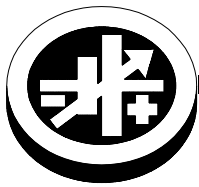


QUICK START GUIDE



KEPCO An ISO 9001 Company.

BOP 2KW
-MG/ME
-MGL/MEL



BOP 2KW-MG/ME/MGL/MEL POWER SUPPLY

This guide gives a brief introduction to the BOP 2KW-MG/ME/MGL/MEL Power supply, shows simple load connections, and allows you to verify the power supply is working. The guide also shows you how to use the front panel controls to perform the most commonly used functions.

BOP 2KW models with MG and ME suffixes are identical except that the MG units have a factory-installed GPIB interface and in the ME units the GPIB interface is replaced with a LAN interface. BOP-MG/ME models with an L suffix have been optimized for better performance when driving inductive loads such as large magnets or motors. Unless otherwise noted this guide applies to all models.

ACCESSING MANUALS. First determine your Firmware Version (see below), then download the applicable BOP 2KW-MG/ME Operator's Manual from www.kepcopower.com/support/opmanls.htm#bop-2k

Refer to the BOP 2KW-MG/ME Operator's Manual for full specifications, installation considerations and operating instructions, including an Installation/Operation Summary which includes hyperlinked references to detailed procedures, but which can be printed as a handy reference. The BOP 2KW-MG/ME Operator's Manual also includes a full description of the digital interfaces and the SCPI command language.

FIRMWARE VERSION. Refer to www.kepcopower.com/support/bophifirm.htm to determine which firmware version is installed.

ACCESSING DRIVERS. Drivers are accessed from www.kepcopower.com/drivers/drivers-dl3.htm. BOP 1KW drivers are applicable to BOP 2KW models.

CONTENTS

Description.	2
Unpacking.	2
Equipment Supplied.	2
Safety.	2
Preliminary Operational Check.	3
Accessories.	3
Installation.	5
Rack Mounting.	5
Wiring.	5
Input Connections.	5
Load Connections.	5
Local Sensing (Factory Default).	5
Remote Sensing Select.	5
Analog I/O Connections.	5
Trigger Connections.	5
GPIB Connections (MG SUFFIX ONLY).	5
LAN Connections (ME SUFFIX ONLY).	5
Finding Kepco Power Supplies on the LAN.	6
RS 232 Connections.	6
Operation.	6
Turning The Power Supply On.	6
Accessing the Menus.	6
How to Modify a Parameter.	7
Adjusting LCD Brightness, contrast and Background	7
Enabling/Disabling Audible Beeps	7
Setting Voltage or Current Mode	7
Programming Voltage or Current and Associated Protect Limits	10
Software Limits.	13
Changing Main Channel Software limit.	13
Determining How the Unit Responds when Output is OFF (Load Type)	13
Configure Load Type.	15
Enabling/disabling Output Power.	15
Additional Features.	15

KEPCO, INC. ● 131-38 SANFORD AVENUE ● FLUSHING, NY. 11355 U.S.A. ● TEL (718) 461-7000 ● FAX (718) 767-1102

www.kepcopower.com ● email: hq@kepcopower.com

I — DESCRIPTION.

The BOP 2KW-MG/ME Series hereafter referred to as BOP, are true 4-quadrant programmable voltage and current power supplies, meaning they are capable of both sourcing and sinking power (see Figure 1). These bipolar power supplies pass smoothly through zero without switching to provide true \pm voltage and \pm current. These BOP power supplies use switch mode technology for low dissipation. A bi-directional, isolating, a-c input power factor correcting (PFC) circuit recuperates energy sinked from an active load and sends it back into the line to maintain low dissipation.

These BOP power supplies are controlled digitally from a menu-driven front-panel keypad or one of the remote digital interfaces (GPIB or RS 232 on MG models, LAN or RS 232 on ME models) to set voltage and current and the four protection limits (+voltage, -voltage, +current and -current.)

A front panel rotary adjuster allows real-time adjustment of the output. A large LCD displays the mode of operation, the settings, and the actual output voltage and current. Additionally, these BOP models can be remotely controlled by an analog $\pm 10V$ input for the main channel (voltage or current), and a +1 to +10V input for the limit channels.

BOP models are suitable for driving inductive loads such as large magnets or motors, and for exercising batteries. They are also suitable for characterizing solar cell arrays, and powering many electrochemical reactions. Models with L suffix have been optimized for exceptionally low current ripple and noise and improved stability (drift and temperature), making them ideal for driving inductive loads such as large magnets or motors.

II — UNPACKING.

This instrument has been thoroughly inspected and tested prior to packing and is ready for operation. **CAUTION: BOP 2KW models weigh over 110 lbs and require two people to lift safely. Do not use the bus bars on the low voltage (6V - 25V) models to grasp the unit.**

After careful unpacking, inspect for shipping damage before attempting to operate. Perform the "Installation." on page 5. If any indication of damage is found, file an immediate claim with the responsible transport service.

TABLE 1. BOP 2KW-MG/ME MODEL PARAMETERS



Model (1)	d-c Output Range		Closed Loop Gain	
	Voltage (2) (V d-c)	Current (A d-c)	Voltage Channel G_V (V/V)	Current Channel G_I (A/V)
2000 WATT MODELS				
BOP 6-250MG/ME (3)	0 to ± 6	0 to ± 250	0.6	25.0
BOP 10-200MG/ME/MGL/MEL	0 to ± 10	0 to ± 200	1.0	20.0
BOP 12-125MG/ME	0 to ± 12	0 to ± 125	1.2	12.5
BOP 20-100MG/ME/MGL/MEL	0 to ± 20	0 to ± 100	2.0	10.0
BOP 25-80MG/ME	0 to ± 25	0 to ± 80	2.5	8.0
BOP 36-56MG/ME/MGL/MEL	0 to ± 36	0 to ± 56	3.6	5.6
BOP 40-50MG/ME/MGL/MEL	0 to ± 40	0 to ± 50	4.0	5.0
BOP 50-40MG/ME/MGL/MEL	0 to ± 50	0 to ± 40	5.0	4.0
BOP 72-28MG/ME/MGL/MEL	0 to ± 72	0 to ± 28	7.2	2.8
BOP 100-20MG/ME	0 to ± 100	0 to ± 20	10.0	2.0
BOP 144-14MG/ME	0 to ± 144	0 to ± 14	14.4	1.4
BOP 200-10MG/ME	0 to ± 200	0 to ± 10	20.0	1.0
(1) Models with MG suffix include GPIB and RS 232 digital interfaces. Models with ME suffix include LAN and RS 232 digital interfaces. (2) When connecting active loads, the steady-state voltage of the active load must not exceed the maximum voltage rating of the BOP. Otherwise the overvoltage protection will shut down the power supply. (3) This model can handle 1.5kW maximum.				

III — EQUIPMENT SUPPLIED.

None.

IV — SAFETY. See Table 2

TABLE 2. SAFETY SYMBOLS

SYMBOL	MEANING	SYMBOL	MEANING
	CAUTION: RISK OF ELECTRIC SHOCK.	WARNING	INDICATES THE POSSIBILITY OF BODILY INJURY OR DEATH.
	CAUTION: REFER TO REFERENCED PROCEDURE.	CAUTION	INDICATES THE POSSIBILITY OF EQUIPMENT DAMAGE.

V — PRELIMINARY OPERATIONAL CHECK.

A simple operational check after unpacking and before equipment installation is advisable to ascertain whether the power supply has suffered damage resulting from shipping.

1. With both control and power boost section POWER switches set to off position, connect the power supply to source power (see “Input Connections.” on page 5).
2. With no load connected, **first** set the control section (upper) POWER switch to ON and **then** the power boost section (lower) POWER switch to the ON position. Each time the unit is turned on an internal self-test is performed. If all tests pass, the unit goes into the default mode. If a failure occurs, the failure is displayed. Figure 5 shows the fac-

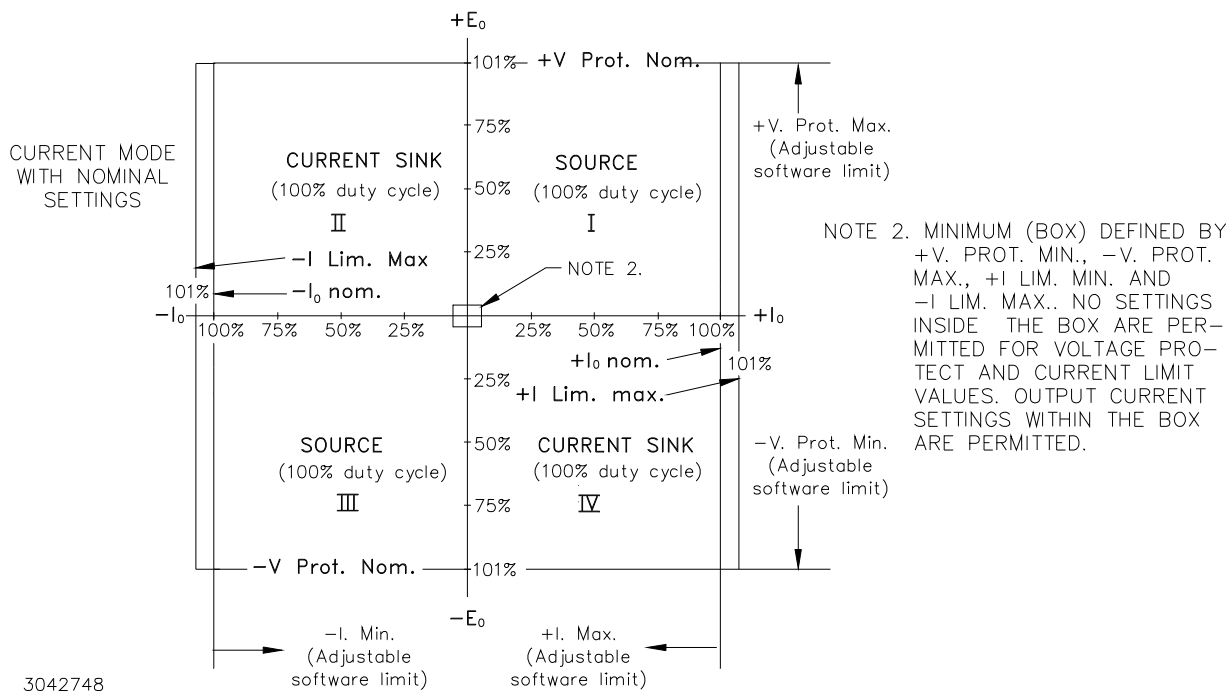
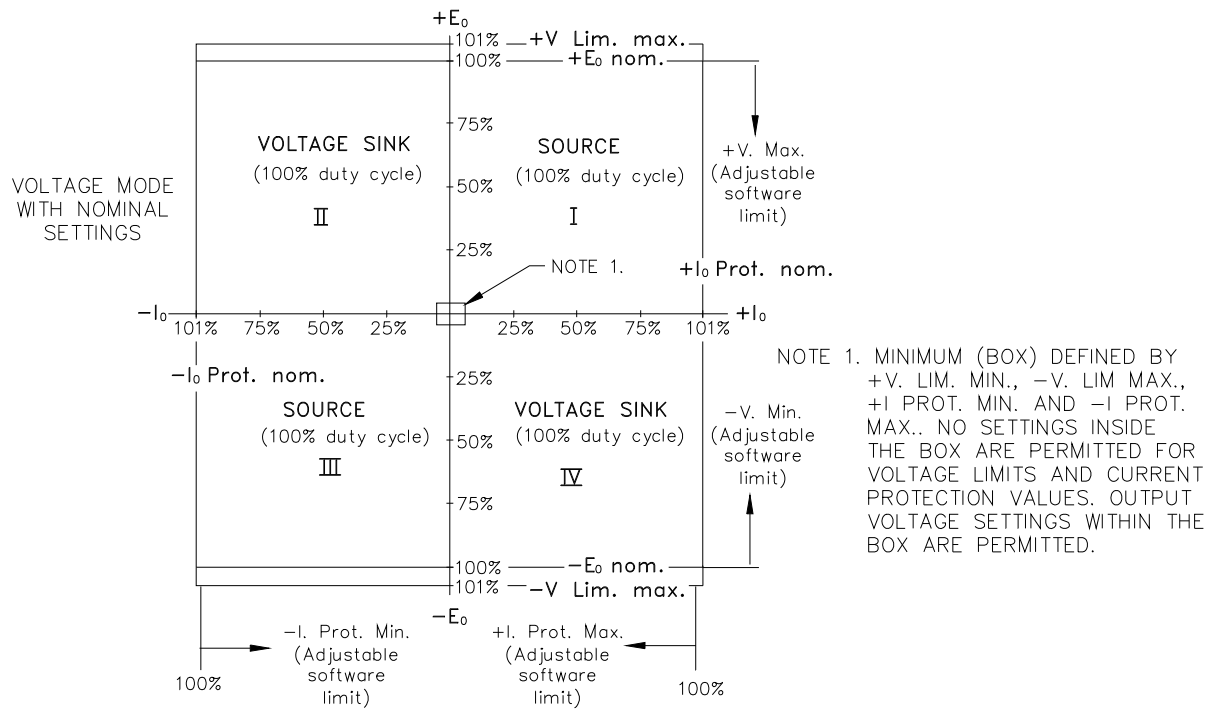
tory-configured power on defaults displayed on the LCD.

3. Connect a digital voltmeter (DVM) (resolution and accuracy of 0.01% or better) to the OUT S and COM S terminals at the BOP 2K rear panel terminal block.
4. Use the keypad to enter the rated maximum voltage of the power supply (e.g., enter 144 for a model BOP 144-14MG) and press **ENTER**. If STANDBY indicator is lit, press **STANDBY** key.
5. Verify DVM voltage reading agrees with programmed voltage and agrees with displayed voltage on LCD (see BOP 2kW Operator Manual for tolerances.)

VI — ACCESSORIES. See Table 3.

TABLE 3. ACCESSORIES

ITEM	FUNCTION	PART NUMBER
Mating Connector, Trigger	Mates with Trigger port.	142-0527 (Kepco) SP2501 (CUI Stack)
IEEE 488 Cable, (1 meter long)	For MG models only. Connects BOP power supply to GPIB bus.	SNC 488-1
IEEE 488 Cable, (2 meter long)	For MG models only. Connects BOP power supply to GPIB bus.	SNC 488-2
IEEE 488 Cable, (4 meter long)	For MG models only. Connects BOP power supply to GPIB bus.	SNC 488-4
RS 232 Cable Kit	Contains RJ11 to RJ45 Patch cord, RJ 45 Patch cord, two RS 232 adapters, one with male pins to connect to DTE equipment and one with female pins to connect to a PC (personal computer), two RS 232 Loop Back test Connectors (one 6-pin and one 8-pin) to test RS 232 communication and aid in isolating RS 232 communication problems.	KIT 219-0436
RS 232 Adapter (Male pins)	Allows RS 232 port to be connected to DTE equipment. (Supplied in KIT 219-0436.)	142-0487 (L-COM RA098M)
RS 232 Adapter (Female pins)	Allows RS 232 port to be connected to a PC (personal computer). (Supplied in KIT 219-0436.)	142-0506 (L-COM RA098F)
15-pin DSUB Connector	Mating connector for Analog input connector A2A5J6 Dsub 15 pin hood Dsub 15 pin male	108-0374 (Tyco-Amp 207470-1) 142-0449 (Amphenol 17S-DA15P)
IDC 6-pin connector	Mating connector for RS-232 PORT, connector A1J5 and PROTECTION EXT. PORT, connector A2A5J7	142-0536 (Amphenol 5-555176-3)



3042748

FIGURE 1. BOP OUTPUT CHARACTERISTICS

VII — INSTALLATION.

RACK MOUNTING. These models may be mounted in a 19-inch wide rack as described in the Operator Manual **CAUTION: Before rack mounting refer to Operator Manual for safety precautions.**

WIRING. Cable access is provided at the rear panel of the control section (see Figure 8) to allow cable connections for Analog control, Trigger, RS-232, GPIB, (MG models) and LAN (ME models).

INPUT CONNECTIONS. Source power is connected to the power supply via three-wire input power connected to the three Eurostyle terminal blocks on the rear panel. This power supply operates with an input a-c voltage in the range of 176 - 264V/47 - 63Hz without any need of range/frequency selection. The unit can be supplied from either a single phase, or between phases of a 3-phase a-c system as long as the input voltage is within the range specified above. The user must provide a properly sized and rated mains lead (line cord) and service with a current rating compatible with the rated input current (19A a-c maximum).

LOAD CONNECTIONS. Power connections require wires that are properly rated for the nominal output current of the unit. Connect the load to the OUTPUT and COMMON power terminals on the BOP 2KW Output Terminal Block on the rear panel (or OUTPUT and COMMON bus bars for the 6V - 25V models) (see Figure 8). OUT S and COM S terminals of the Sense/Monitor Terminal block are for connection of remote sensing leads (after removing the factory-installed local sensing links). **NOTE: Output Sense lines must be connected for proper operation, either locally, or at the load (remote).** Also use OUT S and COM S to monitor voltage at the load using external equipment such as a DVM, oscilloscope, etc. Use OUT MON and COM MON to monitor voltage at the BOP output. Use twisted wire pairs or wires that are tied together for both output power and output sensing connections.

It is critical that configurations comprised of BOP, load, and external programming devices, have a single earth-ground point. Observe the following caution and refer to the applicable BOP 2KW-MG Operator Manual for earth-ground recommendations. **Failure to observe this caution will void the warranty!**



CAUTION: Never connect both the load terminal tied to the BOP COMMON terminal and the programming device common to earth-ground. This compromises accuracy and will cause catastrophic damage to the BOP if the connection between BOP COM and

earth-ground or its corresponding load terminal tied to earth-ground is lost.

LOCAL SENSING (FACTORY DEFAULT).

Unit is shipped with local sensing links installed: OUT S connected to OUT MON and COM MON connected to COM S at the BOP 2KW Sense/Monitor Terminal Block (see Figures 6 and 8).

REMOTE SENSING SELECT. First remove the factory-installed local sensing links between OUT S and OUT MON and between COM MON and COM S at the BOP 2KW Sense/Monitor Terminal Block. Then connect OUT S and COM S lines from the BOP 2KW Sense/Monitor Terminal Block to the load (see Figure 7) using #22 AWG wire, twisted pair.

ANALOG I/O CONNECTIONS. The Analog I/O Port connector, located on the control section rear panel of the BOP 2KW power supply (see Figure 8), provides access to analog programming inputs which can control the mode of operation (voltage or current), output voltage or current, and establish positive and negative voltage and current limits. An output analog corresponding to output current is also provided. Refer to Operator's manual for details.

TRIGGER CONNECTIONS. The Trigger Port (see Figure 8) provides for an external trigger input for use with SCPI *TRG and TRIG commands. Refer to Operator's manual for details.

GPIB CONNECTIONS (MG SUFFIX ONLY).

Your computer must have a GPIB interface card installed. Connect the power supply to the computer's GPIB interface card. Use a standard GPIB interface cable at the GPIB port on the rear panel.

The default GPIB address is 6; refer to the Operator's Manual to change it.

LAN CONNECTIONS (ME SUFFIX ONLY).

Connect the BOP 2KW to a Microsoft Windows-based computer via the LAN connector (see Figure 8). Use a standard ethernet cable whether using a router or hub, or connecting the BOP 2KW directly to a computer. The BOP 2KW-ME is Auto-MDI-X enabled and does not require a crossover cable for direct connection. For Unix and Safari connections see full Operator Manual (refer to "Accessing Manuals." on page 1).

FINDING KEPSCO POWER SUPPLIES ON THE LAN. The PS Find utility can be downloaded from the Kepco web site at:

www.kepcopower.com/drivers/drivers-dl3.htm#bop1k

This utility finds all operational Kepco power supplies connected to the LAN and then shows the MAC and IP addresses of the models found.

To run the utility from your PC download the psfind.zip file to your computer. Extract psfind.exe from the zip file to a location of your choice, then double-click psfind.exe to run the application. A separate window opens as shown in Figure 2. Once the search is completed, all found units are displayed in the Select a Unit window (the MAC address appears in parentheses). If you do not see your device in the Select a Unit window or if the icon to the left of the selected instrument is red (not green), make sure it is turned on and connected to the network, then click the Search Again button.

RS 232 CONNECTIONS. Connect the BOP 2KW to a modem using a Null Modem patch cable at the RS 232 port located on the rear panel (See Figure 8). A Null Modem cable is not required for older MAC computers with D-sub serial port in which the RXD and TXD line transposition is accomplished via external hardware. The default baud rate is 9600; refer to the Operator Manual to change it.

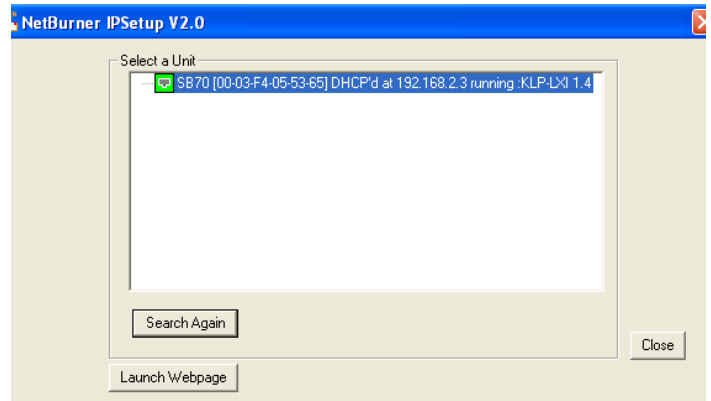


FIGURE 2. PS FIND SCREEN

VIII — OPERATION.

Refer to Figures 3 and 4 for the function of front panel controls and indicators for the control and power boost sections, respectively.

Additional features covered in the Operator Manual are: Quick Boot (eliminating the power-up displays), use of the internal relay, operation via the LAN interface or analog signals and setting coarse/fine adjustment preference of the VOLTAGE and CURRENT controls. An Installation/Operation Summary is also included in the Operator Manual. The Operator Manual also covers the GPIB, Ethernet and RS 232 interfaces, including the use of the drivers downloadable from:

www.kepcopower.com/drivers/drivers-dl3.htm#bop1k.

TURNING THE POWER SUPPLY ON.



CAUTION:

Turn on power to the control section BEFORE the power boost section to avoid temporary oscillation.



CAUTION:

DO NOT repeatedly toggle either circuit breaker/switch as this may damage the unit.

Set control section (upper) POWER ON/OFF circuit breaker/switch on front panel to ON, then set boost section POWER ON/OFF circuit breaker/switch on

front panel to ON. If actuator does not lock when released, wait a few seconds before trying again. The circuit breaker is “trip-free” design; if overload exists, contacts cannot be held closed by actuator.

- When the power supply is turned on, it performs a brief self-test that includes testing the three processors (analog, interface and display) and an inter-module test, then displays the power-up screen (see Figure 5). If an error is detected, the FAULT indicator will light, information about the error will be briefly displayed on the LCD.
- If the unit powers up in REMOTE mode, press **F1** to set the unit to LOCAL mode.
- If the display is not viewable, press **F3** twice. The display will cycle through the range of contrast settings. Press **F3** again to lock in the preferred contrast.

ACCESSING THE MENUS. From the power-up screen, pressing the Function keys indicated on the LCD opens the associated menu. The menu opened may list submenus that may be opened either directly by pressing the associated Function keys, or by highlighting an item on the list and pressing the View/Modify function key. Menus and submenus will display a list of parameters, with the top one highlighted. The func-

tion key assignments can vary, but generally offer the following choices:

- **F1** allows the highlighted parameter to be viewed or modified. After changing the parameter, the following choices are available: **F4** - SAVE or **ENTER** to save the change, **F5** - EXIT to abort the change and exit to the previous menu.
- **F2** - RESTORE DEFAULT restores factory defaults for the parameters displayed (except for GPIB address). The factory defaults may be saved as power-up defaults by pressing **F4**.
- **F3** - The function varies, depending on the menu. In most cases **F3** is used to abort a change without applying the modified setting. From the power-up screen **F3** is used to adjust contrast. In the Revisions/TEST submenu of the General Setup Menu, **F3** is used to execute a test.
- **F4** - SAVE FOR POWER-UP Saves the configuration shown as a power-up setting so the changes will not be lost when the unit is turned off.
- **F5** - APPLY EXIT applies the current (changed) setting without saving for power-up and exits to the previous menu or to the power-up screen, EXIT leaves the current menu without saving or applying changes.

HOW TO MODIFY A PARAMETER.

First access the parameter by accessing the proper menu as described above. To modify a parameter listed in a menu or submenu, proceed as follows:

1. Highlight the parameter using the **↑** and **↓** keys.
2. When the desired choice is highlighted, press **F1** to modify the active setting. The choices are displayed with the active setting highlighted. In the case of numerals, the units digit is highlighted.
 - To change a numeric setting, press the number keys, then press **ENTER** to program the numbers entered. Use the **CLEAR** key to clear numbers entered and start over. The **ADJUST** control can also be used to increment or decrement the highlighted digit. Pressing **ADJUST** while rotating adjusts the least significant digit. If the output is on (unit not in Standby) changes made using the **ADJUST** control are immediately applied to the output.

- For alphanumeric characters use multiple presses of the number keys for letters or symbols: **0** (space), **1** (+, -, /), **2** (ABC), **3** (DEF), **4** (GHI), **5** (JKL), **6** (MNO), **7** (PQRS), **8** (TUV), **9** (WXYZ). Use the **→** key to highlight the next character. As an alternative, the **↓** or **↑** keys or **ADJUST** control will scroll through numbers, and letters and symbols. Use the **CLEAR** key to clear the entire alphanumeric field and start over
3. Press **F4** to apply the change and return to the menu (to change another parameter, repeat steps 1 and 2). To abort (return to the menu without applying the change), press **F5**.

NOTE: Press **HELP** key for more information, press **HELP** again to see multiple screens; press **CLEAR** key to exit the help screen.

ADJUSTING LCD BRIGHTNESS, CONTRAST AND BACKGROUND From the power-up screen, (Figure 5), press **F3** twice to initiate contrast adjustment. The contrast gradually alternates between light and dark. When the contrast is acceptable, press **F3** to apply the change and exit contrast adjust. Use the **→** and **←** keys for fine adjustment of contrast. Contrast can also be adjusted from the power-up screen by pressing **F3** once, then pressing **→** and **←** as needed for fine adjustment.

To change the background, press **F3** from the power-up screen, Highlight Background, press **F1**, highlight Black or White, then **F4** to save. Press **F4** exit and save for power-up or **F5** to apply the changes (without saving for power-up) and exit.

ENABLING/DISABLING AUDIBLE BEEPS From the power-up screen, press **F3**, then modify the setting. Even though audible beeps are set to off, the beeps will still sound upon power-up or detection of a power supply fault.

SETTING VOLTAGE OR CURRENT MODE The BOP uses two separate channels, one to set output voltage or current and one to set the corresponding protection limit. The main channel is determined by the **MODE** key (in local mode) which alternately selects either Voltage mode or Current mode or by SCPI command (in digital remote mode). The protection channel is determined automatically by the main channel selected. When Voltage mode is selected, the current protection channel is active, and when Current mode is selected, the Voltage protection channel is active.

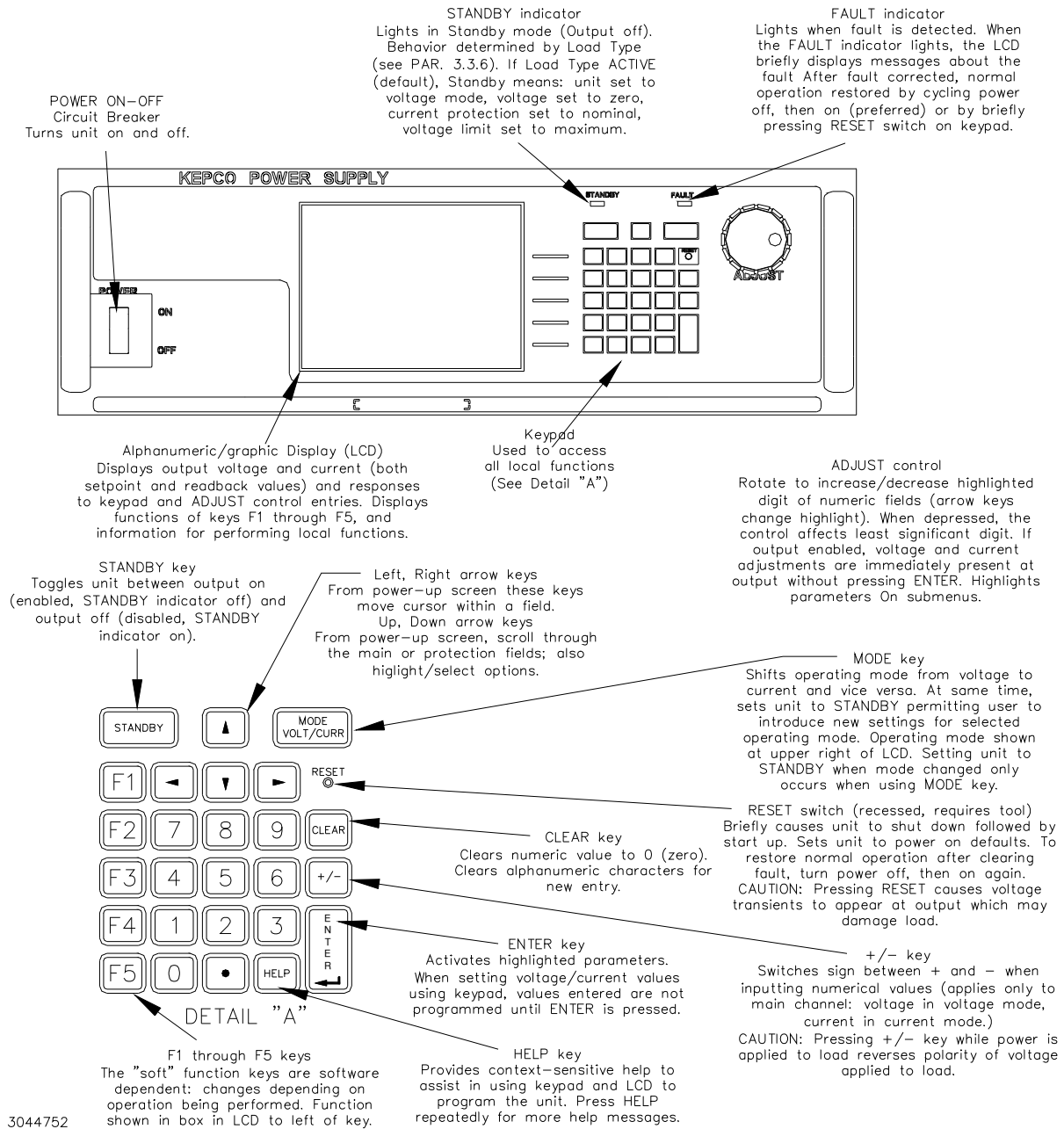


FIGURE 3. BOP 2KW SERIES, CONTROL SECTION, FRONT PANEL CONTROLS AND INDICATORS

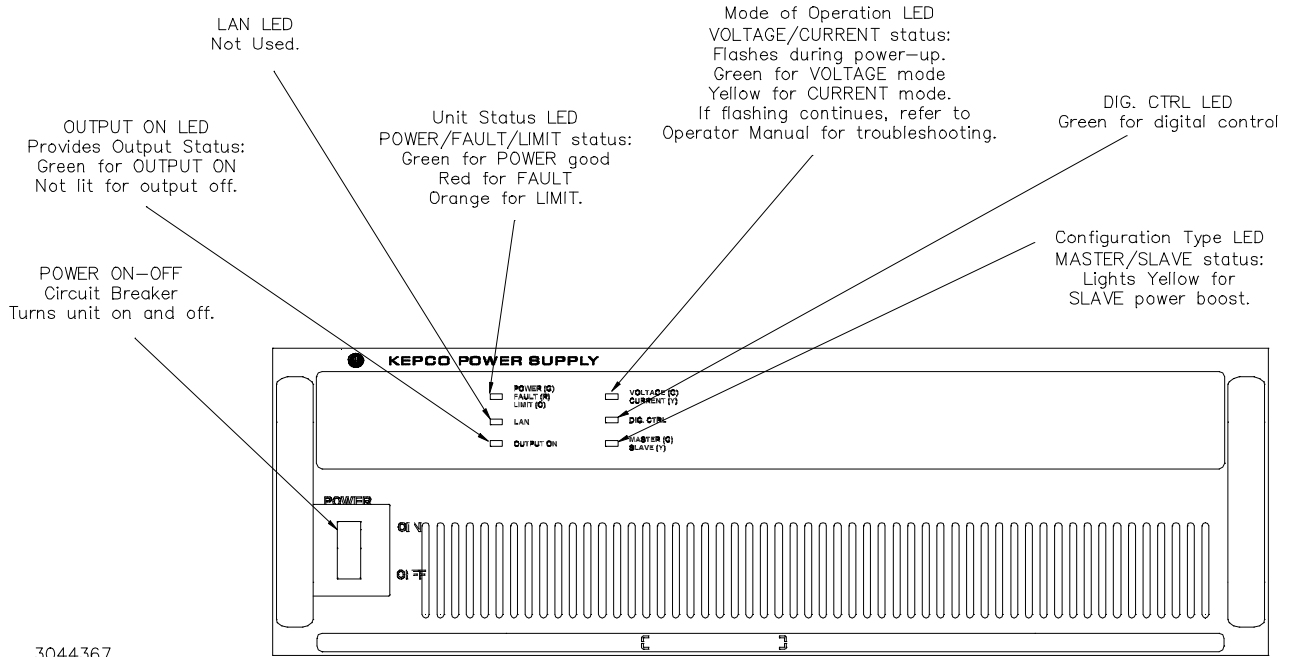


FIGURE 4. BOP 2KW SERIES, POWER BOOST SECTION, FRONT PANEL CONTROLS AND INDICATORS

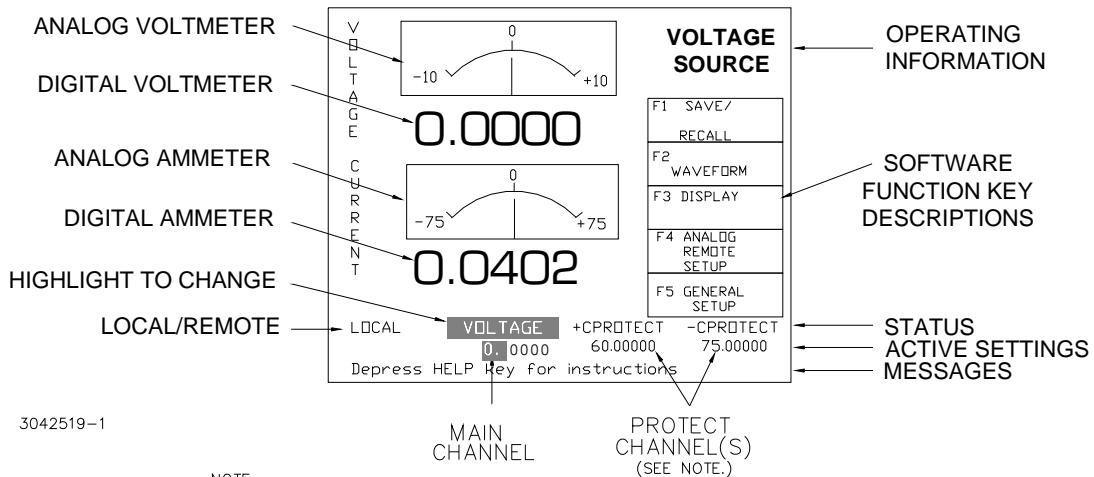
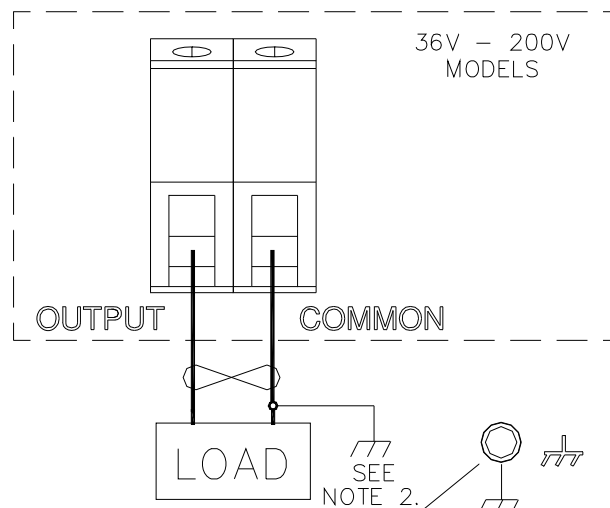
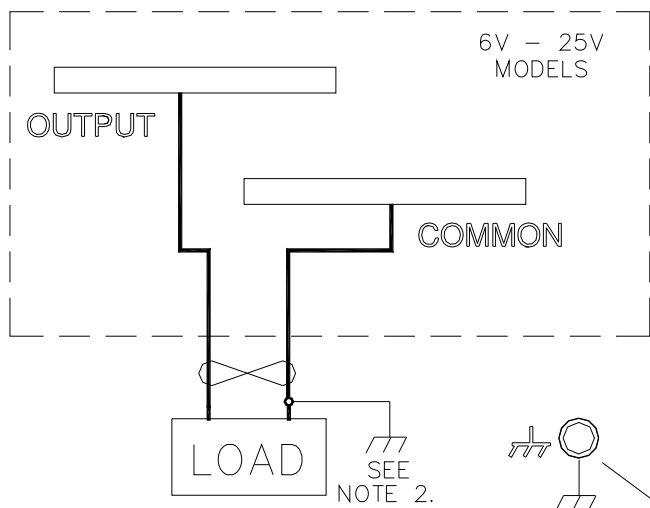
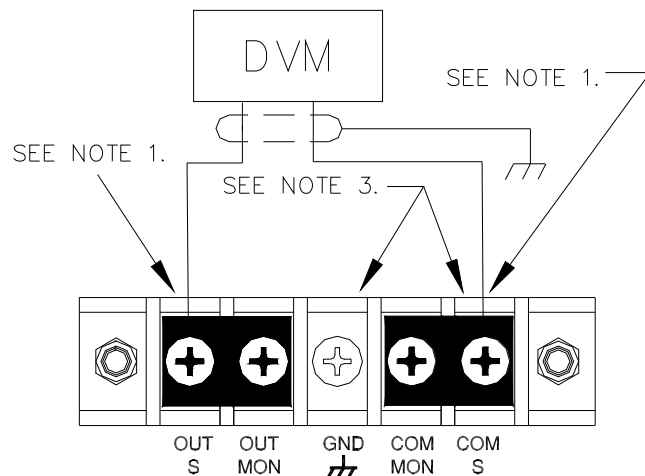


FIGURE 5. POWER-UP SCREEN SHOWING GRAPHIC METERS

NOTES:

1. USE LINKS (SUPPLIED) FOR CONNECTIONS BETWEEN (OUT S) AND (OUT MON) AND BETWEEN (COM S) AND (COM. MON) FOR LOCAL SENSING.
2. GROUNDED LOAD SHOWN; REMOVE GROUND CONNECTION FOR ISOLATED LOAD.
3. TO SUPPRESS NOISE AT THE OUTPUT WHEN USING EXTERNALLY GROUNDED SIGNAL SOURCE, CONNECT 100UF CERAMIC CAPACITOR (50V OR 100V) (E.G. KEPCO P/N 117-1241) BETWEEN COM_S AND GND TERMINALS..



3044365

WARNING
PROTECTIVE EARTH MUST BE CONNECTED FOR SAFE OPERATION.

FIGURE 6. LOAD CONNECTION, LOCAL SENSING, TYPICAL

PROGRAMMING VOLTAGE OR CURRENT AND ASSOCIATED PROTECT LIMITS From the power-up screen the settable voltage/current parameters are displayed at the bottom of the LCD above the **HELP** message. Use or to highlight the main or protect channel.

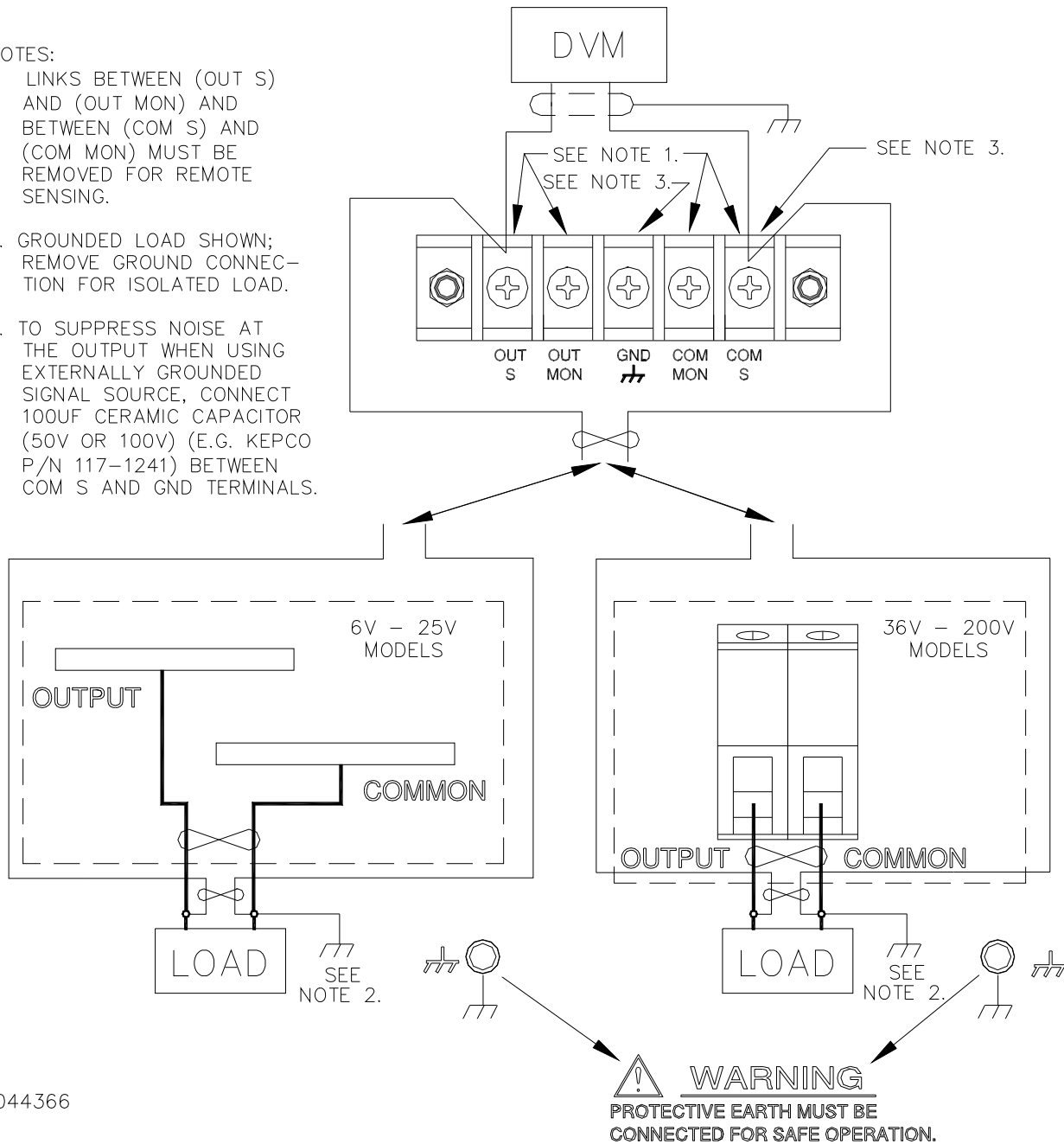
Disable. If necessary to change a setting, use or to highlight the parameter, and press to modify. Highlight the desired selection and press to save, then press to save for power-up or to exit. If analog programming is desired, refer to Operator's Manual.

1. To verify that the unit is configured for internal references press from the power-up screen and verify that Reference Input and Protection Limit are set to Internal, and External Mode is set to

2. Verify that the load type has been configured properly to ensure that the unit behaves as expected when the output is off (see "Max/Min Setting Menu" on page 13 for details).

NOTES:

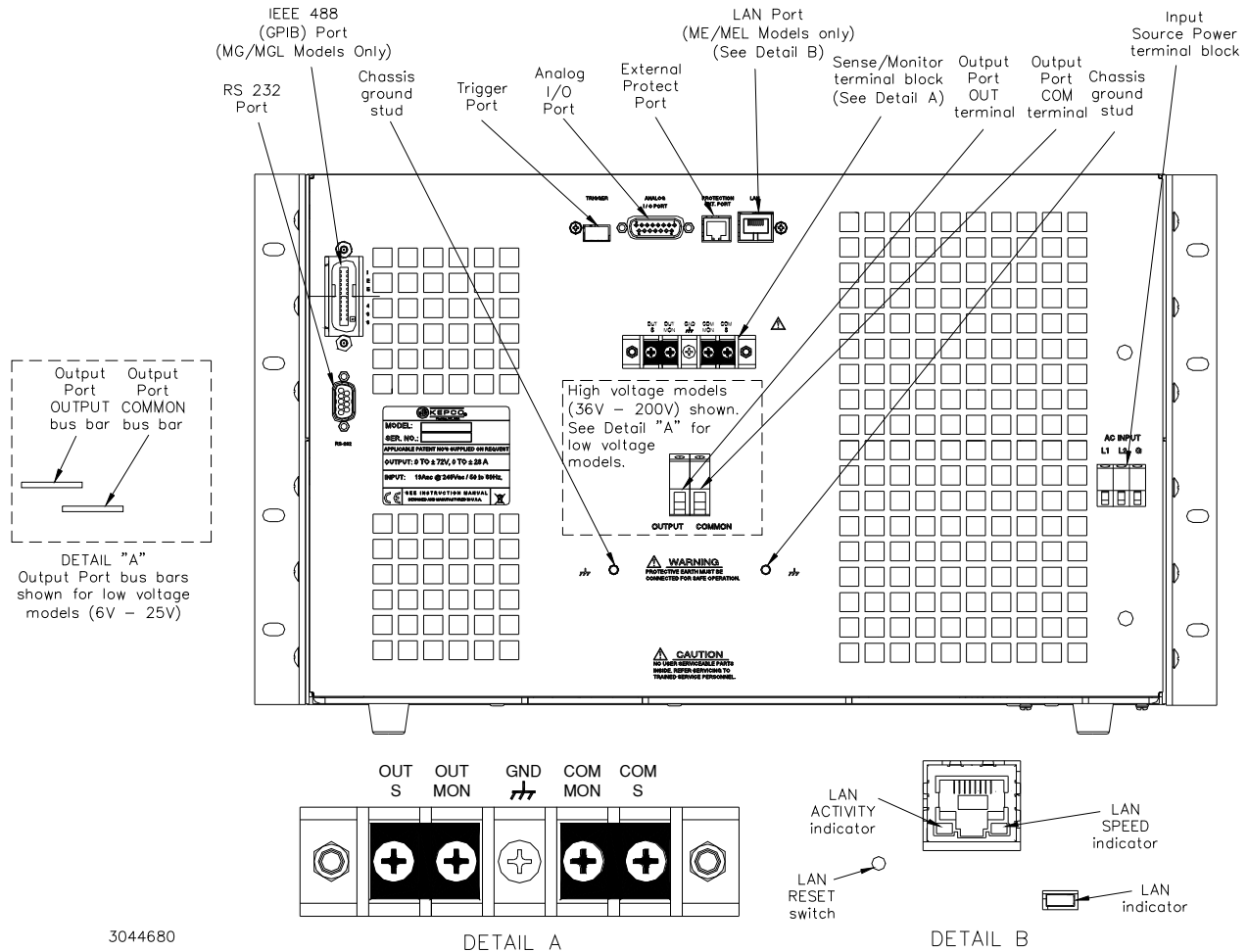
1. LINKS BETWEEN (OUT S) AND (OUT MON) AND BETWEEN (COM S) AND (COM MON) MUST BE REMOVED FOR REMOTE SENSING.
2. GROUNDED LOAD SHOWN; REMOVE GROUND CONNECTION FOR ISOLATED LOAD.
3. TO SUPPRESS NOISE AT THE OUTPUT WHEN USING EXTERNALLY GROUNDED SIGNAL SOURCE, CONNECT 100UF CERAMIC CAPACITOR (50V OR 100V) (E.G. KEPCO P/N 117-1241) BETWEEN COM S AND GND TERMINALS.



3044366

FIGURE 7. LOAD CONNECTION, REMOTE SENSING, TYPICAL

3. Press **MODE** key to select the main channel (**VOLTAGE** or **CURRENT**); the associated **PROTECT** channel is automatically selected and displayed.
4. Set the output on or off as desired using the **STANDBY** key. The output is off (disabled) when the **STANDBY** indicator is lit, on (enabled) when not lit.



3044680
FIGURE 8. BOP 2KW SERIES, REAR PANEL VIEW (CONTROL SECTION, LINKS INSTALLED FOR LOCAL SENSING)

5. Use or to highlight the main channel. There are two ways to program the output in local mode. These methods can be used either when the output is disabled (**STANDBY** indicator lit) or enabled.

WARNING:



When the ADJUST control is rotated, the active parameter is immediately effective if the output is enabled (on = STANDBY indicator not lit). The voltage/current applied to the load changes as the ADJUST control is rotated.

- Use the **ADJUST** control to increase or decrease the main channel setting (e.g., voltage when the unit is in voltage mode). Start

with the most significant digit of the desired value, then use to highlight the next digit. For fine adjustment press the **ADJUST** control in while rotating the knob to modify the least significant digit.

- Enter the desired value on the keypad using the number keys. For example, to program the BOP to 75.8V, press the following keys in order then press **ENTER**. For fine adjustment use , and to modify the least significant digit. To correct the entry before activation press the **CLEAR** key to set the value to zero and start over. When the desired value is displayed, press **ENTER**. This causes the new value to appear at the output and be applied to the load if the output is enabled.

6. To program the corresponding Protect channel, press **F4** or **F5** as necessary to highlight the Protect channel. Then set the value using either of the two methods described above. If the Protect Entry setting is set to Independent, separate entries for the positive and negative protect channel are possible. Otherwise the value entered is applied to both positive and negative protect channels.

NOTE: The BOP can be configured to show the protection limits as either a single value that applies to both protection channels or show individual settings for positive and negative protection limits. Only voltage protection limits are available when in current mode; only current limits are available in voltage mode. See Operator's Manual for details.

SOFTWARE LIMITS. Software limits prevent programming of the main channel or the Protect channel beyond the software limit value. Refer to Operator's Manual for a full explanation of software limits.

Changing Main Channel Software limit. This procedure allows the user to determine the maximum value of voltage or current that can be programmed.

1. Press **F5** from the power-up screen to enter the General Setup menu, then highlight Max/Min Settings.
2. Press **F1** to enter the Max/Min Settings submenu (Figure 9). (If a Password is required, see Operator's Manual for instructions.)

3. Highlight the voltage or current max/min value and press **F1** to change it. Software limits are absolute values (do not use minus sign for negative limits). Use number keys to change the setting, then **F4** to save.
4. When complete, press **F4** to save for power-up, **F3** to abort, or **F5** to apply the changes (without saving for power-up) and exit.
5. Upon return to the power-up screen, the main channel (voltage or current) is compared against the main channel limits in effect. If the main channel exceeds the limit, it is set to zero.
6. Highlight the \pm CPROTECT or \pm VPROTECT max/min value and press **F1** to change it. Software limits are absolute values (do not use minus sign for negative limits). Use number keys to change the setting. Press **F4** to save, or **F5** to abort.
7. When complete, press **F4** to save for power-up, or **F3** to abort, or **F5** to apply the changes (without saving for power-up) and exit.

Upon return to the power-up screen, the new protection limit (voltage or current) is compared against the protection limits in effect. If the new protection limit setting is below the existing setting for the protection limit, the protection channel (voltage or current) is set to zero.

DETERMINING HOW THE UNIT RESPONDS WHEN OUTPUT IS OFF (LOAD TYPE) The BOP supports three Load Type selections (see Table 4) which determine how the power supply responds when the output is off: ACTIVE, RESISTIVE and BATTERY. The Load Type selection does not affect the settings of the power supply for ON state; it only affects the mode of operation, main internal reference level and the protection levels during the OFF state.

NOTE:
VALUES SHOWN ARE
TYPICAL FOR
BOP 10-75MG.

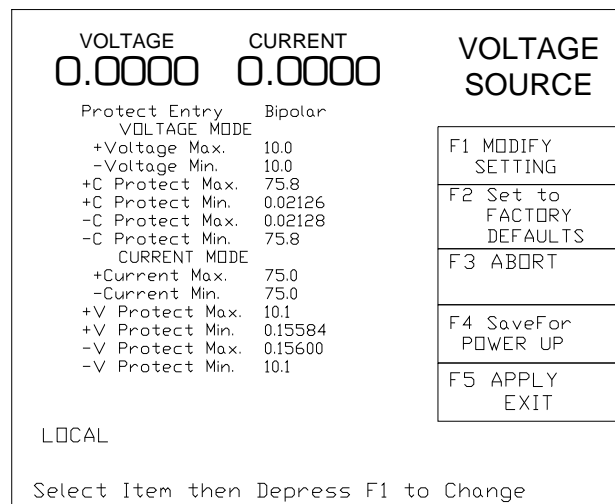


FIGURE 9. MAX/MIN SETTING MENU

TABLE 4. POWER SUPPLY BEHAVIOR WHEN OUTPUT IS SET TO OFF

LOAD TYPE SETTING	If unit was in Voltage Mode when output OFF command issued.	If unit was in Current Mode when output OFF command issued.
ACTIVE	<ul style="list-style-type: none"> • Unit remains in voltage mode. • Voltage set to zero. • Both \pm Current Protect set to maximum. • Both \pm Voltage Limit remain at maximum. 	<ul style="list-style-type: none"> • Unit set to voltage mode. • Voltage set to zero. • Both \pm Current Protect remain at maximum. • Both \pm Voltage Limit set to maximum.
RESISTIVE	<ul style="list-style-type: none"> • Unit remains in voltage mode. • Voltage set to zero. • Both \pm Current Protect set to minimum box values. • Both \pm Voltage Limit remain at maximum. 	<ul style="list-style-type: none"> • Unit remains in current mode. • Current set to zero. • Both \pm Current Protect set to minimum box values. • Both \pm Voltage Limit set to maximum,
BATTERY	<ul style="list-style-type: none"> • Unit set to current mode. • Current set to zero. • Both \pm Voltage Protect remain at maximum. • Both \pm Current Limit set to maximum. 	<ul style="list-style-type: none"> • Unit remains in current mode, • Current set to zero. • Both \pm Voltage Protect set to maximum. • Both \pm Current Limit remain at maximum.

WARNING



For inductive loads, and especially superconducting magnet type loads, the inherent offset of the BOP in the OFF state may generate significant current in the circuit. Two properly rated external switches must be installed for safety: one in series between the power supply and the magnet, and the other in parallel with the magnet. Once the BOP front panel display reads 0V, 0A, close the parallel switch, then open the series switch before removing or installing connections between BOP and load. To restore normal operation, first close the series switch, then open the parallel switch.

Active. Active mode (default setting) is necessary for the power supply to function properly and safely with inductive loads and constant-current-type active electronic loads. Active mode can also be used with resistive loads. Table 4 indicates how the power supply responds to a command to go from Output ON to OFF. When the output is disabled, the unit is set to voltage mode, voltage is set to zero and both current protect and voltage limit are set to maximum. When the unit is enabled, the pre-existing settings for voltage, current protect and voltage limit are restored.

WARNING



For both inductive loads and constant-current-type active electronic

loads when the BOP output is set to OFF, a path is provided for absorbing either the energy accumulated in the reactance of the load during the ON state, or energy delivered by an electronic load. This prevents damage to the load and power supply as well as providing safety for the user. However, In addition to the built-in safety features, constant-current-type active electronic loads must be adjusted to zero and the BOP front panel LCD must read 0V, minimum current, before handling the power supply-to-load connections.

Resistive. This mode, as the name suggests, is useful for resistive loads. Table 4 indicates how the power supply responds to a command to go from Output ON to OFF.

WARNING



Accessing the BOP after the output is disabled in BATTERY mode is hazardous because (1) high current arcing is possible and (2) either the external battery voltage, or the voltage (\pm Voltage Protection max) on the BOP output terminals may be dangerous. Therefore, for battery and constant-voltage-type active electronic loads it is recommended that two properly rated external switches be installed for safety: one in series with the battery, and

one across the BOP output. After the unit is set to OFF, first open the switch in series with the battery, then close the switch across the BOP output to ensure safety before handling BOP connections. When connecting the battery, the switch across the output should be opened after the connections are complete and then the switch in series with the battery should be closed. If the constant-voltage-type active electronic load is adjusted to zero before handling the power supply-to-load connections, only the switch across the BOP output is required.

Battery. This mode is necessary for the power supply to function properly and safely with either battery or constant-voltage-type active electronic loads. This mode prevents the battery from discharging during the OFF state. When the output is disabled (set to OFF), the BOP will go to current mode, current will be set to zero, with voltage protect and current limit set to maximum. In this way the battery will not be discharged while the output is OFF. For constant-voltage-type

IX — ADDITIONAL FEATURES.

The user is urged to refer to the Operator's Manual for full explanations all BOP 2KW features, including:

- Passwords - three independent levels of access
- Changing the Default Power up Settings
- Digital Remote Operation - using SCPI commands via RS 232, GPIB or LAN ports; operation via web pages
- Analog Remote Operation - via Analog I/O port
- Details about Protect Limits and Software-controlled limits

active electronic loads this mode stops energy flow during the OFF state. Table 4 indicates how the power supply responds to a command to go from Output ON to OFF.

CONFIGURE LOAD TYPE. To configure, press **F5** from the power-up screen, then highlight Load Type and press **F1** to modify. (If a Password is required, see Operator's Manual for instructions.) Highlight Active, Resistive or Battery (see explanations and associated WARNINGS above) and press **F4** to save. Then press **F4** to save for power-up, **F3** to abort, or **F5** to apply the changes (without saving for power-up) and exit. After configuring, the new setting will be effective when the power supply goes from output on to output off.

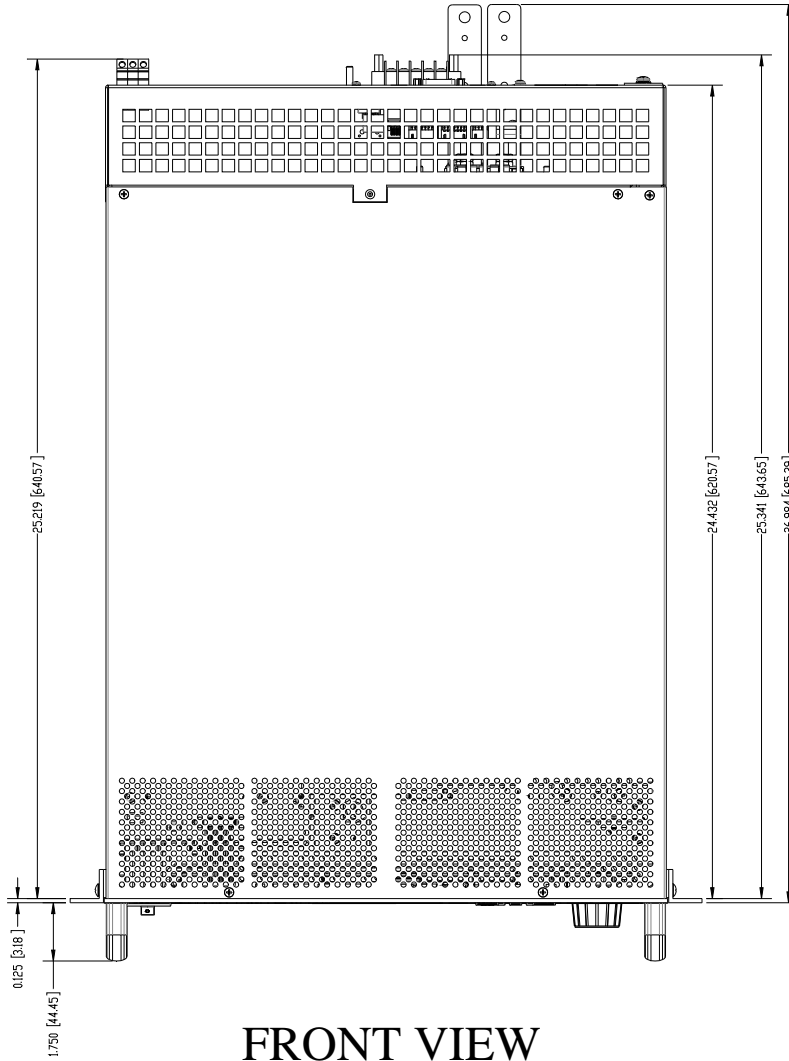
To restore factory default (Active), press **F5** from the power-up screen, highlight Load Type, press **F1**, then press **F2** to restore default. Press **F4** to save for power-up or **F5** to exit

ENABLING/DISABLING OUTPUT POWER.

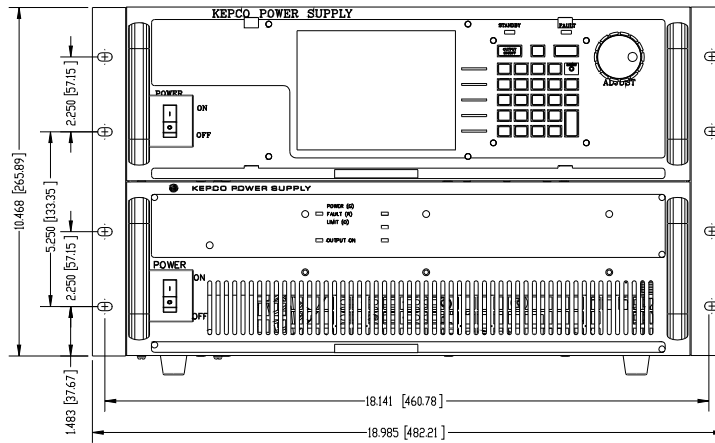
The BOP output can be disabled (OFF) or enabled (ON) by toggling the **STANDBY** key in local mode. The behavior of the unit when disabled depends on the Load Type setting (See "Max/Min Setting Menu" on page 13. 9 and Table 4 for details).

- Storing/Recalling Power Supply Output Settings
- Waveform Generation - Sine, Triangle, \pm Ramp, Square and Level segments. Local operation allows up to 16 waveforms, maximum 10 segments per waveform. Remote operation allows 1 waveform, maximum of 126 segments, or using LIST commands.
- Operator Testing
- Calibration - via either local keypad or remote SCPI commands
- Parallel/Series Configurations -increase current capability, voltage capability, or both.

TOP VIEW



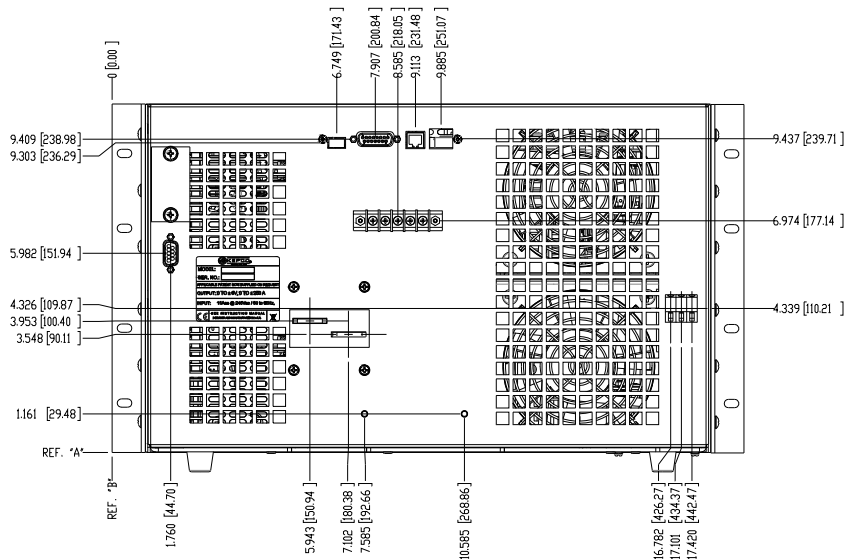
FRONT VIEW



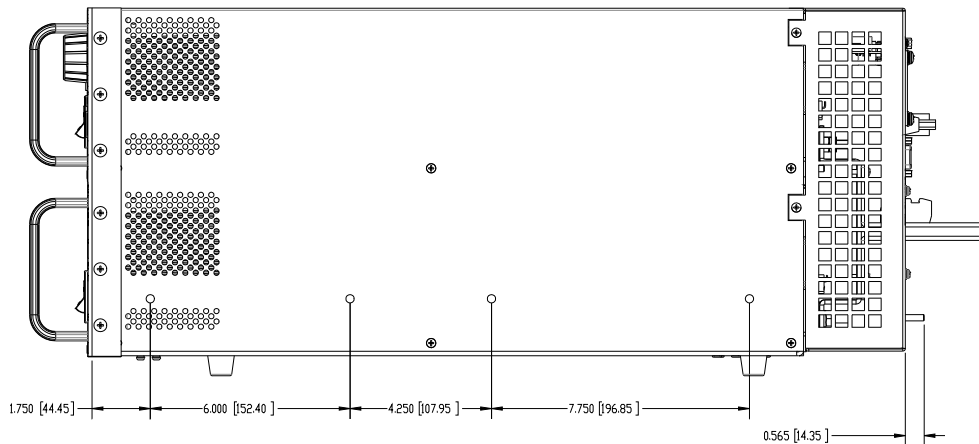
3044681

FIGURE 10. BOP 2KW OUTLINE DIMENSIONS, LOW VOLTAGE (6V - 25V) MODELS (SHEET 1 OF 2)

REAR VIEW



SIDE VIEW



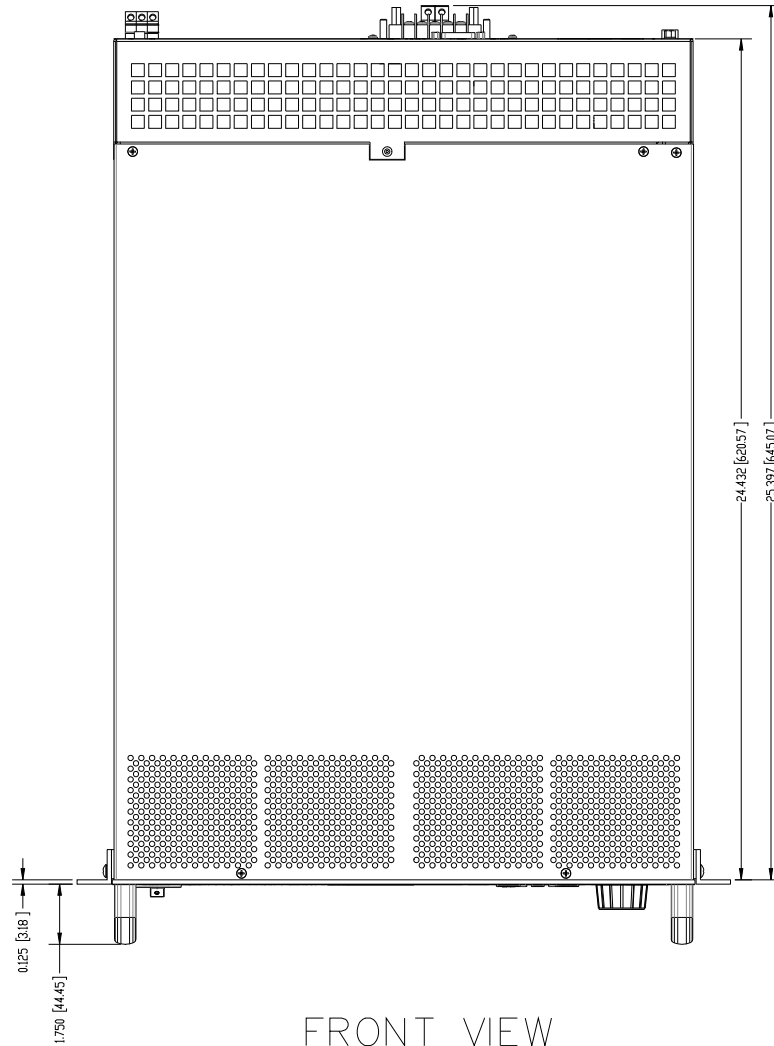
NOTES:

1. MATERIAL:
 - A) CHASSIS: #11 GA. C.R.S.
 - B) FRONT PANEL: 1/8 THK 6061-T6 ALUMINUM.
 - C) COVER: #16 GA. C.R.S.
 - D) BACK PLATES: 0.060" THK GALVANIZED STEEL.
2. FINISH:
 - A) CHASSIS & COVER: CADMIUM PLATE WITH CHROMATE WASH.
 - B) FRONT PANEL: SEE 1311145 PAGE 2 OF 3.
3. DIMENSION IN PARENTHASES ARE IN MILLIMETERS.
4. TOLERANCES ARE $\pm 1/32$ [0.8], EXCEPT AS NOTED.
5. OPTIONAL SLIDES (CONTACT KEPCO SALES ENGINEERING

3044681

FIGURE 10. BOP 2KW OUTLINE DIMENSIONS, LOW VOLTAGE (6V - 25V) MODELS (SHEET 2 OF 2)

TOP VIEW



FRONT VIEW

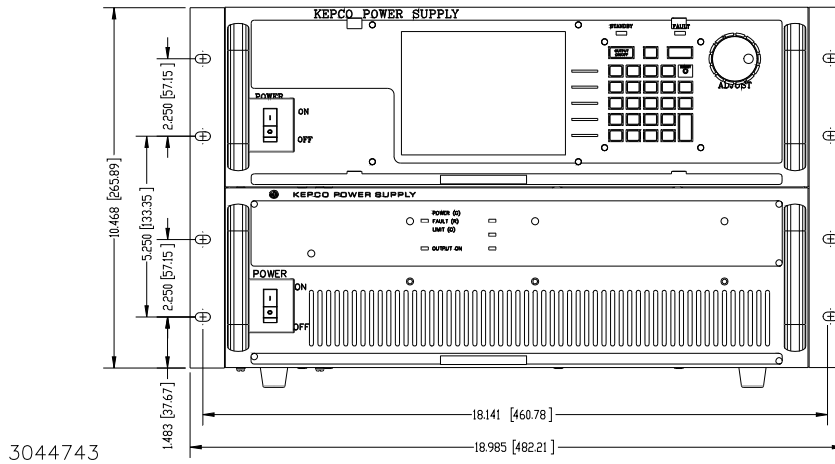
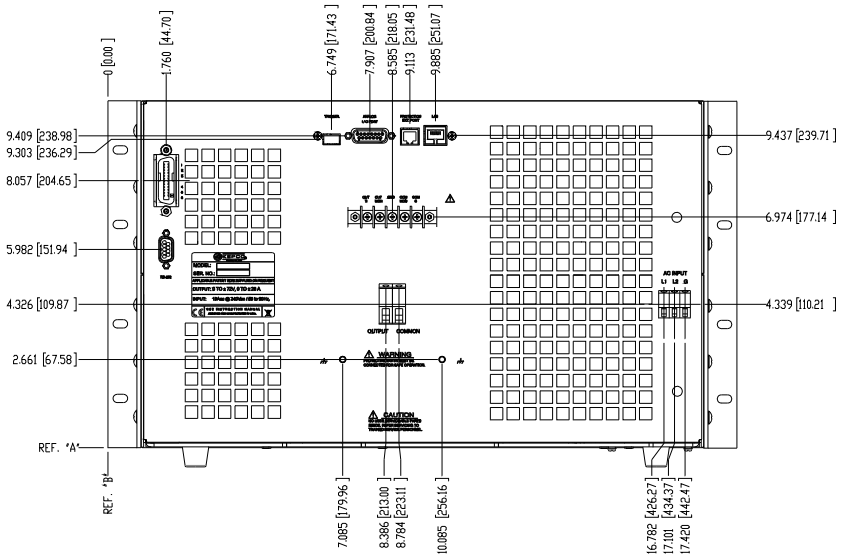
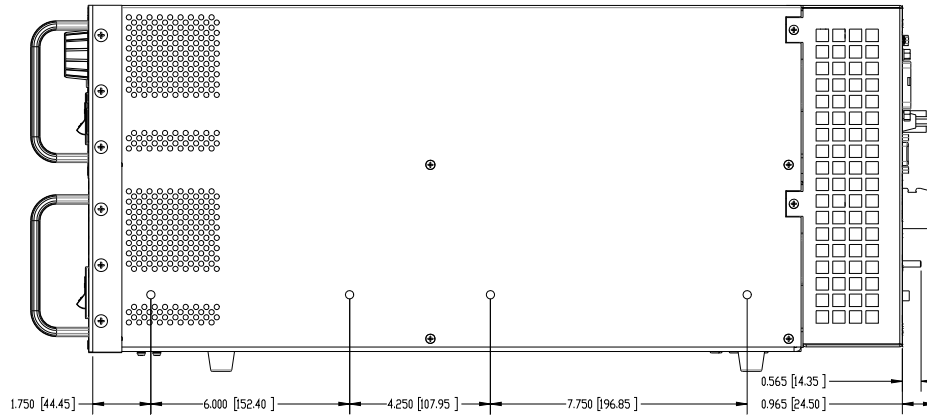


FIGURE 11. BOP 2KW OUTLINE DIMENSIONS, HIGH VOLTAGE (36V - 200V) MODELS (SHEET 1 OF 2)

REAR VIEW



SIDE VIEW



NOTES:

1. MATERIAL:
 - A) CHASSIS: #11 GA. C.R.S.
 - B) FRONT PANEL: 1/8 THK 6061-T6 ALUMINUM.
 - C) COVER: #16 GA. C.R.S.
 - D) BACK PLATES: 0.060" THK GALVANIZED STEEL.
2. FINISH:
 - A) CHASSIS & COVER: CADMIUM PLATE WITH CHROMATE WASH.
 - B) FRONT PANEL: SEE 1311145 PAGE 2 OF 3.
3. DIMENSION IN PARENTHASES ARE IN MILLIMETERS.
4. TOLERANCES ARE $\pm 1/32$ [0.8], EXCEPT AS NOTED.
5. OPTIONAL SLIDES (CONTACT KEPCO SALES ENGINEERING)

3044743

FIGURE 11. BOP 2KW OUTLINE DIMENSIONS, HIGH VOLTAGE (36V - 200V) MODELS (SHEET 2 OF 2)

