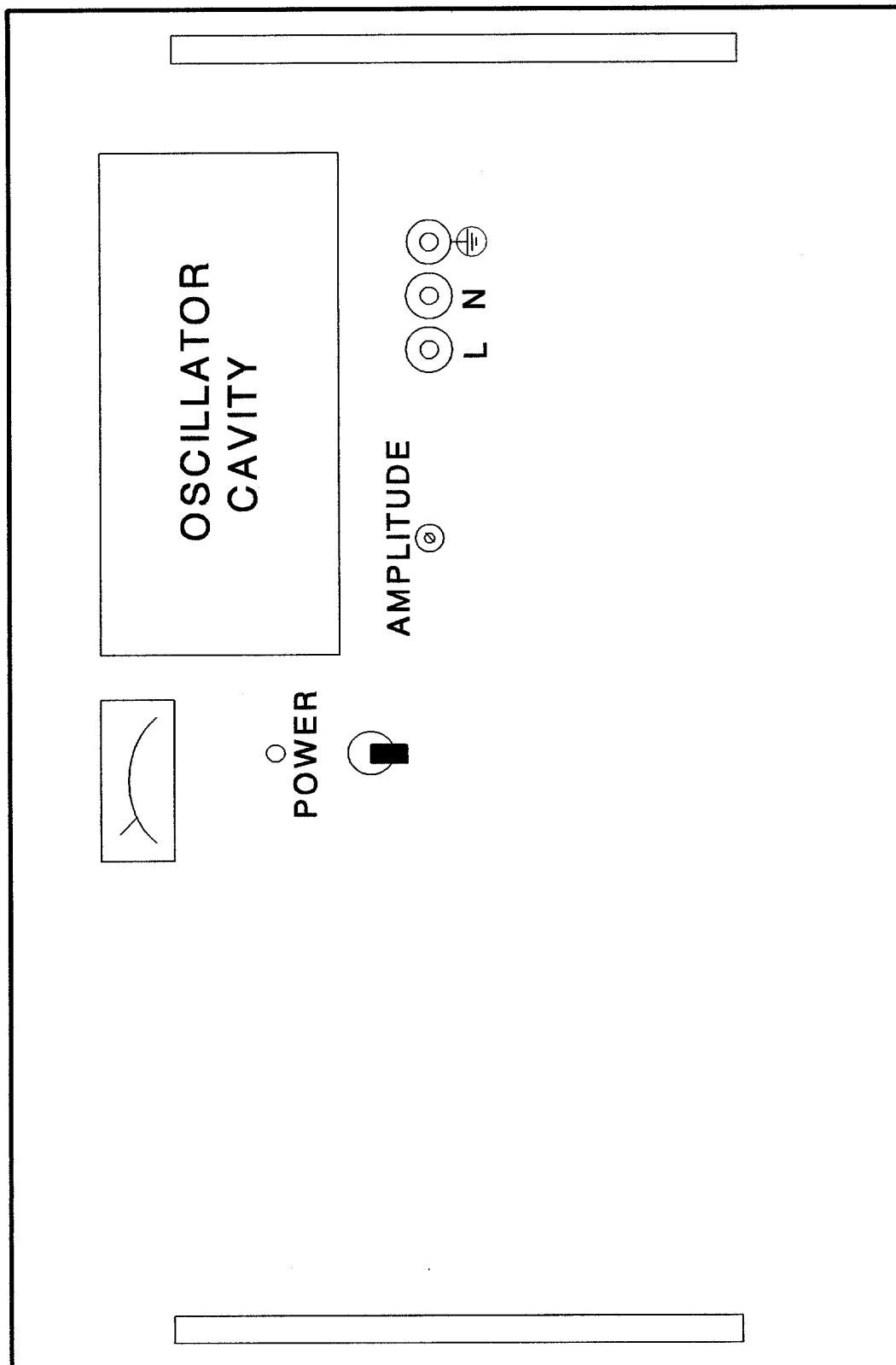


Figure 2-11. Model 1751SLE (Front View)

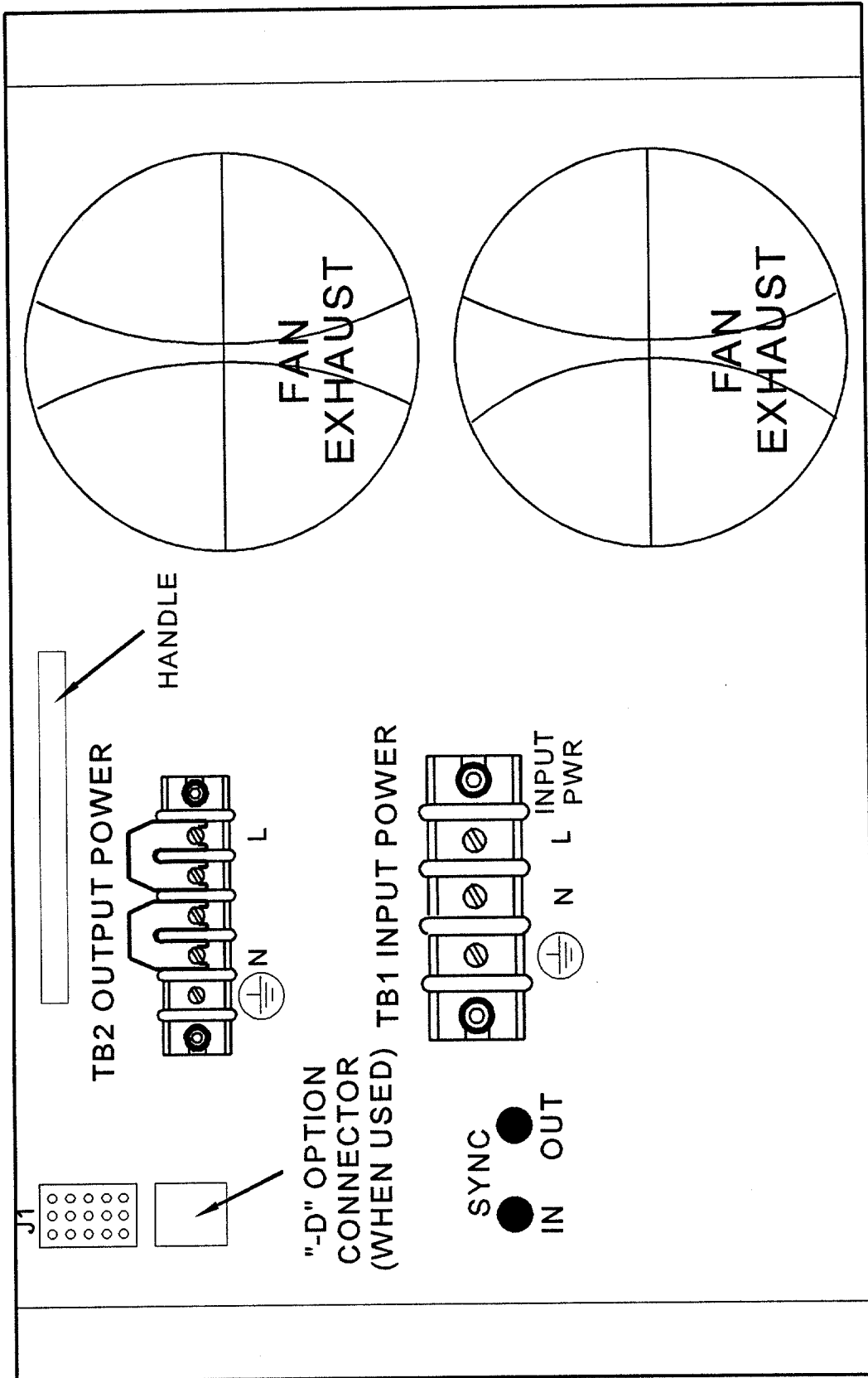


Figure 2-12. Model 1751SLE (Rear View)

2.7 SYSTEM INTERCONNECTION**2.7.1 Multi-Phase Operation**

Two or three power sources may be interconnected to generate two or three phase AC power (refer to Table 2-2 for further information).

NOTE

Table 2-2 utilizes the 400 Series oscillator (refer to paragraph 2.7.2). Refer to the appropriate PIP Operating Manual if a PIP is utilized.

Two or three phase signals are developed by a multi-phase oscillator installed in the A Phase power amplifier. Signals from the oscillator are routed to the B Phase and/or C Phase power amplifiers through a signal interconnect cable. These signals are then applied to the front panel AMPLITUDE control on each amplifier by a signal routing plug-in which must be installed in the unit. Upon initial calibration of the system, the voltage of Phase A is adjusted to a desired value, i.e., 115 VAC. The other phase amplifier(s) output voltages are then adjusted by means of their front panel amplitude controls to equal the output voltage of Phase A. After this initial calibration has been accomplished, the voltage control on the Phase A amplifier is used to vary the output voltage of all phases simultaneously and equally.

Two phase operation requires two power sources. Three phase operation may be accomplished with three power sources, two power sources in open delta configuration, or two power sources in phantom wye configuration. Refer to Figure 2-13 for output interconnect information for the various systems.

In the open delta configuration, two power amplifiers of equal VA rating are driven by a standard three phase oscillator having a 120° phase angle between Phase A, Phase B, and Phase C. An open delta requires that the two amplifiers have a 60° phase angle between them. This is accomplished by inverting the output from the second amplifier.

In these systems, the amplifier containing the plug-in oscillator is referred to as the Master or Phase A source. The second amplifier is referred to as the Slave or Phase B source.

The vector diagram for the open delta connection is shown in Figure 2-14.

Table 2-2. 1-, 2-, or 3-Phase Using Two or Three AC Power Sources

System Model	Power Source(s)	Plug-In Standard	Plug-In Servo	Cable Standard	Cable Servo
2000SLE-1	1001SLE(2)	400BT	400DPA	5970042	5970030
2000SLE-2	1001SLE(2)	400C	400DPC	5970042	5970030
2000SLE-3D	1001SLE(2)	400C	400DPC	5970042	5970030
3000SLE-3	1001SLE(3)	400B, 400C	400DPB, 400DPC	5970041	5970029
3500SLE-1	1751SLE(2)	400BT	400DPA	5970042	5970030
3500SLE-2	1751SLE(2)	400C	400DPC	5970042	5970030
3500SLE-3D	1751SLE(2)	400C	400DPC	5970042	5970030
5250SLE-3	1751SLE(3)	400B, 400C	400DPB, 400DPC	5970041	5970029

NOTES:

1. A three digit dash number may be used to identify system input, output or special functions. Refer to Figure 1-4 for information.

EXAMPLE: 3000SLE-3-22T will be a 230 VAC input, 0-260 VAC output with T-option monitoring AC Power Source System.

2. An additional plug-in master oscillator is required to complete the system, such as a Model PIP 9012E-3, a 3 phase oscillator would be used in a 3000SLE-3 system.
3. An additional cable, 5970014, is required for auxiliary signal interconnect when a D-option is installed in a 3 amplifier system.

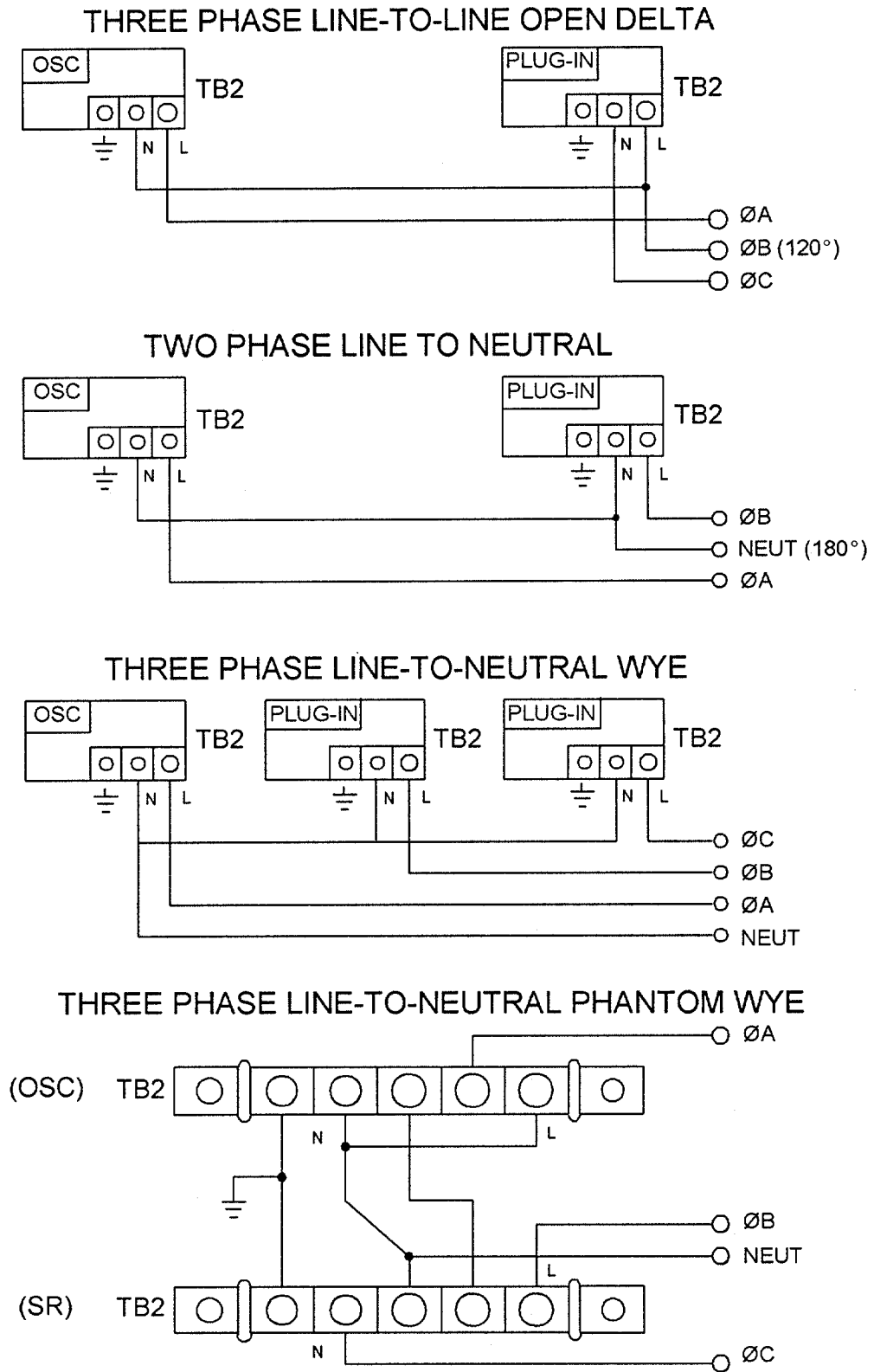


Figure 2-13. System Interconnections

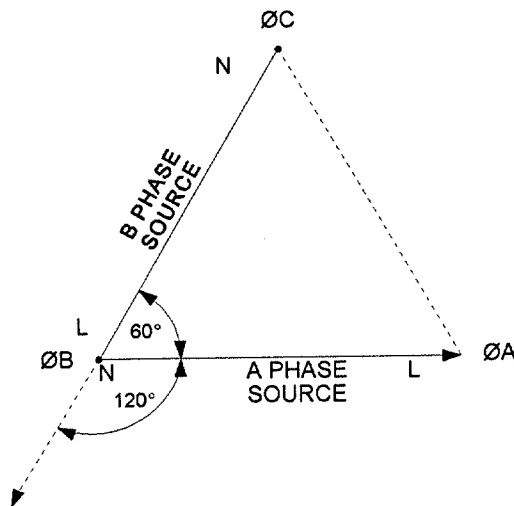


Figure 2-14. Open Delta Vector Diagram

2.7.2 Model 400SR Configuration Switch, S1

The 400SR plug-in is a universal signal routing switch used in multi-phase systems to route drive signals from a master plug-in oscillator or an external oscillator source (refer to Figure 2-15). The routing is accomplished by the closing of specific switches on the 8 pole switch.

2.7.3 Model 400 Series Plug-In Oscillators

Standard plug-ins are discussed in paragraphs 2.7.3.1 through 2.7.3.7 (refer to the appropriate PIP Operating Manual if a PIP is utilized).

2.7.3.1 Model 400A

External oscillator adaptor (refer to Figure 2-16). Has a front panel phone jack and routes the signal to the power amplifier input. A DIP switch is not necessary. If a DIP switch is present, switches 7 and 8 must be ON, connecting pins 14 to 21 and 16 to 12.

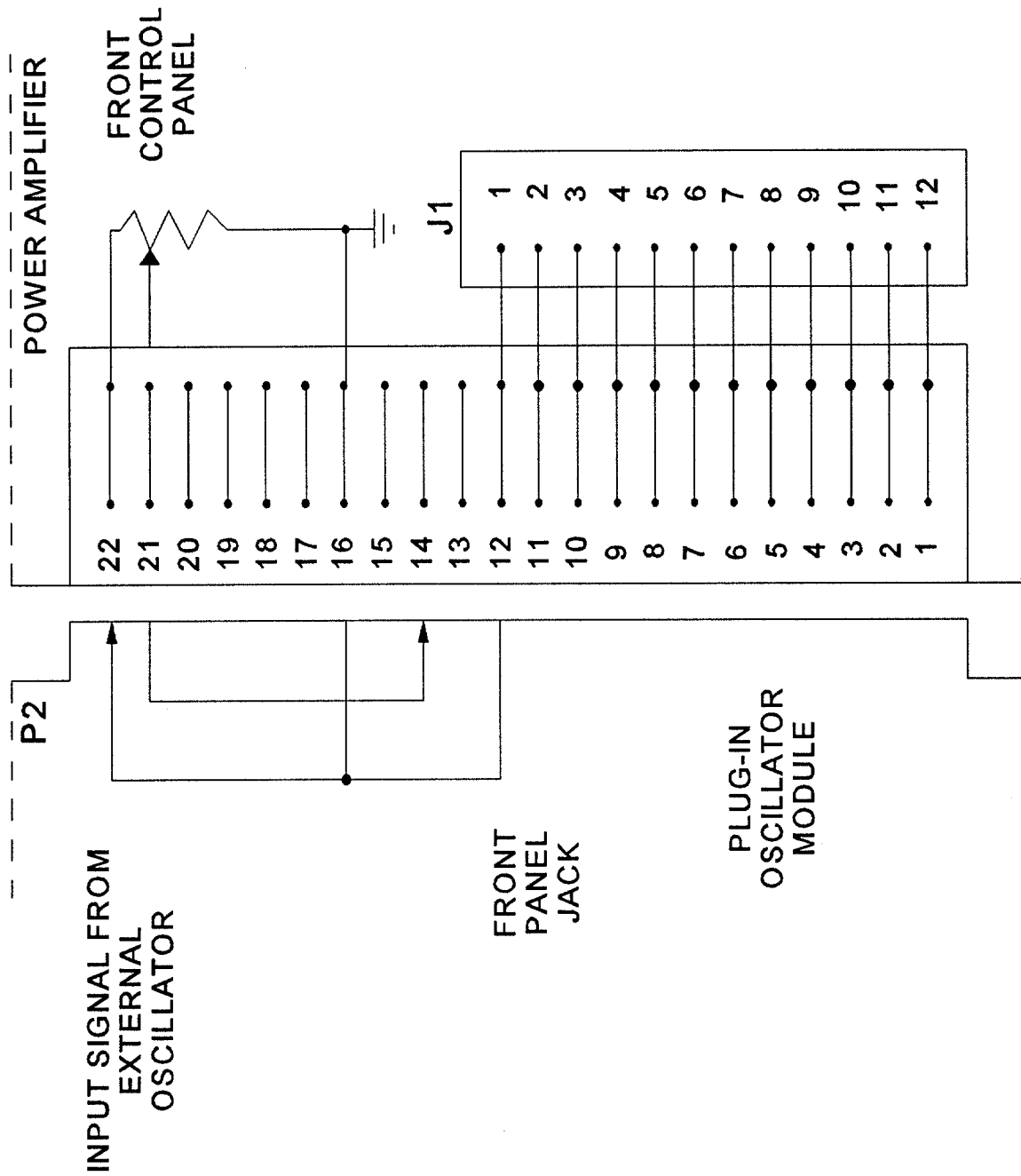


Figure 2-15. Model 400SR Configuration Switch, S1

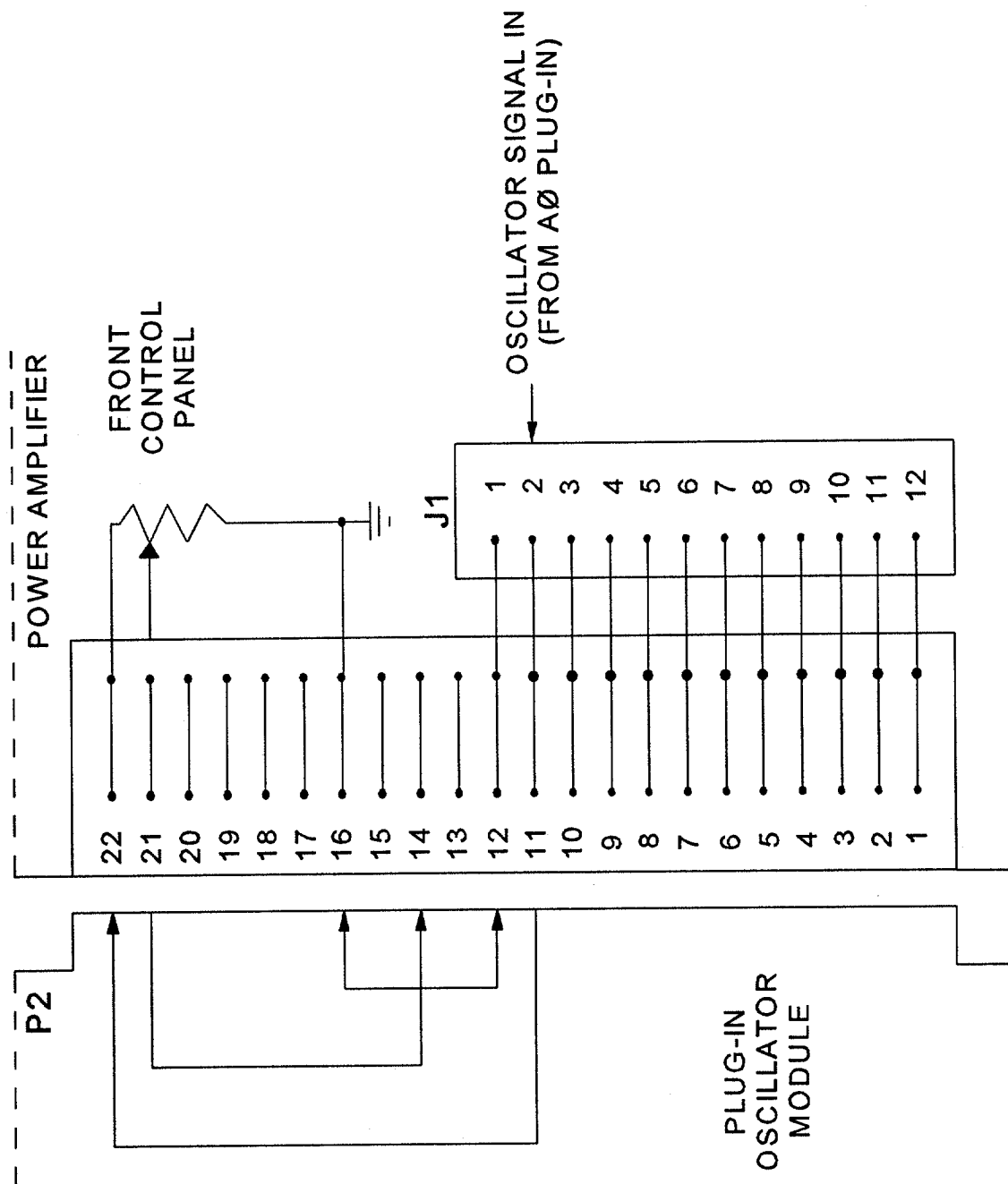


Figure 2-16. Model 400A Signal Routing Plug-In

2.7.3.2 Model 400B

Blank plug-in used in the second amplifier (B Phase) of a multi-phase system (refer to Figure 2-17). Routes the appropriate signal from the oscillator in the first amplifier to the second amplifier input. Switches 6, 7 and 8 must be ON, connecting pins 22 to 11, 21 to 14, and 16 to 12.

2.7.3.3 Model 400C

Blank plug-in used in the third amplifier (C Phase) of the 3 amplifier, 3 phase system (refer to Figure 2-18). Routes the appropriate signal from the oscillator in the first amplifier to the third amplifier input. Switches 5, 7, and 8 must be ON, connecting pins 22 to 10, 21 to 14, and 16 to 12.

2.7.3.4 Model 400DPA

Blank plug-in used in certain single phase PIP or servo controlled systems as a Phase A signal routing (refer to Figure 2-19). Switches 4 and 8 must be ON connecting pins 14 to 9, and 16 to 12.

2.7.3.5 Model 400DPB

Blank plug-in used in Phase B of a multi-phase PIP or in servo controlled oscillator systems (refer to Figure 2-20). Switches 1 and 8 must be ON, connecting pins 14 to 11 and 16 to 12.

2.7.3.6 Model 400DPC

Blank plug-in used in Phase C of a multi-phase PIP or in servo controlled oscillator systems (refer to Figure 2-21). Switches 2 and 8 must be ON, connecting pins 14 to 10 and 16 to 12.

2.7.3.7 Model 400BT

Blank plug-in for second amplifier(s) in a tandem system, such as a 2000SL-1 (refer to Figure 2-22). Also used in single phase TG704A systems or in Phase A of multi-phase TG704A-3 systems. Switches 4, 7, and 8 must be ON, connecting pins 22 to 9, 21 to 14, and 16 to 12.

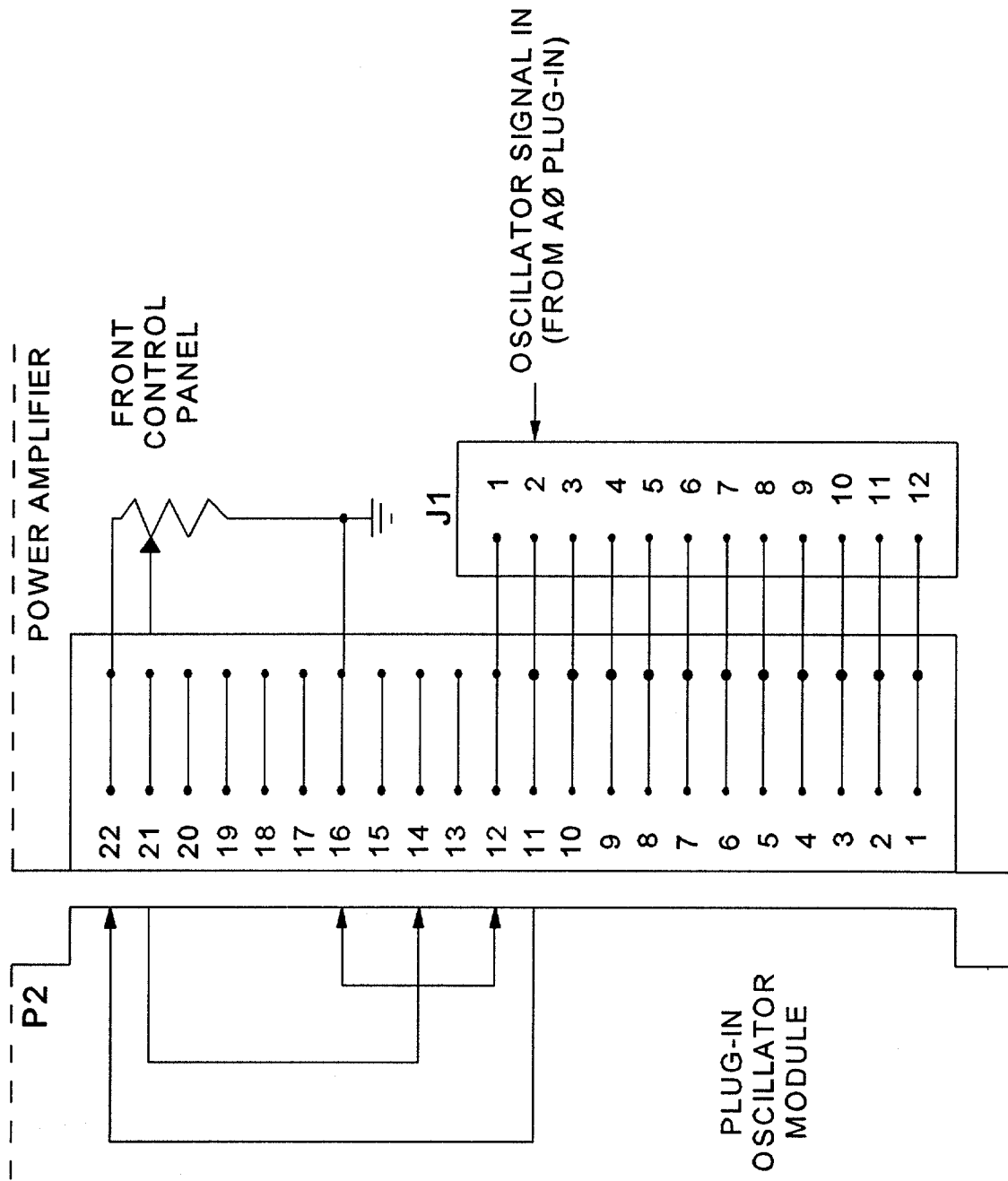


Figure 2-17. Model 400B Signal Routing Plug-In

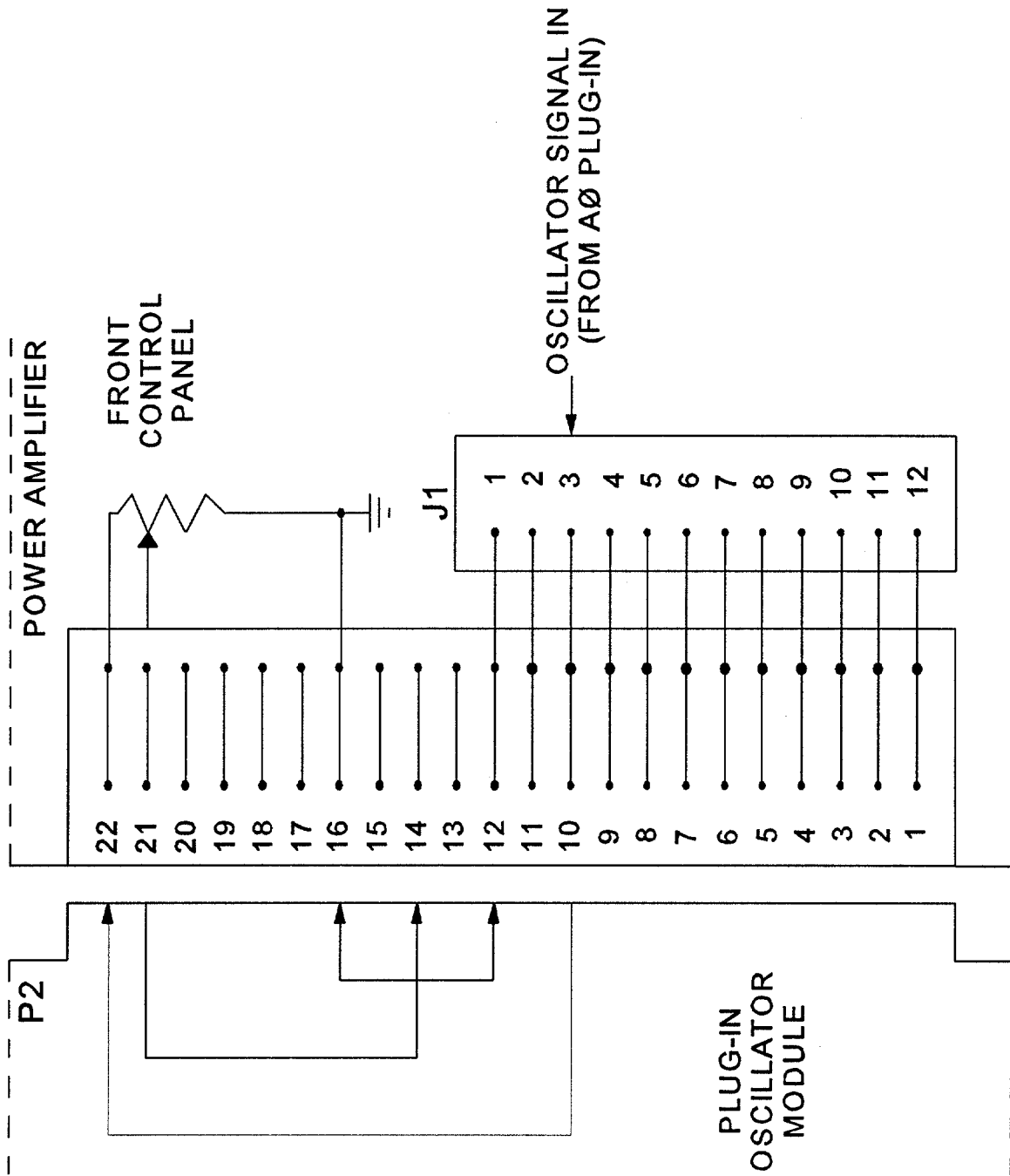


Figure 2-18. Model 400C Signal Routing Plug-In

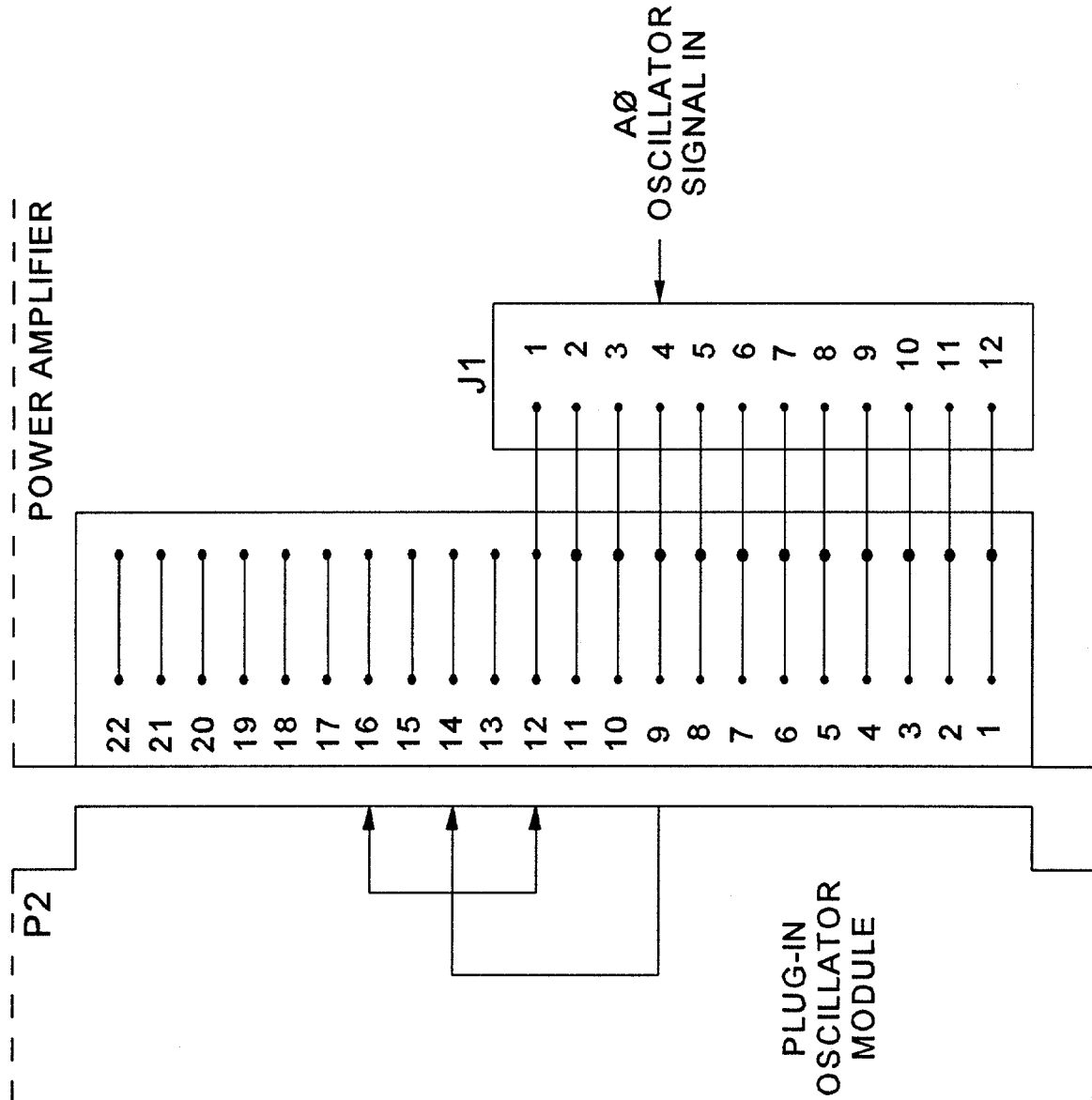


Figure 2-19. Model 400DPA Signal Routing Plug-In

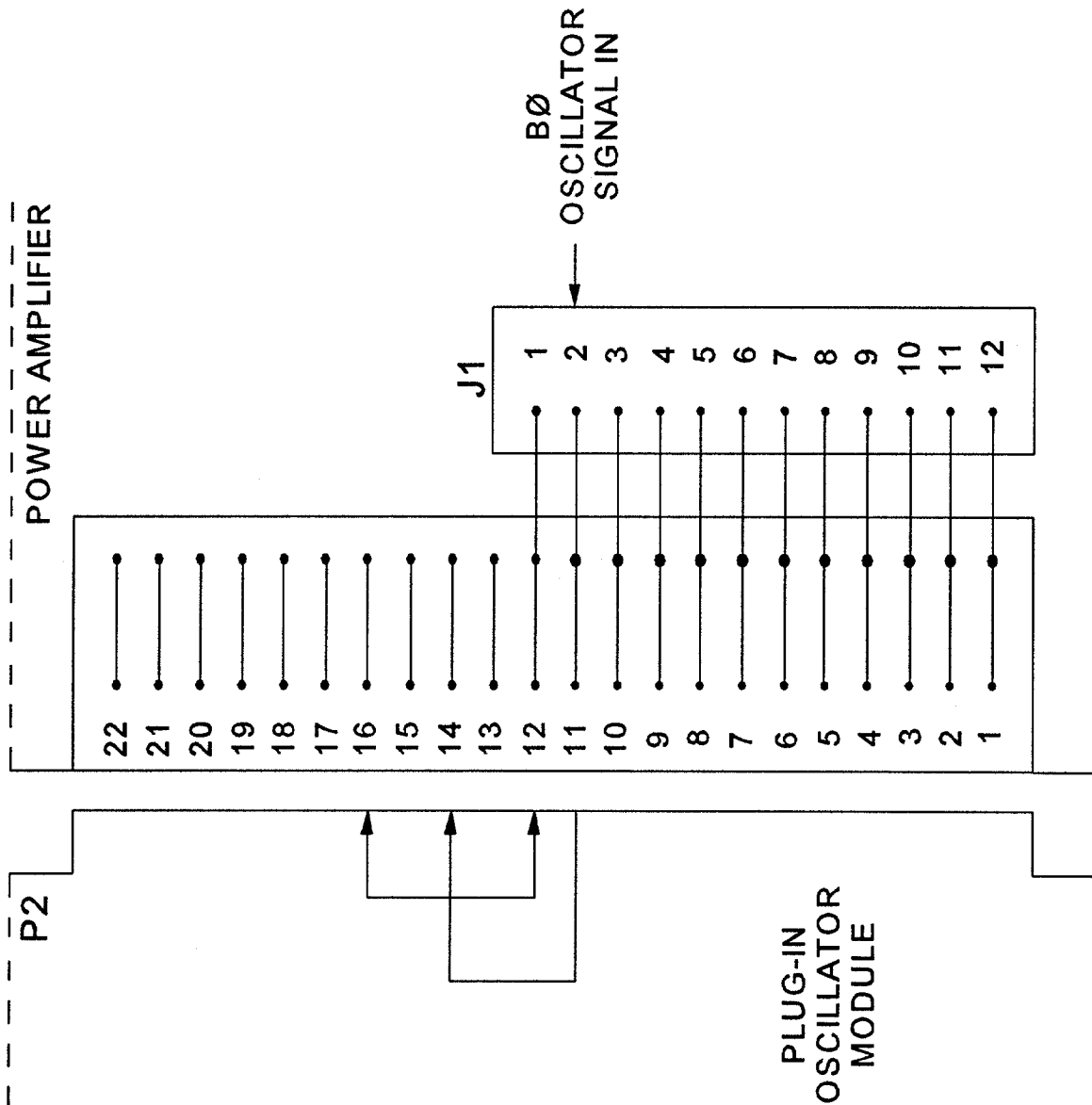


Figure 2-20. Model 400DPB Signal Routing Plug-In

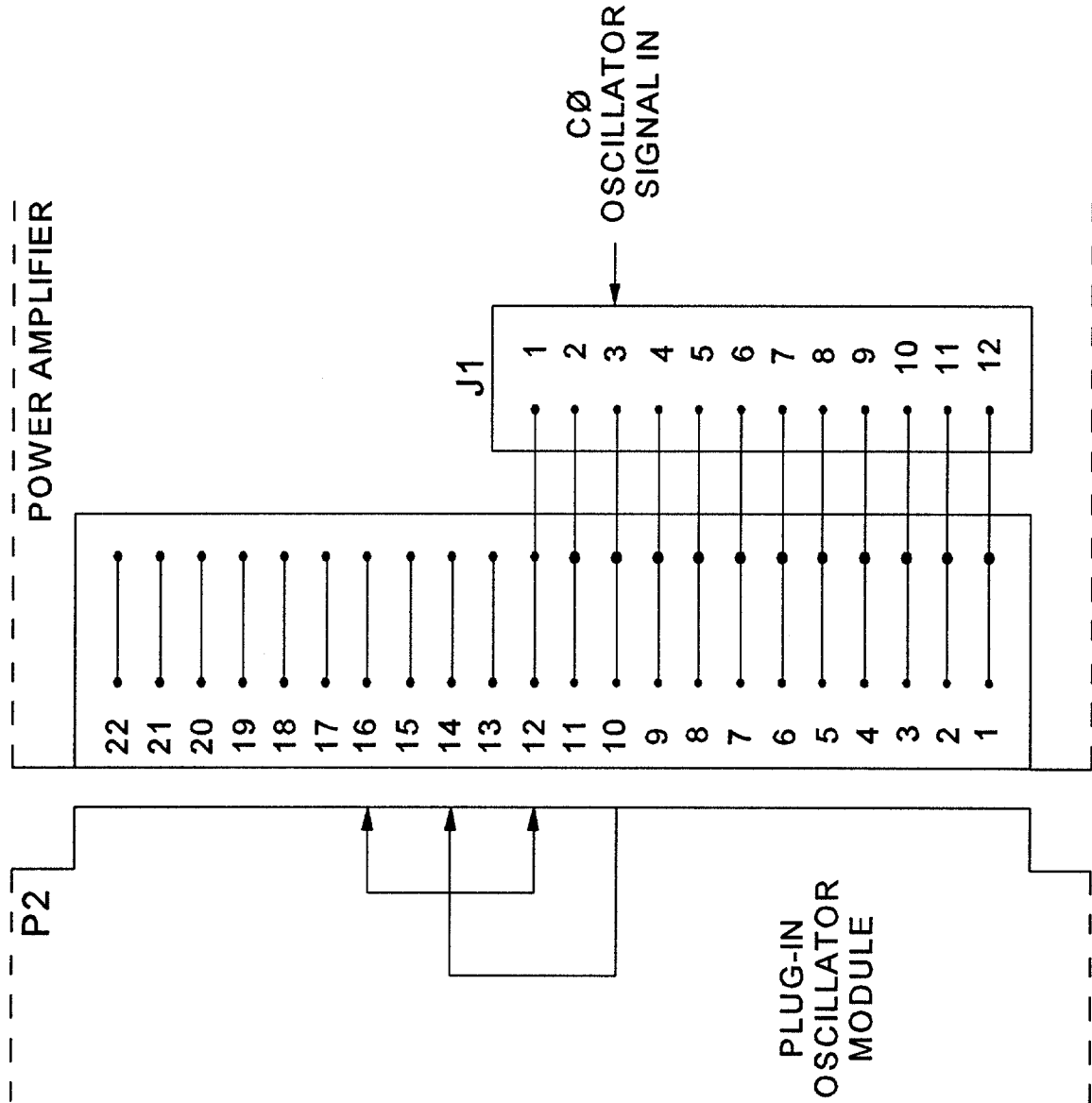


Figure 2-21. Model 400DPC Signal Routing Plug-In

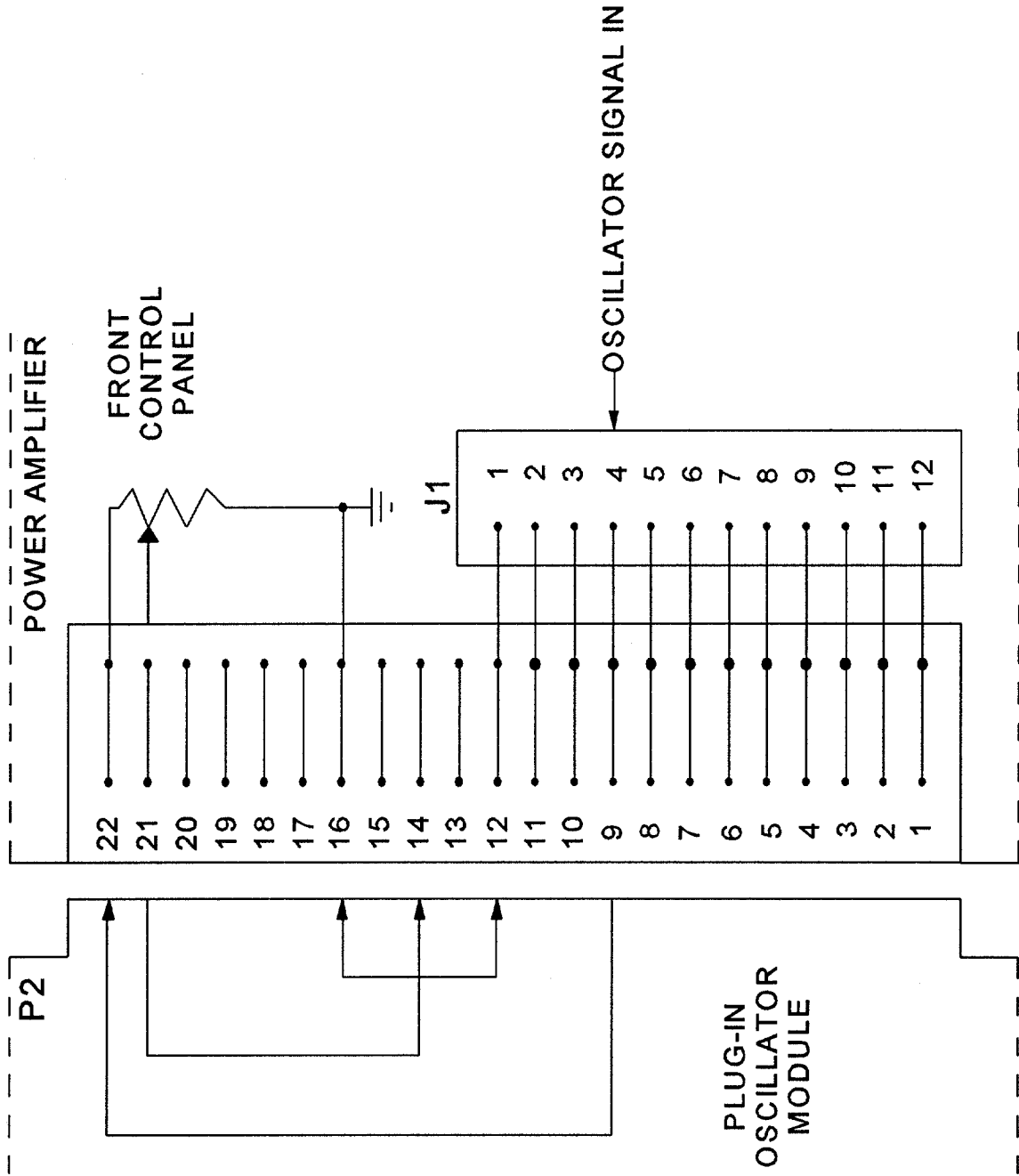
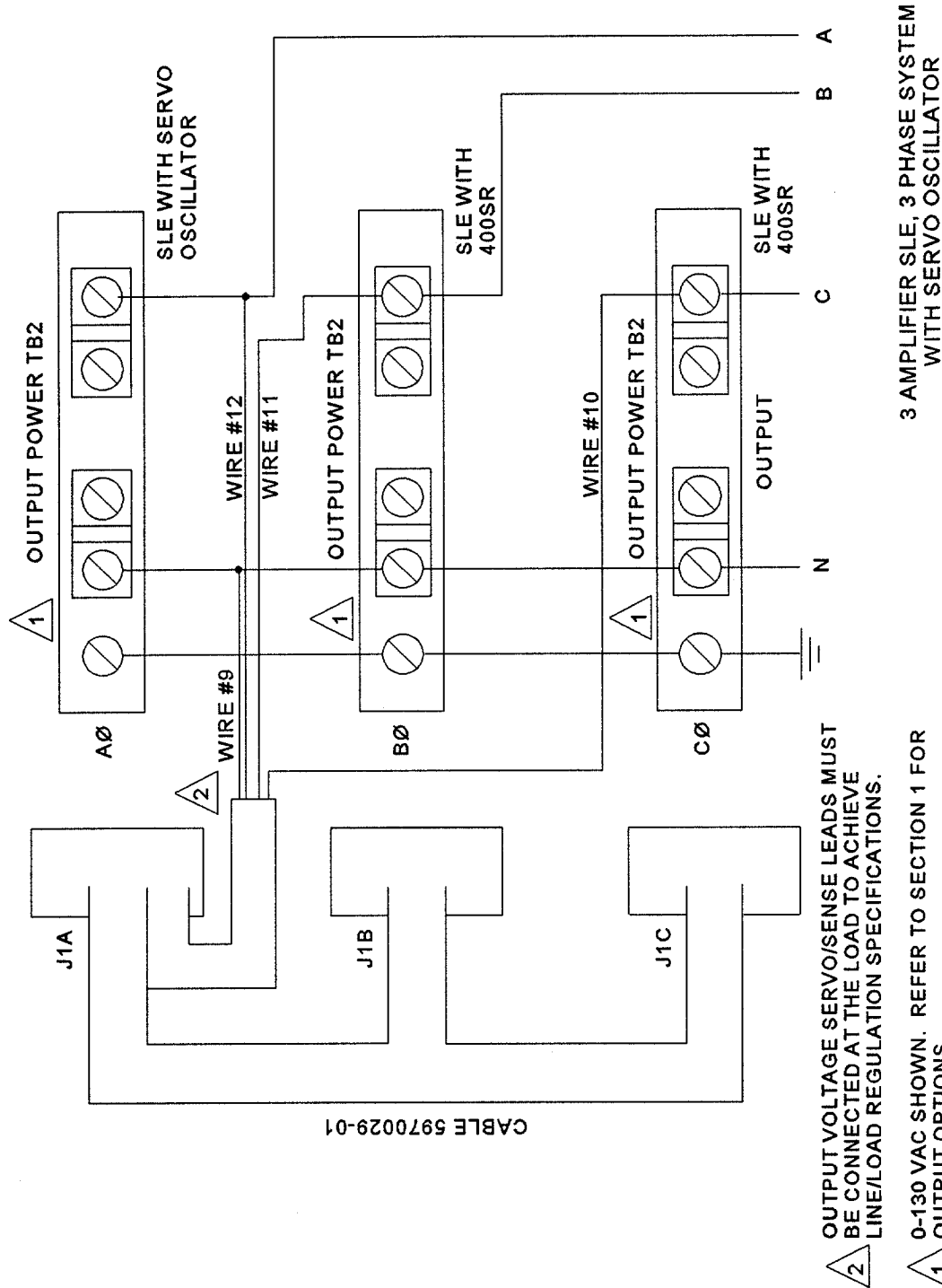


Figure 2-22. Model 400BT Signal Routing Plug-In

2.7.4 Interconnect Diagrams

Refer to Figure 2-23 for information concerning a 3 amplifier, 3 phase system with a servo oscillator.

Refer to Figure 2-24 for information concerning a 3 amplifier, 3 phase system with D-option, servo control.

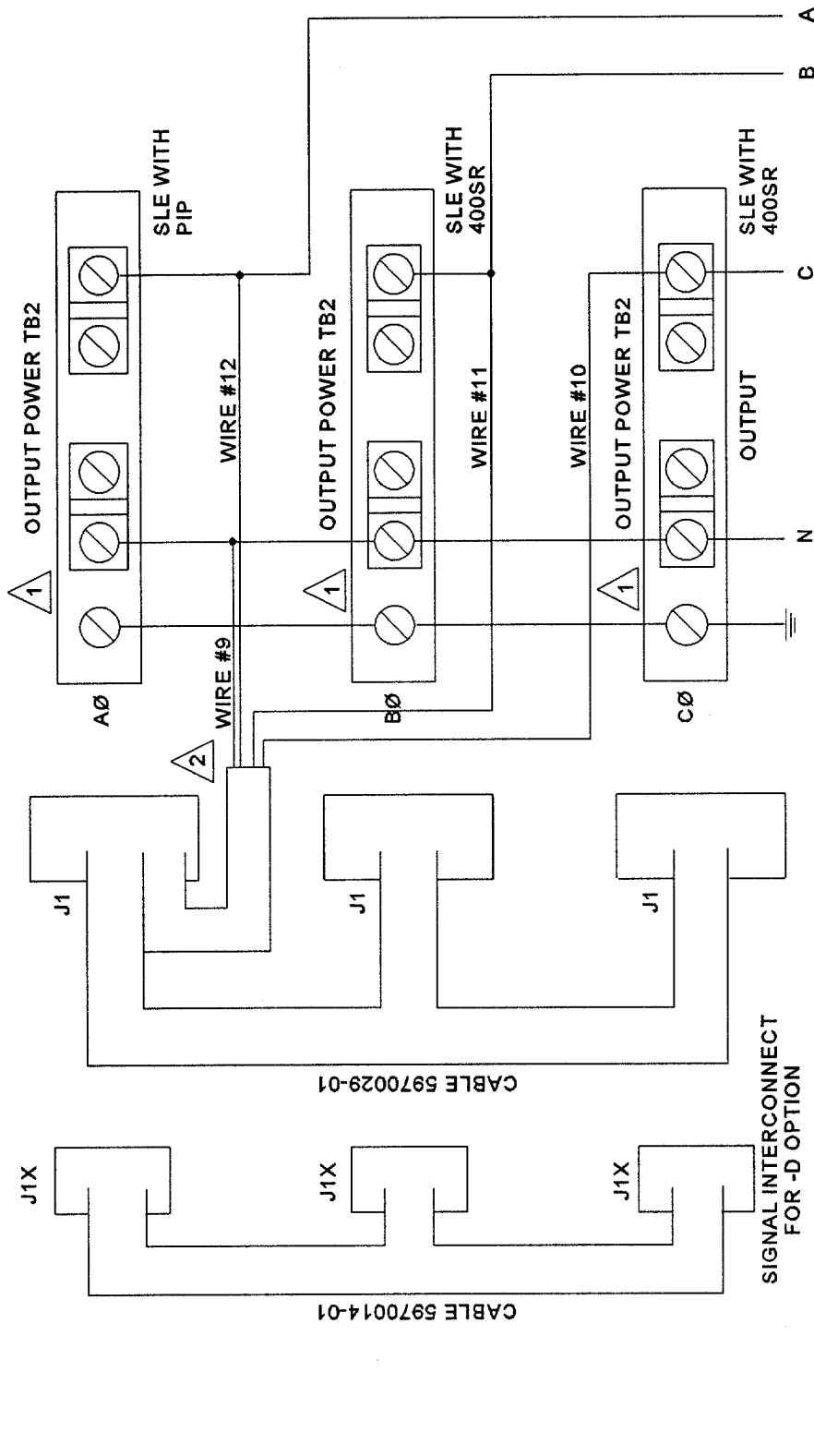


- △ 2 OUTPUT VOLTAGE SERVO/SENSE LEADS MUST BE CONNECTED AT THE LOAD TO ACHIEVE LINE/LOAD REGULATION SPECIFICATIONS.
- △ 1 0-130 VAC SHOWN. REFER TO SECTION 1 FOR OUTPUT OPTIONS.

NOTES: UNLESS OTHERWISE SPECIFIED.

3 AMPLIFIER SLE, 3 PHASE SYSTEM WITH SERVO OSCILLATOR

Figure 23. System Output/Signal Interconnect



- △ 2 OUTPUT VOLTAGE SERVO/SENSE LEADS MUST BE CONNECTED AT THE LOAD TO ACHIEVE LINE/LOAD REGULATION SPECIFICATIONS.
- △ 1 0-130 VAC SHOWN. REFER TO SECTION 1 FOR OUTPUT OPTIONS.

3 AMPLIFIER SLE, 3-PHASE SYSTEM WITH -D OPTION, SERVO CONTROL

NOTES: UNLESS OTHERWISE SPECIFIED.

Figure 2-24. System Output/Signal Interconnect with -D Option

NOTES

SECTION III

OPERATION

3.1 INTRODUCTION

Before operating the power source, the user must become familiar with the particular model and configuration. The different models, configurations and options available are discussed in Sections I and II of this manual.

3.2 MANUAL OPERATION

After the power source has been installed in accordance with the instructions in Section II, the power source can be manually adjusted for the desired value of output voltage via the AMPLITUDE control on the front panel. The power source requires a plug-in oscillator or signal source. If the oscillator or signal source is fixed frequency, no adjustment is necessary. If the oscillator or signal source is variable, it must be set to the desired value. Ensure the frequency is set within the limits of the power source as outlined in Section II.

3.3 GPIB OPERATION

SLE Series AC Power Sources meet all the requirements of MATE-STD-280673, including built in TMA for CIIL/ATLAS interfacing. The signal required to operate the SLE Series AC Power Source is provided by an Elgar PIP oscillator. The PIP is connected to the GPIB interface on the rear panel of the power source. Refer to the Operating Manual for the PIP installed for information on programming the power source via GPIB.

3.4 CONTROLS AND INDICATORS

Refer to Figure 2-8 for an illustration of the Model 1001SLE front panel or to Figure 2-11 for an illustration of the Model 1751SLE front panel.

3.4.1 Output Voltage Meter

The Output Voltage Meter indicates the output voltage.

3.4.2 Oscillator Cavity

This cavity is used for installation of the Elgar plug-in oscillator module. The oscillator is installed by carefully connecting and attaching any loose cables. Install the appropriate Elgar Plug-In oscillator module, which provides control over output voltages and frequencies, into the front panel cavity of the SLE Series AC Power Source. The oscillator module is aligned so its Main Board card edge connector fits into the recessed AC Power Source motherboard connector (do not bind or pinch the flexible cables during installation). When installing a plug-in oscillator module, exercise care to ensure proper mechanical alignment and snug connector fit. When this connection is firmly seated, the oscillator is secured to the AC Power Source chassis by two front panel captive screws. Tighten the two front panel captive screws with a flat blade screwdriver so that they cannot be removed by hand.

WARNING

Always ensure that facility AC power is de-energized prior to connecting or disconnecting the power cable(s) and/or installing or removing the plug-in oscillator module from the Model 1001SLE/1751SLE AC Power Source. Similarly, the Model 1001SLE/1751SLE AC Power Source circuit breaker must be switched OFF (0) prior to connecting or disconnecting input and/or output power cable(s) and/or installing or removing the plug-in oscillator module from the Model 1001SLE/1751SLE AC Power Source.

CAUTION

Dangerous voltages may be present inside the oscillator cavity when the oscillator module is removed. Qualified personnel must use extreme caution when servicing this equipment.

3.4.3 POWER On Switch-Circuit Breaker

This two-position switch applies AC line input power to the unit when in the On (up) position. The switch-circuit breaker safeguards the unit by opening when the input current exceeds the rated value of the circuit breaker.

3.4.4 POWER On Indicator

This indicator is illuminated (green) when AC line input power is present in the unit when the POWER switch-circuit breaker is placed in the On (up) position. The indicator will extinguish when AC line power is removed from the unit.

3.4.5 AMPLITUDE Adjustment Screw

This screw is used to adjust the amplitude when a non-programmable oscillator is used. Voltage amplitude is controlled by rotating the screw to adjust the output voltage that is read on the Output Voltage Meter.

3.5 OPERATING INSTRUCTIONS**3.5.1 Power ON**

Perform the following:

1. Position the POWER switch-circuit breaker to On (up).
2. Observe that the POWER indicator illuminates (green) and remains illuminated.
3. Ensure that the fan(s) are operating.

3.5.2 Frequency Control

Perform the following:

1. Enter the desired frequency into the plug-in oscillator (refer to the appropriate oscillator Operating Manual for specific procedures).
2. Verify the setting.

3.5.3 Amplitude Control

Perform the following:

1. If a PIP is used, enter the desired amplitude into the plug-in oscillator (refer to the appropriate oscillator Operating Manual for specific procedures).
2. If a fixed oscillator is used, adjust the AMPLITUDE screw.
3. Verify the setting.

CAUTION

Do not continue operation of the power source if the POWER switch-circuit breaker trips when power is turned on or when the amplitude is increased. The power source is protected against shorts at the output terminals and recovers immediately when the short is removed. Tripping of the circuit breaker indicates that the unit requires adjustment or repair. Refer the unit to qualified personnel to perform this; the user should not attempt troubleshooting or repair.

WARNING

Dangerous voltages may be present inside the oscillator cavity when the oscillator module is removed. Qualified personnel must use extreme caution when servicing this equipment.

APPENDIX A

WIRE GAUGE SELECTION

The following guidelines assist in determining the optimum cable specification for the user's power applications. These guidelines are equally applicable to both DC and low frequency AC (up to 5 KHz) power cabling. The same engineering rules apply whether going into or out of an electrical device. Thus, this guide applies equally to the input cable and output cable for the ELGAR instrument and application loads.

Power cables must be able to safely carry maximum load current without overheating or causing insulation destruction. It is important to everyday performance to minimize IR (voltage drop) loss within the cable to a maximum of 1.5 volts total path. These losses have a direct effect on the quality (tight specifications) of power delivered to and from instruments and corresponding loads.

As a rule of thumb, specifying a generously larger power cable wire gauge has a negligible fiscal impact when compared to the costly investment in time and effort to evaluate and overcome both the cable deficiencies and the performance tradeoffs associated with a marginal (smaller) wire gauge.

When specifying wire gauge, the operating temperature needs to be considered.

Wire gauge current capability and insulation performance drops with increased temperature developed within a cable bundle and with increased environmental temperature. Thus, short cables with generously overrated gauge and insulation properties come well recommended for power source applications.

Avoid using published commercial utility wiring codes. These codes are designed for the internal wiring of homes and buildings and accommodate the safety factors of wiring loss heat, breakdown insulation, aging, etc. However, these codes consider that up to 5% voltage drop is acceptable.

Such a loss directly detracts from the quality performance specifications of the ELGAR instrument. Frequently, these codes do not consider bundles of wire within a cable arrangement.

Sense lines carry very little current and, thus, have negligible gauge overrating requirements. Sense lines tend to be particularly sensitive to induced voltages from nearby cables and from electrically noisy devices. Any disturbance induced onto sense lines is immediately signaled back to the instrument with a direct adverse effect on the output terminals.

To minimize undesired sense line pickup, sense line cables should use the cancelling effects of twisted pair wires.

Shielded twisted pairs are even better, if needed. Sense lines should be physically separated from high current output, ideally via a separate cable. Sense resistors, if used, should be connected as close as practical to the load. Observe the maximum remote sense voltage drop limit (refer to page A-3).

High frequency disturbances are usually minimized by prudent use of 0.01mfd to 1.0 μ fd bypass capacitors.

In high performance applications, as in motor start up and associated inrush/ transient currents, extra consideration is required. The cable wire gauge must consider peak voltages and currents which may be up to ten times the average values. An underrated wire gauge adds losses which alter the inrush characteristics of the application and, thus, the expected performance.

The following table identifies popular ratings for DC and AC power source cable wire gauges.

Recommended Wire Gauge Selection Guide Table

Column 1	Column 2	Column 3	Column 4
Size (AWG)	Amperes (Maximum)	Ohms/100 Feet (One Way)	IR Drop/100 Feet* (Col. 2 X Col. 3)
18	5	0.473	2.363
16	7	0.374	2.621
14	15	0.233	3.489
12	20	0.147	2.940
10	30	0.095	2.859
8	40	0.053	2.136
6	55	0.033	1.837
4	70	0.021	1.477
2	95	0.013	1.273

* A maximum of 0.75V is allowable.

The following notes apply to the above table and to the power cable definition:

1. The above figures are based upon insulated copper conductors at 30°C (86°F), two current carrying conductors in the cable plus a safety ground (chassis) plus a shield.

Column 2 and Column 3 in the table above refer to the "one way" ohms and IR drop of current carrying conductors (e.g., a 50-foot cable contains 100 feet of current carrying conductors).

2. Determine which wire gauge to use for the application by knowing the expected peak load current (I_{peak}), the maximum tolerated voltage loss (V_{loss}) within the cable, and the one way cable length. The formula below determines which ohms/100 feet entry is required from Column 3. Read the corresponding wire gauge from Column 1.

$$(\text{Column 3 value}) = V_{\text{loss}} / [I_{\text{peak}} \times 0.02 \times (\text{cable length})]$$

Where:

Column 3 value = Entry of the table above

Cable length = One way cable length in feet.

V_{loss} = Maximum loss, in volts, permitted within cable.

Special case: Should the V_{loss} requirement be very loose, the peak may exceed the maximum amperes (Column 2). In this case, the correct wire gauge is selected directly from the first two columns of the table.

Example:

A 20 ampere (I_{peak}) circuit which may have a maximum 0.5 volt drop (V_{loss}) along its 15-foot cable (one way cable length) requires (by formula) a Column 3 resistance value of 0.083. This corresponds to wire gauge size 8 AWG.

If the cable length was 10 feet, the Column 3 value would be 0.125 and the corresponding wire gauge would be 10 AWG.

3. Aluminum wire is not recommended due to soft metal migration at the terminal which may cause long term (years) poor connections and oxidation. If used, increase the wire gauge by two sizes (e.g., specify 10 gauge aluminum instead of 14 gauge copper wire).
4. Derate the above wire gauge (use a heavier gauge) for higher environmental temperatures since conductor resistance increases with temperature.

<u>Temperature in Degrees</u>		<u>Current Capability</u>
<u>C</u>	<u>F</u>	
40	104	80%
50	122	50%

5. Derate the above wire gauge (go to a heavier gauge) for an increased number of current carrying conductors. This offsets the thermal rise of bundled conductors.

<u>Number of Conductors</u>	<u>Current Capability</u>
3 to 6	80%
6	70%

6. The preferred insulation material is application dependent. Elgar's recommendation is any flame retardant, heat resistant, moisture resistant thermoplastic insulation rated to a nominal 75°C (240°F). Voltage breakdown must exceed the combined effects of:
- The rated output voltage.
 - Transient voltages induced onto the conductors from any source.
 - The differential voltage to other nearby conductors.
 - Floating or series connections of supplies/loads.
 - Safety margins to accommodate degradations due to age, mechanical abrasion and insulation migration caused by bending and temperature.
7. Sense lines are generally 24 to 18 (more mechanical strength) gauge wire, twisted pair, shielded, and have the same insulation rating and properties as its related current carrying conductors. Sense lines are physically separated (a separate cable) from current carrying conductors to minimize undesirable pickup.
8. As frequency increases, the magnetic field of the current carrying conductors becomes more significant in terms of adverse coupling to adjacent electrical circuits. The use of twisted pairs help cancel these effects. Shielded twisted pairs are even better. Avoid close coupling with nearby cables by using separate cable runs for high power and low power cables.
9. The above general values and recommendations should be reviewed, modified and amended, as necessary, for each application. Cables should be marked with appropriate safety WARNING decals if hazardous voltages may be present.

APPENDIX B

CONFIGURATION AND

FUNCTIONAL VERIFICATION

CHECKSHEET

CONFIGURATION AND FUNCTIONAL VERIFICATION CHECKSHEET

SLE SERIES AC POWER SOURCE

Model Number: _____ Chassis S/N: _____

Equipment Property Number: _____

Part of Equipment: _____ Location: _____

Date: _____ Inspector: _____

AC Input Voltage: _____ Output Voltage Range: _____

Oscillator Used: _____

GPIB Compatible: Yes _____ No _____

If yes, GPIB Address: _____

Remote Language: ABLE _____ CIIL _____

Options Installed: (check all that are configured)

Automatic Voltage Range Changing _____

Synchronization _____

Output Current Limit Programming _____

Output Current/Voltage/Power Monitoring via GPIB _____

D-Option (Internal Self Test) _____

Functional Results:

Output Amplitude: _____

Output Frequency: _____

Options: _____

Comments: _____

