Sorensen

DCR-B2 SERIES

1800 - Watt
Power Supplies

Instruction Manual

Manual covers DCR-B2 models:

10-120B2	150-12B2
20-80B2	300-6B2
40-40B2	600-3B2
60-30B2	

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- Equipment purchased in the United States carries only a United States warranty for which repair must be accomplished at the Sorensen factory.

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SECTION 1
INTRODUCTION

1.1 INTRODUCTION

This manual contains operation and maintenance data on the 1800 watt units of the DCR-B2 series Sorensen Power Supplies. It is intended to familiarize the user with the functioning of the unit, to introduce the varied applications to which the unit may be adapted, and to furnish sufficient maintenance data to assure long operating life.

Six major sections form the manual divisions. Section 1 contains a brief functional description of the DCR-B2 series power supplies. Initial inspection and checkout procedures are outlined in Section 2. Operating instructions, including methods for adapting units to various applications, comprise Section 3. Sections 4 and 5 provide the principles of operation and maintenance procedures respectively. System drawings and the replacement parts list are provided in Section 6.

1.2 DESCRIPTION

1.2.1 General

Designed for either bench or rack use, the typical DCR-B2 power supply provides a highly regulated, precise dc output, adjustable over a wide range. It operates from a nominal 115 Vac (208/220/230 Vac inputs are available as options) and exhibits a rapid response to transients, both load and line.

DCR-B2 series supplies are a phase-controlled type with SCR's (Silicon Controlled Rectifiers) or Triacs at the input to the transformer, followed by a passive Pi filter. This design allows for a wide range of output voltages, simplicity of design, and offers large amounts of regulated power at relatively high efficiencies compared to linear regulators.

Silicon type semiconductors are used extensively in DCR-B2 circuitry, and contribute significantly to the units wide ambient temperature range characteristic. Low dissipation transistors and diodes are located on a single printed circuit board while high dissipation devices are heat-sinked to aluminum brackets and heatsinks.

All controls used during normal operation are mounted on the front panel. These include a power circuit breaker, FINE and COARSE VOLTAGE adjust potentiometers, and FINE and COARSE CURRENT adjust potentiometers. The system output is taken across a terminal pair at rear terminal strip TB2 or from the binding posts on the front panel of the supply.

A variety of Sorensen power supply application notes are available through your Sorensen Service Representative. These notes detail many hook-up configurations and special usages available to meet most power supply applications.

1.2.2 Automatic Crossover

There are two basic operating modes, voltage and current. In the voltage mode, the voltage is held constant while the current varies with the load. In the current mode, the voltage varies, and current is held constant. The automatic crossover feature enables the unit to switch operating modes as a function of load requirements. If, for example, load current attempts to increase above a preset current limit, the unit will switch operation automatically from the voltage to the current mode. In this mode, the current will be regulated at the value preset on the front panel. If load requirements are lowered, return to the voltage regulating mode will occur automatically. Two red panel lamps indicate whether operating in the voltage or current mode.

1.2.3 Remote Sensing

Terminals located on rear-mounted terminal board TB3 offer a means of extending a unit's regulating point from the output terminals to the load. This effectively compensates for variations in the load lead voltage drop. Section 3 outlines the connections for remote sensing.

1.2.4 Series Operation

For applications requiring output voltages higher than a single unit can provide, DCR-B2 power supplies may be connected in series (See Section 3). Regulation in series operation is the sum of the regulations for all units.

1.2.5 Parallel Operation

Parallel operation may be used to service those applications requiring an output current higher than a single supply can provide. Using a master/slave approach, a maximum of four units can be connected in parallel. An alternate method of connection is direct paralleling. With this approach, there is no limit to the number of units which can be paralleled. The regulation will deteriorate, and will be the sum of the regulations for the individual settings plus the output voltage differences between units at no load.

1.2.6 Remote Programming

Output voltage or current of DCR-B2 power supplies may be remotely programmed in either the voltage or current mode by resistance or voltage signal. Details and considerations are given in Section 3.

1.2.7 Unit Shutdown Circuit

In the DCR-B2 line, application of the plus (+) sense (terminal 1 of TB3) to the shutdown terminal (terminal 11 of TB3) instantly shuts down the supply. This function can provide unit protection by connecting a temperature or voltage sensitive switch (or transistor) in this line to shut the system down under specified conditions. An example is in the master/slave connection of two DCR-B2 power supplies (refer to Section 3, Operating Instructions). If the shutdown function is adapted to the master unit, the system output goes to zero; if applied to the slave unit, only that unit is affected and the system output is reduced accordingly.

1.2.8 Protection Features

Protection against the effects of overloads and internal short circuits is provided. Overload protection is inherent in automatic crossover. The main power circuit components are protected by the unit circuit breaker. Control circuitry is protected by a fuse on the board.

In the event of an overvoltage condition at the output, such as a failure in the power supply or an externally induced condition, an overvoltage electronic crowbar is actuated by an integral OVP sensing circuit. The crowbar acts to quickly reduce the output voltage to zero. (See details in Section 3).

1.3 OPTIONAL MODIFICATIONS

The standard DCR-B2 unit is designed for operation from a nominal 115 Vac input; however, units may be purchased factory modified to accept inputs of 208, 220 or 230 Vac (modifications M1, M2 or M3 respectively).

The sides of the DCR-B2 have inserts to allow attachment of slide rails. Consult the factory for information on these optional slide rails.

For information on additional modifications, consult the factory.

1.4 SPECIFICATIONS

The specifications for the DCR-B2 1800 watt series power supplies are given in Table 1-1.

Table 1-1 Specifications

DCR-B2 SPECIFICATIONS
1800 WATT SERIES

DCR Model	OUTPUT POWER			Constant Voltage Ripple (PARD)	Constant Current Ripple (PARD)	TEMP/CO		REMOTE PROGRAMMING		SIGNAL	Efficiency	INPUT POWER			OUTPUT IMPEDANCE (Typical)		
	Voltage (Vdc)	Current (Adc) 40°C	70°C	(mV rms)	(mA rms)	(mV/°C)	(mA/°C)	(Ohms/V)	(Ohms/A)	(Volt In/ Volt Out)	(% Typ.)	Voltage Range (Vac) Note 1	Current Max. (Aac) Note 2	Power Factor (Typ.)	120Hz	1kHz	10kHz
10-120B2	0-10	120	60	65	785	1.5	36	1200	3.3	1/1	62	103-127	24.0	.67	.008	.007	.02
20-80B2	0-20	80	40	65	260	3.0	24	600	5	1/2	70	103-127	30.0	.66	.01	.009	.025
40-40B2	0-40	40	20	90	90	6.0	12	300	10	1/4	78	103-127	26.8	.66	.018	.016	.045
60-30B2	0-60	30	16.5	125	63	9.0	0.9	200	16	1/6	84	103-127	27.0	.68	.024	.022	.06
150-12B2	0-150	12	6.6	300	24	22.5	3.6	80	33	1/15	84	103-127	27.0	.69	.17	.16	.186
300-6B2	0-300	6	3.3	700	14	45.0	1.8	40	66	1/30	84	103-127	27.0	.69	.70	.65	.77
600-3B2	0-600	3	1.65	1200	6	90.0	0.9	20	133	1/60	86	103-127	27.4	.66	2.17	2.0	2.2

Notes:
1. Optional Inputs: 208V, 220V, 230V (Options M1, M2, M3 respectively).
2. At 115V input.

COMMON SPECIFICATIONS

Voltage Mode:

Regulation: 0.03% with load change (NL-to-FL or FL-to-NL) and a full line-voltage change combined.
Resolution: 0.05% of Eo max. (typical)
Drift (% Eo max): 0.1% typical, for 8 hours after 30-minute warmup with constant line, load, and ambient temperature.
Transient Response: 50ms (typical) to return to ±1% band for a step load change 50%-100% or 100%-50% of full load (10V models ±3% band, 20V models ±2%). Below 60 Hz, ripple and transient response characteristics will deteriorate by a factor of $(60/x)^2$ where F is the input frequency.

Current Mode:

Regulation: 0.25% with 0-95% compliance-voltage change and ±10% line voltage change combined.
Resolution: 0.05% of Io max (typical)
Drift (% Io max): 0.15% (typical)

General:

Series Operation: To 200 Vdc Maximum. (150 and 300 volt models, only two in series).
Parallel Operation: By master-slave (four units maximum) or straight parallel.
Remote Sensing: See paragraph 3.2.2
Operating Temperature Range: 0°C to 71°C
Storage Temperature: -40°C to +85°C
Isolation Voltage: 1000 Vdc input to output.
Finish: Bonderize-Black semi-gloss with white lettering.
Overload/Short-circuit Protection: Adjustable current limiting with automatic recovery.
Overvoltage Protector: Fully adjustable OVP on all models.
Average Weight: 105 lbs.

SECTION 2
INSTALLATION

2.1 GENERAL

After unpacking, perform initial inspections and preliminary electrical check procedures to assure that the unit is in good working order. If it is determined that the unit is damaged, the carrier should be notified immediately. Repair problems should be directed to the nearest Sorensen representative, or to the factory.

2.2 INITIAL INSPECTION

Proceed as follows to inspect for damage incurred during shipment:

1. Inspect panel and chassis for scratches, dents and chips.

2. Turn front panel voltage and current controls from stop to stop. Rotation should be smooth through a 300 degree rotation.

3. Check meter faces for cracked or broken windows. Check each meter pointer for zero indication. If necessary, use adjust screw to bring indicator to zero.

4. Look for cracked or broken lenses on indicating lights.

5. Alternate power switch between ON and OFF. Action should be both positive and audible. Return switch to OFF position.

6. Remove rear Lexan Safety cover, and check terminal block TB3. Make sure that links are firmly in place across terminals 3-4, 5-6, 7-8. Replace cover.

7. Remove top cover retaining screw. Inspect components and printed circuit board for damage. Replace cover.

2.3 ELECTRICAL INSTALLATION

Standard units are shipped ready for use with nominal 115 Vac input, but may be factory or field modified to operate from a nominal 208, 220 or 230 volt input. (M1, M2, M3 options respectively).

2.3.1 Input Power Cord

The input power cord terminates externally in a three prong, polarized plug. The unit chassis is wired to the plug through the line cord, and therefore, the insertion of the plug into a compatible receptacle, hooked up to a grounded input, will automatically ground the unit. If a grounded input is not available, use an adapter, making sure that the adapter's external lead is well grounded.

2.4 MECHANICAL INSTALLATION

As received, the unit is ready for bench use. To adapt for rack mounting, simply remove feet and reinstall the feet retaining screws. As the unit is convection cooled, and the feet normally allow air to enter through the bottom, care must be taken when rack mounting to assure free air flow.

CAUTION

During installation, if two or more supplies are to be rack mounted or otherwise stacked, the operating ambient of the upper units should not exceed 70°C Output current must be derated according to specifications for ambients above 40°C/104°F.

2.5 ELECTRICAL CHECK

2.5.1 Voltage Mode

To check voltage mode operation, proceed as follows:

1. Set POWER switch to OFF. Connect input as per paragraph 2.3.
2. Turn COARSE and FINE VOLTAGE controls fully counterclockwise; turn COARSE and FINE CURRENT controls fully clockwise.
3. Set unit power switch to ON with zero load current.
4. Turn COARSE VOLTAGE control slowly clockwise while observing the unit voltmeter. The pointer should swing upscale, and the voltage indicator light should be ON.
5. With the pointer at half scale, rotate the FINE VOLTAGE control from stop to stop. The voltage should vary approximately 0.4% of maximum output voltage.
6. Set POWER switch to OFF.

2.5.2 Current Mode

To check current mode operation, proceed as follows:

1. Set POWER switch to OFF.

2. Turn COARSE and FINE CURRENT controls fully counterclockwise. Set COARSE VOLTAGE control to its mid position.

3. Connect a wire, of sufficient gauge to handle full output current, across the output terminals. [TB2 (+) to TB2 (-)]

4. Set unit power to ON. The CURRENT mode indicator will illuminate.

5. Rotate COARSE CURRENT control slowly clockwise until a current indication appears. Continue clockwise rotation; the meter indication will increase accordingly.

6. Set unit POWER switch to OFF, and remove shorting wire.

SECTION 3
OPERATION

3.1 GENERAL

This section provides basic operating instructions, and details the methods by which DCR-B2 power supplies may be adapted to their more common applications including remote sensing, remote programming, series and parallel operation. Table 3-1 identifies the operating controls shown in Figure 3-1, and describes their functions.

WARNING

- Full system voltage appears across the unit output terminals. Follow operating procedures exactly and do not make terminal board or load terminal alterations with unit power ON.

- High voltage output and loss of current limiting can result from loosening or removing links on rear mounted terminal board TB3. This may result in personal injury and damage to equipment. Do not remove or loosen any links unless specifically instructed in the following procedures.

- F1 on PCB near connector is at AC line potential. This could cause personal injury. Disconnect power before removing PCB.

CAUTION

This unit contains an integral OVP device. This device places a short circuit across the output terminals when the OVP trip level setting is exceeded. If the load contains large capacitors or is an active load (such as a battery), the stored energy in the load will be discharged into the OVP device. This discharge may injure the OVP and/or the load. Connect a series diode in the output lead to block the load discharge, in such cases. See Figure 3-9 for typical diode connection and types.

Table 3-1 Front Panel Controls and Indicators

CONTROL/INDICATOR	FUNCTION
POWER indicator	A white light connected across the primary of input transformer T2. Illuminates when the unit POWER switch is in the ON position.
POWER switch	A 115 volt, 15 ampere circuit breaker is used to connect or disconnect input line voltage.
COARSE CURRENT adjust	A 650 ohm potentiometer used in the first stage of the current-mode amplifier to vary the reference, and subsequently the output current.
FINE VOLTAGE adjust and FINE CURRENT adjust	80 ohm potentiometers connected in series with the COARSE VOLTAGE and CURRENT potentiometers, used to make slight variations in the output voltage or current.
CURRENT mode indicator	A red light which illuminates when the unit is operating in the current regulating mode.
Panel voltmeter	A meter connected internally across the SENSE terminals, to indicate unit output voltage. *
Panel current meter	A meter connected in series with the NEGATIVE output, to indicate unit output current.
VOLTAGE mode indicator	A red light which illuminates when the unit is operating in the voltage regulating mode.
COARSE VOLTAGE adjust	A 13K ohm potentiometer across which the reference voltage for voltage-mode operation is developed. Used to adjust the output voltage.

* In local sense mode only; when remote sensing is used, indicates voltage across load.

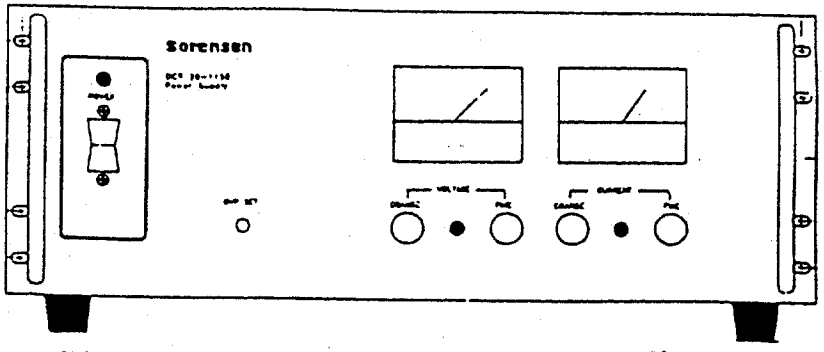


Figure 3-1 DCR-B Controls and Indicators

Remote Shutdown: Sink 1 mA to Regulator Common - - - - - - - - - - (11)

Internal Current Shunt, Positive. - (10)

} Approx. 0.4V for rated output.

Internal Current Shunt, Negative. - (9)

Current Programming:

Resistance: Remove jumper 7-8, connect program resistor between 8-9. (8)

Voltage: Remove jumper 7-8 connect signal (0-10V) to 8 positive, return to 9. OBSERVE POLARITY (7)

CURRENT CONTROL

Voltage Programming:

Resistance: Remove jumper 5-6, connect program resistor between 4-5. (6)

Voltage: Remove jumper 3-4, connect signal (0-10V) to 3 (positive), return to 1. OBSERVE POLARITY (5)

VOLTAGE CONTROL

Variable reference output, 0-10V. - (4)

Error Amplifier Input. - (3)

Output Voltage Sense NEG. (2) (-)

Sense current = 1.0mA (Neg Lead)
= 20mA (Pos Lead) (typical)

OUTPUT SENSE

Load Circuit Burden = .5V/Lead.

(Regulator Common) POS (1) (+)

(2) (- sense) is jumpered to - OUTPUT
(1) (+ sense) is jumpered to + OUTPUT

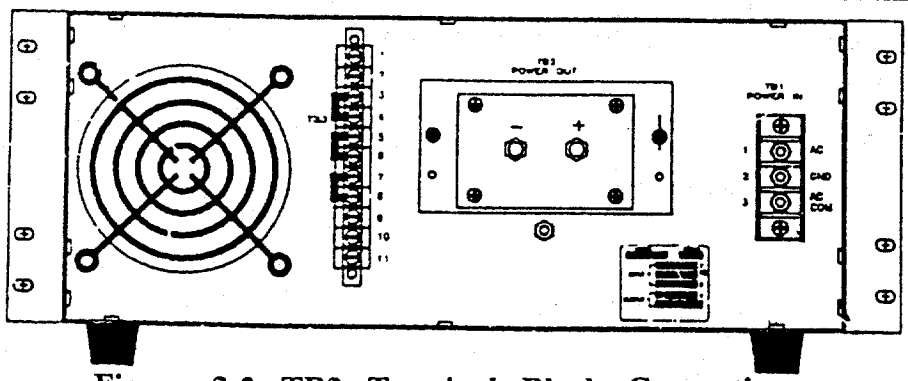


Figure 3-2 TB3 Terminal Block Connections

3.2 VOLTAGE MODE OPERATION

3.2.1 Local Sensing

DCR-B2 series units are shipped ready for use in the local sensing configuration, that is, with unit regulation occurring at the output terminals. Local sensing is usually acceptable for applications where the load current is nearly constant (or when large output conductors are used). In special applications (where load regulation is critical) remote sensing may be used (see para. 3.2.2). To operate unit in the voltage mode and local sensing configuration, proceed as follows:

1. Set POWER to OFF, connect appropriate input voltage.
2. Rotate the VOLTAGE controls fully counterclockwise and the CURRENT controls fully clockwise.
3. Set unit power to ON. Power light will illuminate.
4. Rotate COARSE VOLTAGE control until the unit voltmeter indicates the desired output voltage. Use FINE VOLTAGE control for small adjustments.
5. Set unit power to OFF.
6. Remove rear Lexan Safety cover and connect load lines to output terminals. Replace cover.
7. Set unit power to ON, and turn CURRENT control to the desired current limiting value. POWER light will illuminate, and the unit is in voltage mode operation.

NOTE

With unit in the voltage mode, an increase in load current requirements above the value set in step 7 will cause an automatic crossover to the current mode (current limiting). The current mode indicator will illuminate when this occurs.

3.2.2 Remote Sensing (Figure 3-3)

In the remote sensing condition, voltage regulation is at the load rather than at the unit output terminals. This compensates for voltage drop variations in the load lines.

NOTE

Voltage drop should not exceed 3 volts maximum per load lead, 1 volt maximum on 150 to 600V models. Voltage across the load is equal to voltage output of the unit minus line drops.

On high voltage models (150 to 600V), the 3V drop in the external load lines may cause damage to the DCR control amplifier under load short circuit conditions. A large portion of the rated output voltage is dropped across the load lines under the load short condition, and this high voltage will enter the amplifier causing damage. For this reason, it is recommended that remote sensing be avoided, or that the external line drop not exceed 1 volt per load line on the 150 to 600 Vdc models.

Note that a heavy pulse load can act the same as a momentary load short, and may damage the amplifier under remote sense conditions.

Consult the factory for recommendations if you intend to use remote sense under load shorting (or pulse loading) conditions.

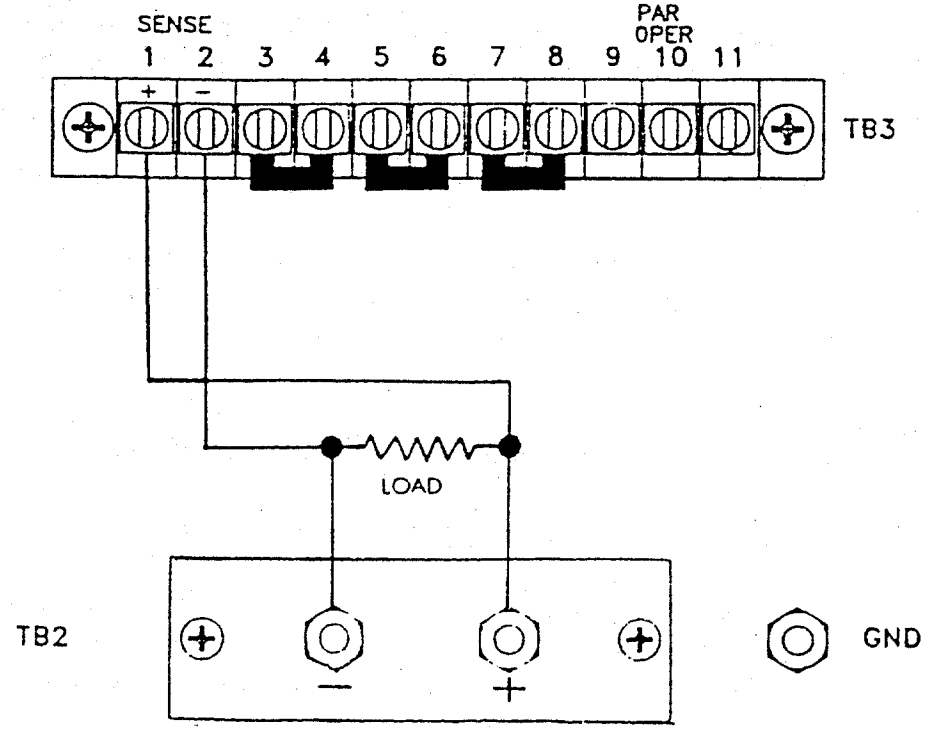


Figure 3-3 Remote Sensing Connections

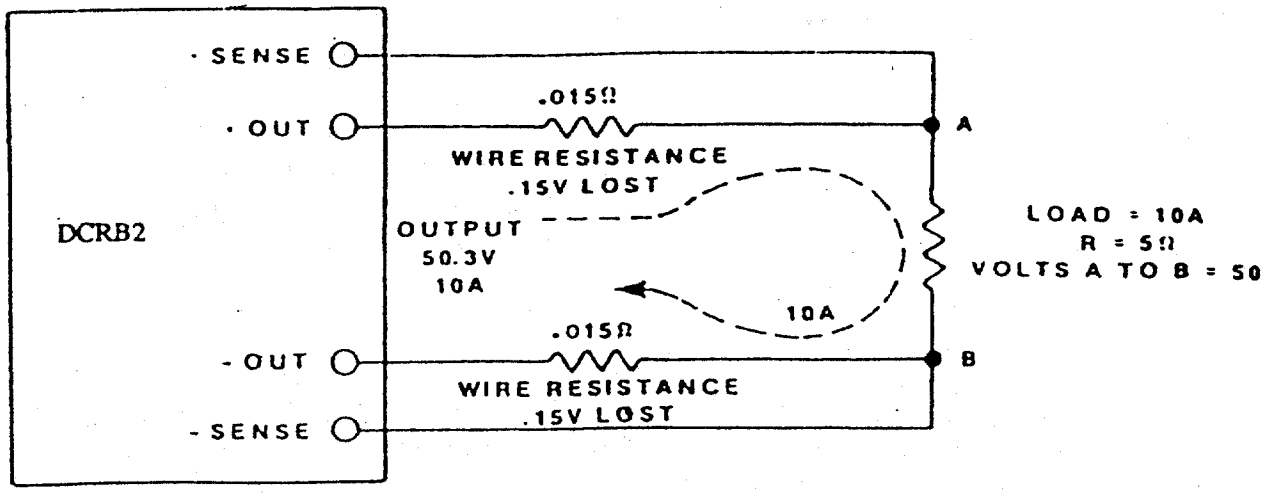


Figure 3-4 Illustration of Load Lead Resistance (Remote Sensing)

To adapt unit for remote sensing operation, proceed as follows:

1. With no load on the unit, apply input power and set output voltage to the desired value; then set POWER switch to OFF.

2. Remove rear Lexan Safety cover and disconnect red and black wires going from the plus and minus output terminals to the plus and minus sense terminals.

3. Run output lead from the load to the plus and minus output terminals.

4. Connect sensing leads from plus sense and minus sense terminals to the load. Observe Polarity. To reduce stray pickup, use shielded cable (shield grounded at the supply) or a twisted pair of wires for sensing leads.

5. Replace the rear Lexan Safety cover and set POWER to ON.

3.2.3 Resistance Programming Voltage Mode (Figure 3-5)

The output voltage of any model in the DCR-B2 series may be controlled from remote locations by connecting a resistance (fixed or variable) into the voltage mode amplifier reference circuit. Terminals on rear terminal board TB3 are provided for this purpose.

The ohms/volt sensitivity for each unit is listed in the specifications (Table 1-1). The programming resistor should have a low temperature coefficient (±30 ppm), and should dissipate approximately 10 milliwatts. Programming current is approximately 1.0 milliampere. If changes in the programmed output are to be made by abrupt changes in programming resistance, make before break switching should be used.

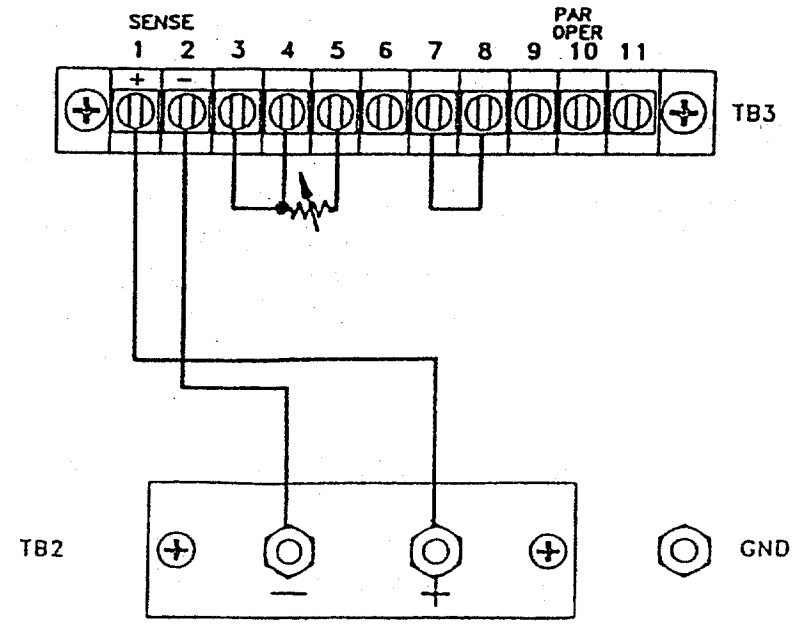


Figure 3-5 Resistance Programming Voltage Mode Connections

To adapt unit to resistance programming operation, proceed as follows:

1. Set unit power to OFF.

2. Remove link between terminals 5 and 6, and connect a programming resistor between terminals 4 and 5 (Figure 3-5). Use shielded or twisted wire for interconnecting leads.

3. Rotate COARSE and FINE VOLTAGE controls fully counterclockwise. Set POWER switch to ON.

4. Rotate CURRENT controls to desired limiting value. Remove input power, and connect load to output terminals.

5. Set POWER switch to ON. Unit will now supply programmed voltage to load.

CAUTION

If programming operation is to be discontinued, set POWER switch to OFF, remove programming resistor, and reconnect link between terminals 5 and 6.

NOTE

Panel controls are disabled when unit is connected in this way.

3.2.4 Signal Programming Voltage Mode

A fixed or variable voltage signal may be fed into the voltage mode amplifier circuit to provide a fixed or variable voltage output. The selected signal source output should be floating, unless the positive output of the supply is grounded. The required signal is 0-10V capable of sourcing 1 mA. Proceed as follows:

1. Set POWER switch to OFF.
2. Remove link from between terminals 3 and 4 of TB3.
3. Connect the signal source between terminals 3 and 1 of TB3. Observe Polarity (positive end to terminal 3).

CAUTION

If programming voltage exceeds 10V, excessive output voltage could occur which can damage the unit.

3.3 CURRENT MODE OPERATION

In current mode operation, the current output is regulated at the value determined by the setting of the current controls. The output voltage varies as a function of load. To operate unit in the current mode proceed as follows:

1. Set POWER switch to OFF.
2. Rotate FINE and COARSE VOLTAGE controls fully counterclockwise, and adjust COARSE CURRENT control approximately three quarters clockwise.
3. Set POWER switch to ON.
4. Rotate COARSE VOLTAGE control clockwise until unit voltmeter indicates the desired voltage limit.
5. Set POWER switch to OFF.
6. Connect load to output terminals. Observe Polarity.
7. Set POWER switch to ON, and turn CURRENT controls to desired current regulation setting. CURRENT MODE light will illuminate, and unit will deliver constant, regulated current to load.

NOTE

- Any output instability (such as oscillations due to inductive loading) can be eliminated by adjusting potentiometer R36 on the unit PCB.

- If voltage increases above the limit set in step 3 preceding, unit will automatically crossover to voltage mode operation.

3.3.1 Resistance Programming Current Mode (Figure 3-6)

DCR-B2 supplies may be programmed externally to provide output current. This is done by inserting a fixed or variable resistance into the current mode amplifier reference circuit. The programming resistor selected should have a low temperature coefficient (±30 ppm) and should dissipate approximately 0.5 milliwatt. Programming current is approximately 1.0 milliampere.

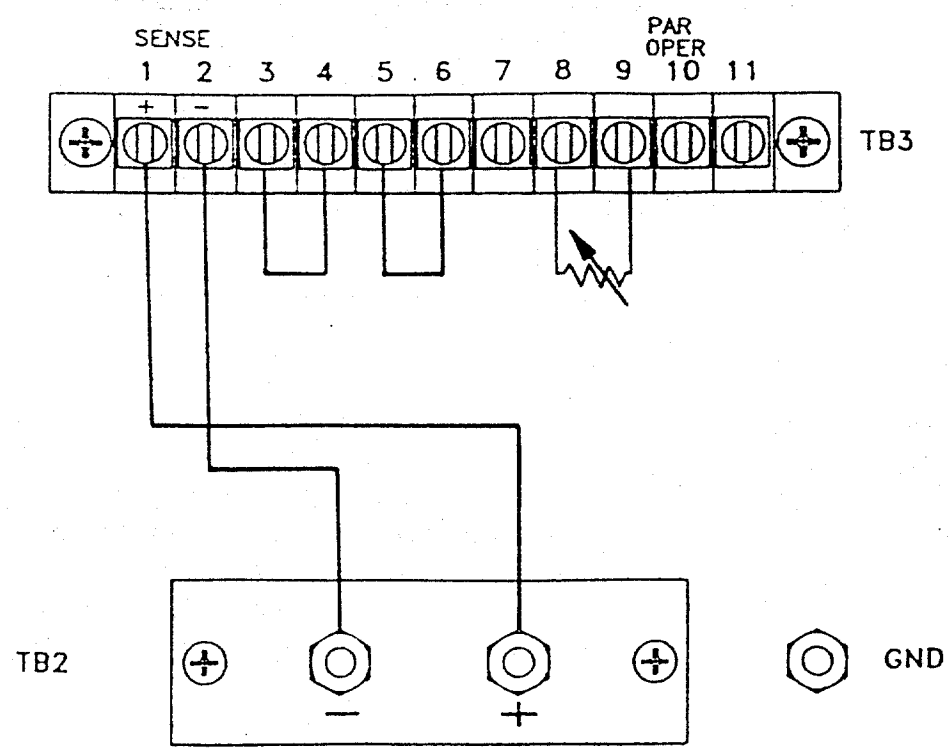


Figure 3-6 Resistance Programming Current Mode Connections

To adapt unit to the current mode, resistance programming configuration, proceed as follows:

1. Set POWER switch to OFF.
2. Remove the link between terminals 7 and 8, and rotate VOLTAGE controls to mid position.
3. Insert programming resistor between terminals 8 and 9.
4. Set POWER switch to ON.
5. Adjust COARSE VOLTAGE control until unit voltmeter indicates desired voltage limit value.
6. Set POWER switch to OFF. Connect load leads to output terminals. Observe Polarity.
7. Set POWER switch to ON. CURRENT mode indicator will illuminate.

CAUTION

If resistance programming is to be discontinued, set POWER switch to OFF, remove programming device, and reconnect link between terminals 7 and 8.

3.3.2 Signal Programming Current Mode

The procedure for adapting a DCR-B2 unit to current mode signal programming is identical to that for current mode resistance programming except that the signal source, (488 DAP or equivalent) rather than a programming resistor, is connected across terminals 8 and 9. A floating (ungrounded) signal source capable of sinking approximately 1.0 mA should be selected, and twisted wires should be used for the interconnecting leads. For a full range variation in unit output current, signal must have 0 to 400 mV volt range, or 0 to 10 volt range depending on SW1 setting. Terminal 8 is positive.

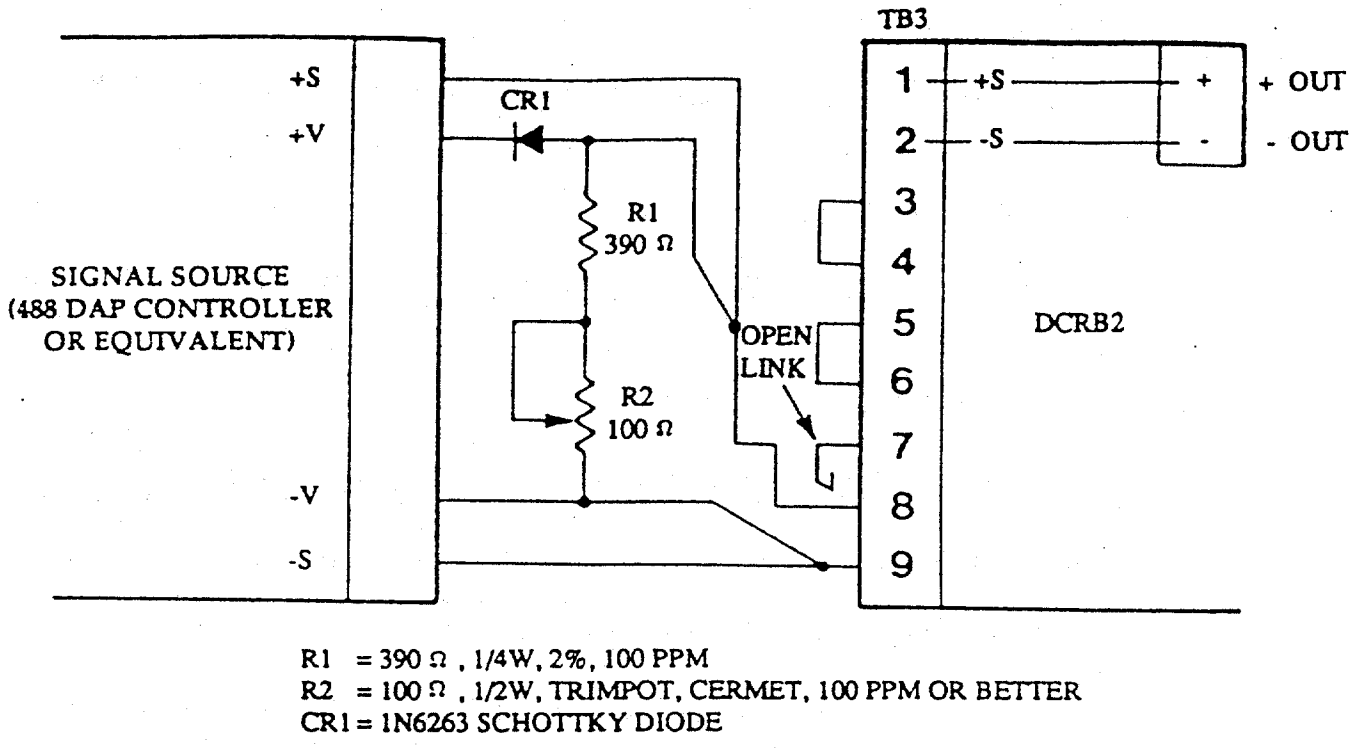
CAUTION

In 400 mV range setting, do not apply more than 400 mV to the DCR-B2, as the DCR-B2 current limit will be dangerously high.

3.3.3 Alternate Current Programming Method

This alternate programming method is recommended for the DCR-B2 power supply. These models are designed to accept control inputs of 400 mV. This diode-isolated current-sink method, while somewhat more complex to implement, provides a maximum current limit of 115% regardless of inadvertent errors in control input.

Figure 3-7 illustrates unit interconnection for the DCR-B2 power supply series.



R1 = 390 Ω , 1/4W, 2%, 100 PPM
R2 = 100 Ω , 1/2W, TRIMPOT, CERMET, 100 PPM OR BETTER
CR1 = 1N6263 SCHOTTKY DIODE

Figure 3-7 DCR-B2 Interconnections (Current Programming, 0-400 mV Range)

3.3.3.1 Calibration Procedure

1. Turn signal source ON, DCR-B2 power OFF.
2. Program signal source to zero output voltage.
3. Set the DCR-B2 panel voltage control fully clockwise (or to desired voltage limit).
4. Short the DCR-B2 output terminals and apply DCR-B2 input power.
5. Set zero current adjust potentiometer R17 on the DCR-B2 PCB to the point where the output current just drops to zero

NOTE

A small positive current is desirable to insure that the zero is not set too low.

6. Set signal source and DCR-B2 power OFF.

7. Disconnect the signal source from terminals 7 and 8 of the DCR-B2. Short DCR-B2 output.

8. Turn DCR-B2 output ON.

9. Set external pot (R2 in Figure 3-7) to obtain 115% of rated DCR-B2 output current.

10. Turn DCR-B2 power OFF.

11. Reconnect the signal source connections removed in step 7.

12. Turn the signal source and the DCR-B2 power ON.

13. Set the signal source for 400 mV output.

14. Vary the signal source output slightly until the rated full scale dc output current of the DCR-B2 is obtained. (e.g., DCR40-13B may require 385 mV for 13A output).

15. Using output voltage obtained in step 13, calculate the programming constant (Amps output per control supply input). For example: Assume that a voltage of 385 mV is required to obtain a full 13A output. The formula would be as follows:

$$\text{PROGRAM CONSTANT} = \frac{\text{DCR-B2 Amps Out}}{\text{Signal Source mV Out}} = \text{Amps/mV}$$

$$\text{(e.g.)}\ \frac{13\text{A}}{385} = 0.0338\ \text{Amps/mV}$$

16. Remove DCR-B2 output short.

Overvoltage from the signal source will only produce 115% of rated output current.

3.4 PARALLEL OPERATION

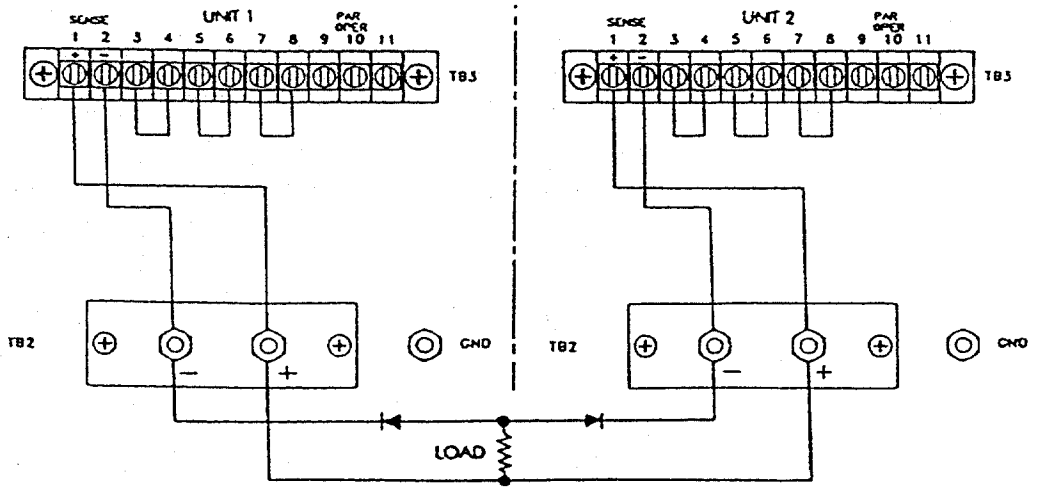
DCR-B2 single phase units may be paralleled using either of two methods. One method uses a master/slave approach, and the other involves direct paralleling. Each method has its advantages. In master/slave operation the output voltage regulation is maintained, but only four units may be paralleled; with the direct method, there is no limit to the number of units which may be paralleled and no current derating is required. Output voltage regulation, however, does deteriorate.

3.4.1 Direct Paralleling (Figure 3-8)

The following steps outline the procedure for connecting two units in parallel (the same procedure may be extended to parallel as many units as desired):

1. At no load, adjust individual unit voltages to desired system output. Attempt to match individual unit outputs with FINE VOLTAGE controls.
2. Set power on each unit to OFF, and run load leads from units to load. Observe Polarity.
3. If remote sensing is to be used, connect sensing leads from units to load, also observing polarity. Use twisted wire or shielded pair for leads.
4. Set each unit POWER switch to ON.

The unit supplying the highest voltage will supply the load, as it is impossible to identically match the output voltages. If the load requirements exceed the setting on the CURRENT control, this unit will automatically cross over to current mode operation, and its output voltage will drop. The second unit will then assume that portion of the load rejected by the first. Any further increases in load will be supplied by the second unit up to its current limit setting. Regulation, therefore, will be the sum of the regulations of the units plus the difference in the voltage settings.



For remote sensing, connect both unit + and - terminals directly to the load instead of output terminal board. OBSERVE POLARITY. Forward diode types listed in Table 3-3 for series connection will be adequate. Heatsinking is also necessary.

Figure 3-8 Direct Parallel Connections

3.4.2 Master/Slave Paralleling (Figure 3-9)

To connect two units in parallel, proceed as follows:

NOTE

Up to three slave units may be added by extending this procedure.

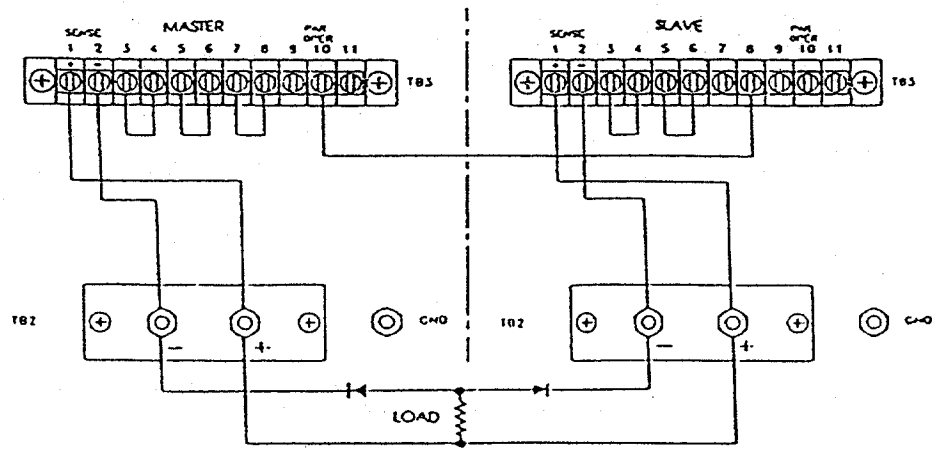
1. With no load applied, set master unit POWER switch to ON, and adjust voltage to desired system output (plus total load lead drop unless in the remote sensing mode). Set unit power to OFF.

2. Connect load leads from both units to the load. If possible, use load leads of approximately equal length. Observe Polarity.

3. Disconnect link between terminals 7 and 8 on slave unit. Set slave voltage controls fully clockwise. Connect a wire between terminal 8 of the slave unit and terminal 10 of the master unit.

4. Set master unit POWER switch to ON, and then set the slave unit POWER switch to on.

5. Adjust control R17 (on Control PCB) to balance the output currents between the paralleled units.
   Note that the units should be adjusted for equal output currents using the heaviest load (i.e., with both units operating near full load rating).



Forward diode types listed in Table 3-3 for series connection will be adequate. Heatsinking is also necessary.

Figure 3-9 Master/Slave Connections, Parallel Operation

3.5 SERIES OPERATION

3.5.1 Direct Series Connections (Figure 3-10)

The 10Vdc to 80Vdc DCR-B2 models may be directly series-connected for up to a total output of 200 Vdc. The 150 and 300 volt models may only have two units in series (for 300Vdc and 600Vdc total output respectively), and the 600 volt unit can not be series connected. Only like units may be connected in series. System regulation is the sum of the regulations of all units.

The procedure is outlined for connecting two units in series. Additional units may be connected by repeating the procedure for each.

NOTE

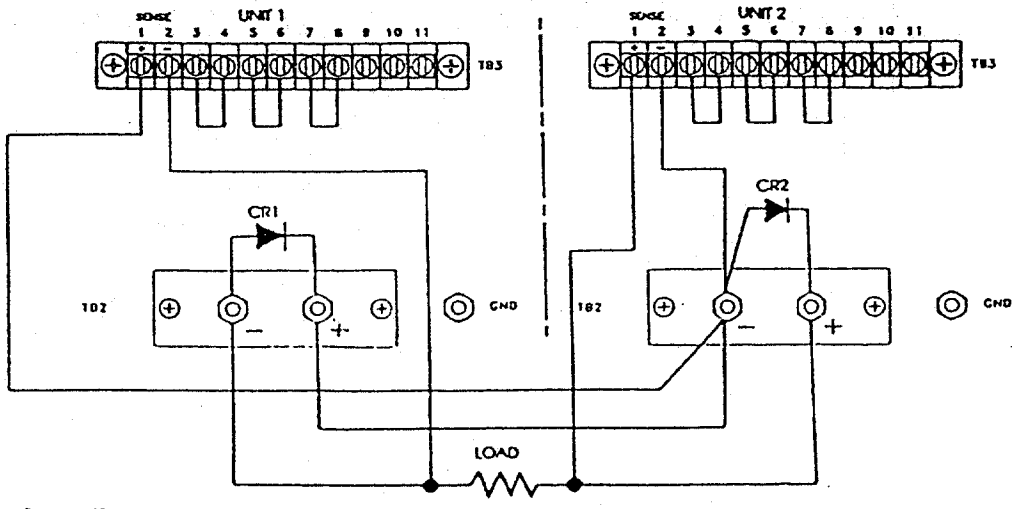
Series connected units may be adapted to resistance or signal programming. Be sure programming device is isolated from ground sufficiently to withstand maximum series operating potential.

1. With no load connected, set each unit to its desired output voltage level, and appropriate current limiting value.
2. Set the POWER switch of each unit to OFF.
3. Interconnect units as shown in Figure 3-10.

CAUTION

Rectifiers (and heat sinks where required) must be connected across the output terminals of each unit as shown in the figure. This will prevent damage to the output capacitors. Specific rectifier types are listed in Table 3-3.

4. Set unit power switches to ON. Units operate with independently adjustable outputs, and the power to each may be set ON or OFF separately.



See Table 3-3 for diode values

Figure 3-10 Direct Series Connections (Remote Sensing)

3.5.2 Master/Slave Connection (Figure 3-11)

The voltage range of a DCR-B2 power supply system can be increased by series connecting units up to a total rated output of 200 Vdc (150/300 volt models, two in series) in a master/slave configuration. Two 40 volt supplies thus connected provide 0 to 80 volt range capability with voltage programming necessary only on one unit. External components required are two wire-wound resistors (RA and RB in the figure), a 15 μF bypass capacitor to eliminate noise feed-through and a shunt power rectifier across the output terminals of each unit.

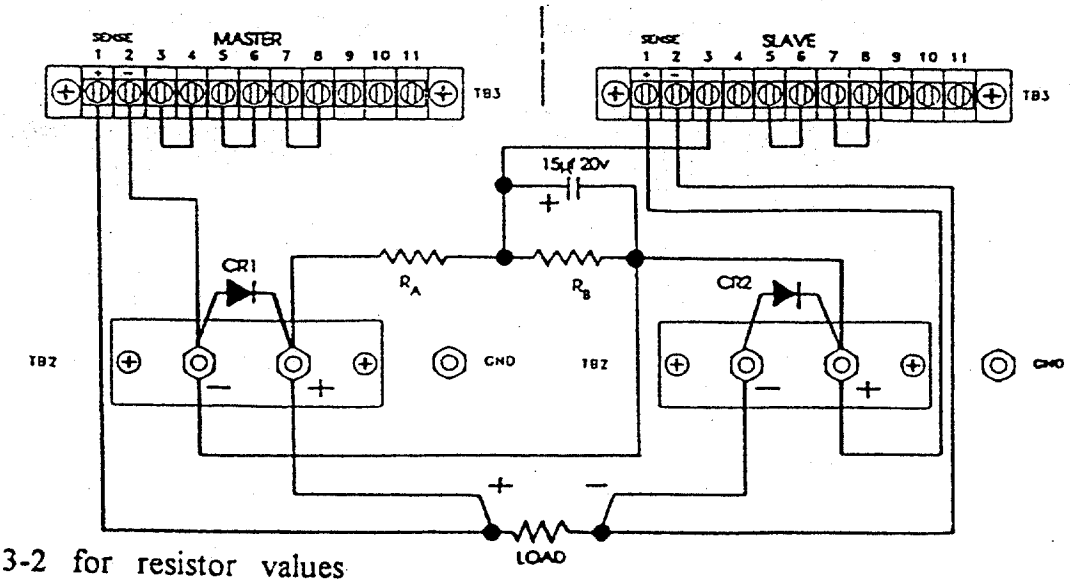
Assuming two supplies with the same output ratings are to be used, (consult factory for connecting dissimilar units), connect as shown in Figure 3-11. RA and RB are low TC, wire-wound resistors of 5 watts rating or greater. Resistance values for two identical units in series have been calculated for all voltage ranges in the DCR-B2 series, and are summarized in Table 3-2 for each application.

NOTE

For more than two units (with identical output ratings) connected in series, RB remains 10K, and RA is calculated using the formula:

$RA = 10^3 (Vo - 10)/X$

where Vo is the voltage of the master supply, and X is the number of units in the system.



See Table 3-2 for resistor values
See Table 3-3 for diode values

Figure 3-11 Master/Slave Connections Series Operation

Table 3-2 RA/RB Values--Two Identical DCR-B2 Units Series Connected

(V) RATED	RA	RB
10*	Open	Open
20	5K	10K
40	15K	10K
60	25K	10K
150	70K	10K
300	145K	10K
600	295K	10K

*For 10 volt units, terminal 3 of the slave unit is connected directly to the plus (+) sense terminal of the master unit.

Table 3-3 Recommended Rectifiers, Series Operation

DCR Model	Mfr. -Type	Sorensen Part No.	Heatsink** Dim. Inches (mm)
10-120B2	1N4587 1N4587*	587571-1 587571-3	4 x 4 x 1/8 (102) x (102) x (3)
20-80B2	1N1183 1N1183*	587382-1 587382-6	3-1/2 x 3-1/2 x 1/8 (89) x (89) x (3.2)
40-40B2	MR1121 MR1121R*	26-1046-2 26-1046-12	2-3/4 x 2-3/4 x 1/8 (70) x (70) x (3.2)
60-30B2	MR1121 MR1121R*	26-1046-2 26-1046-12	3 x 3 x 1/32 (76) x (76) x (.8)
150-12B2	1N4141	587566-2	None Required
300-6B2	1N4142	587566-3	None Required
600-3B2	1N4144	587566-5	None Required

* Reverse-polarity rectifiers
** Flat aluminum plate

With POWER switches OFF, connect each unit to an appropriate input power source (115/208/220/230 Vac). All units in the sysem can be connected through a common ac line OFF/ON switch. Proceed as follows:

1. Set the COARSE and FINE CURRENT controls of each unit fully clockwise.

2. Set the slave unit POWER switch to ON.

3. Set the master unit COARSE and FINE VOLTAGE controls fully counterclockwise, and set its POWER switch to ON.

4. Adjust master unit controls for desired system output level, which, in the case of two identical units, will be twice that indicated on its panel meter.

NOTES

* System output for series connected units of different power ratings will be the sum of the individual unit voltages, at a maximum current level equal to that of the lowest unit current rating.

* In multiple unit operation, a greater time lag must be anticipated to reach full system output at each power turn on.

3.6 UNIT SHUTDOWN CIRCUIT

In the DCR-B2 line, shutdown is accomplished by connecting the remote shutdown (terminal 11 of TB3) to the positive sense (terminal 1 of TB3). This connection may be metallic, (reed relay or wire) or may be a transistor or optical coupler. The device must sink approximately 2 mA from terminal 11, such that pin 11 drops below approximately 10 volts relative to (+) sense. The relay (or transistor) used for shutdown should be rated for 20V. Since the transistor will be connected to the (+) sense output, this device must be isolated (floating) such as through an opto-isolator. An example is in the master/slave connection of two DCR-B2 power supplies. If the shutdown function is adapted to the master unit, the system output goes to zero; if applied to the slave unit, only that unit is affected and the system output is reduced accordingly.

3.7 OVP

The OVP is a fast-response silicon-controlled rectifier (SCR) crowbar circuit.

3.7.1 OVP Adjustment

The OVP operating point is set as follows:

1. With OVP potentiometer R18 (accessible through hole in front panel) fully clockwise, set unit power to ON, and adjust front panel control to the desired trip point as indicated on the unit voltmeter. It is recommended that the OVP trip level be selected at least 10% higher than the desired operating level, to prevent nuisance trip-out.

2. Adjust R18 slowly counterclockwise until the OVP trips. Leave R18 in this position.

3. Set unit power to OFF, and turn front panel voltage control counterclockwise away from the trip point.

4. Apply unit power and adjust the supply output voltage to the desired operating level.

3.7.2 Cautions

CAUTION

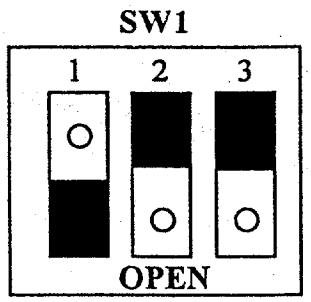
Parallel operation requires protective diodes. See Figure 3-8 and 3-9.

CAUTION

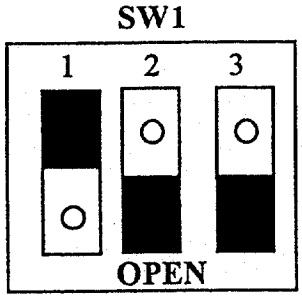
If the DCR-B2 is used with an energy storage type of load (e.g., batteries or large capacitor or inductor banks) protective diodes must be used in series with the negative load lead as shown in Figures 3-8 and 3-9. This precaution must be taken to prevent energy stored in the external device or load being absorbed by the OVP crowbar SCR. Due to the limited energy capabilities of the SCR, damage could occur to the SCR and, perhaps, the load.

3.8 CHANGEABLE CURRENT PROGRAMMING PARAMETERS

In the DCR-B2 Series, current programming parameters are changeable. There are two input ranges which are switch setable for the current mode signal voltage. The first is the standard 0-400mV input voltage and the second is a new range of 0-10V. These ranges are chosen by utilizing the SW1 switch located on Control Board Number 1063005. Switch positions for each input range are shown below.



0-10V



0-400mV

CAUTION

To prevent exceeding the input voltage range (per caution as stated in Section 3.3.2) check SW1 positioning before applying current mode signal programming voltage.

SECTION 4
THEORY OF OPERATION

4.1 INTRODUCTION

This section provides a basic discussion of unit operating principles, which may be used in conjunction with the troubleshooting chart provided in Section 5, to enable the logical and rapid isolation of unit faults. A brief description of the phase control principle is given first, followed by a block diagram analysis of system functions. The function of each section is then described in detail.

4.2 PHASE CONTROL PRINCIPLE

The sinusoidal wave in Figure 4-1 represents normal ac line voltage. If, by some means, conduction of this voltage is delayed, the average voltage output will be reduced. Control of the delay then results in control of the average voltage. This is phase control. The silicon controlled rectifier (SCR) acts like a switch, activated by the delay circuit, to provide the phase control. The delay is expressed in degrees and is known as the firing angle. Figure 4-1 shows firing angles of 60° and 120°.

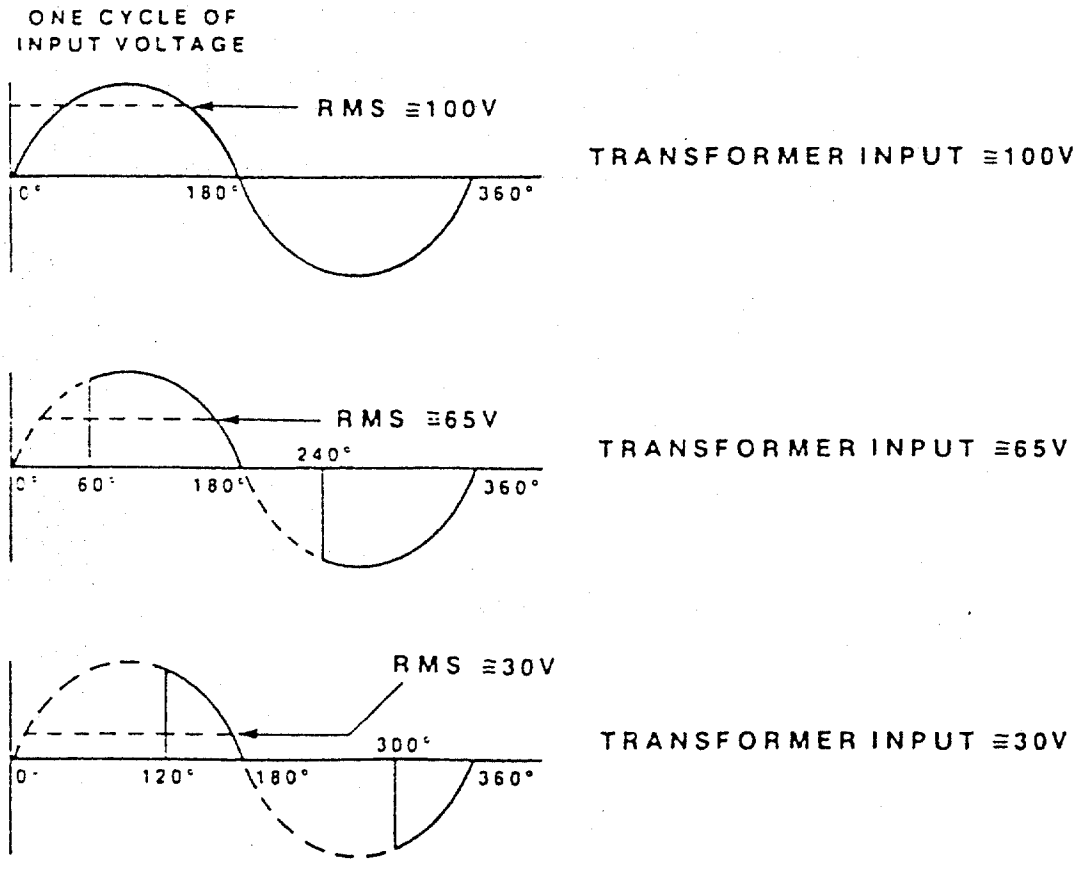


Figure 4-1 Phase Control Firing Angles

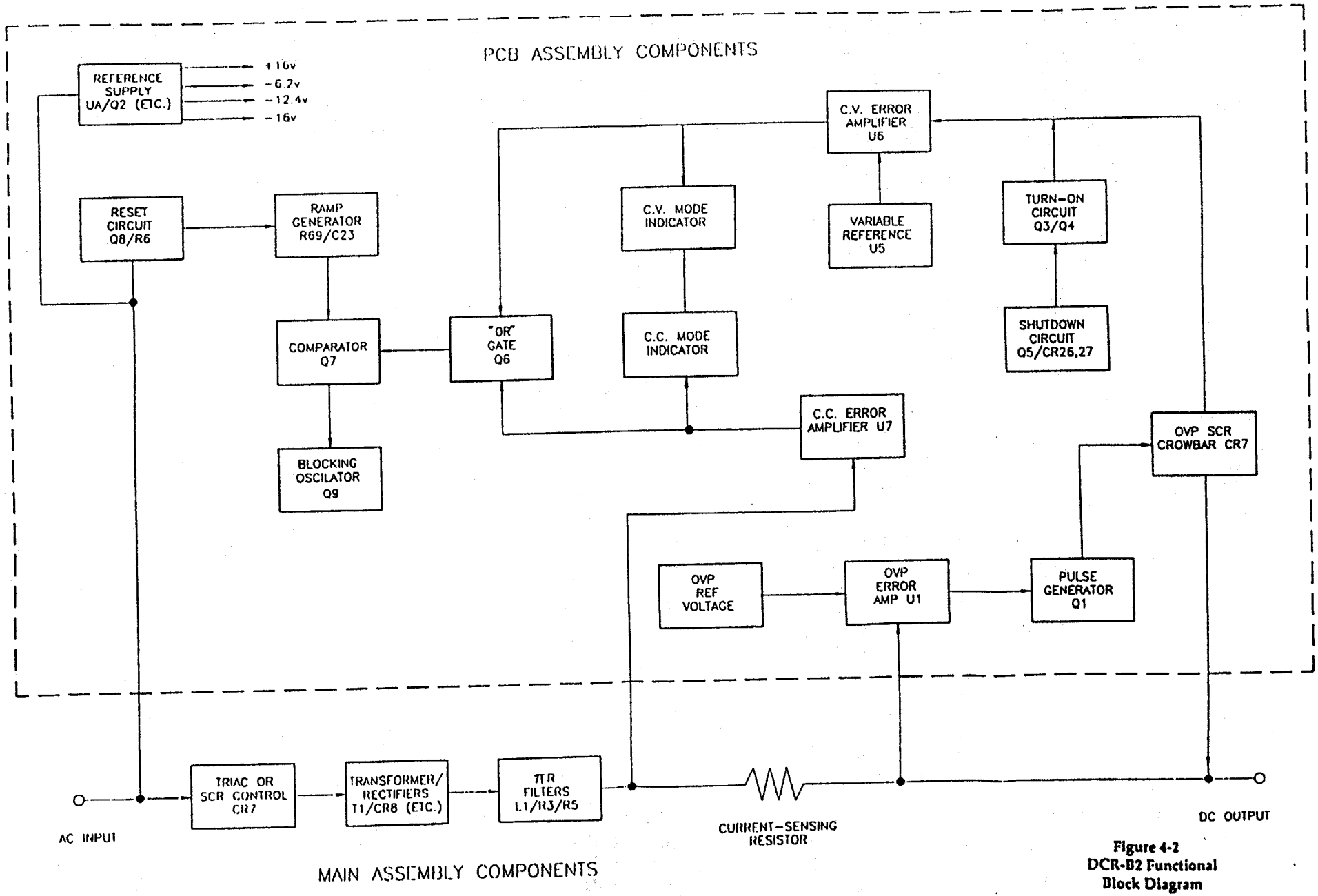


Figure 4-2
DCR-B2 Functional Block Diagram

4.3 BLOCK DIAGRAM ANALYSIS (Figure 4-2)

The ac input voltage is first applied to CR7 (Triac), which is in series with power transformer T1. CR7 functions with the control circuits to form a feedback loop which prevents a change in output voltage when either the line or load changes.

To accomplish this, the control circuits issue a phase adjusted firing pulse to CR7 once during each half cycle of the input ac voltage. These circuits continuously sample the output voltage, which establishes the precise time at which the firing pulse is to be generated. The phase controlled ac voltage is stepped up or down by power transformer T1, and coupled through a full-wave rectifier and filtering circuits to the output terminals.

Feedback signals from the output back to CR7 originate in the constant voltage/current error amplifiers U6/U7. In the constant voltage mode, U6 continuously compares the supply output with a reference voltage generated by a variable reference programming circuit, (U5). A difference in these voltages appears as an error signal, which is delivered to amplifier U6. This dc error signal is applied to Q6 (comparator input #1). A sawtooth ramp voltage, generated by Q8, R69 and C23, is applied to Q7 (comparator input #2). The comparator output (across R62) sets the conduction angle of blocking oscillator Q9. The duration of Q9 conduction is directly proportional to the error signal, and its output triggers D31 into conduction. D31 acts as a switch, whose firing angle is dependent on the magnitude of dc error signal, thus controlling the overall supply output.

Similarly, in the constant current mode, changes in line or load are sensed by R12, in series with the output. It is then amplified by U7, and applied to Q6 comparator input. Output control from this point is essentially the same as in the constant voltage analysis, above.

4.4 DETAILED CIRCUIT DESCRIPTION

NOTE

All component designators are referenced to PCB schematic diagram page 6-15 unless otherwise noted.

4.4.1 Reference and Bias Supplies

The precisely regulated voltage required for operation of the control circuitry is produced by a reference supply consisting of zener diodes D9/D10, operational amplifier U4, passing stage Q2, transformer T2 and center-tapped full wave rectifier D35/D36/D37/D38. (See main schematic).

The reference supply output appears across a comparison bridge composed of divider R31/ R32, zener D16, and R77. Error signals are sensed across this bridge and amplified by U4. The variable impedance characteristic of passing stage Q2 changes the level of absorbed voltage across the stage, maintaining the output at a precisely controlled negative 12.4 volts (Figure 4-3).

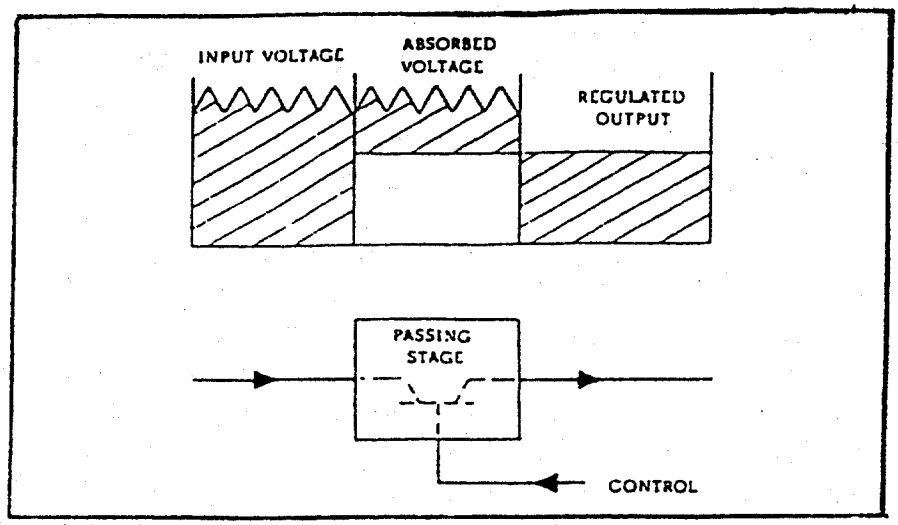


Figure 4-3 Passing Stage Principle

To illustrate circuit operation, assume an increase in the TB2 (page 6-4) supply output. Pin 2 of U4 will become more negative, and the output at pin 6 more positive, tending to turn Q2 off. The reduction in drive current increases the impedance of Q2, and consequently its absorbed voltage, resulting in precise regulation of reference supply output.

Several other bias supplies are used to power the control circuitry:

1. +20 volts from D7. Note that there is no filtering on this 20 volt output. This signal is used as a time reference to the ac line. The +20 volt source is then gated through D21, and filtered by C18 to provide the +20 Vdc primary operating power for the control PCB.

2. The 16 volts across C18 is fed to R47 and D8, to generate and precisely regulate the +11.7V for the current amplifier reference voltage.

3. +30 Vdc unregulated (D9 and D10 on the overall schematic) is used to operate the current/voltage mode lamps.

4.4.2 Voltage Mode Section

Primary components of this circuit include constant voltage error amplifier U6, variable reference voltage programmer U5, and emitter-follower stage Q6. The circuit functions as follows:

Pin 3 of U5 is connected to plus sense. Front panel voltage controls R10/R11 function as variable feedback resistances from U5 pin 6 to pin 2. The negative 12.4 volt reference through R39/38/37 establishes the desired programming current range, so that 0 to 10 volt signal is obtained at pin 6 of U5.

The main error amplifier is U6. Pin 4 of U6 is at virtual dc ground since pin 5 is at ground (+sense). Thus, the current through R74 can be varied from 0 to 1 milliampere. This current, through R79, programs the supply to the desired output. U6 pin 5 senses this output, and compares it to the voltage developed at U6 pin 4. The resultant is an error signal, amplified by U6, and coupled to R61 through the emitter of Q6.

An illustration of voltage mode operation: An increase in system output drives U6 pin 4 more negative. U6 pin 11, and thus the Q6 emitter also become more negative, creating the error voltage necessary to retard the firing angle of D31 through T1/Q9 action as noted in the block diagram analysis.

C15/R44 establishes ac loop stability, aided by C16/R46.

4.4.3 Current Mode Section

The primary component in this section is constant current amplifier U7. The 11.7V reference voltage is divided down by bridge dividers R20/R21 and R24/R19 to U7 pins 5 and 4 respectively. The resultant voltages are referenced to the positive output, through a current sensing resistor (R21), with R13/R14 serving as the front panel current adjust potentiometers.

R46/C17 establishes ac loop stability. C11/R36 (variable) is a secondary stability network used for inductive load compensation.

R22/C7 acts to prevent rapid changes in the phase delay angle, caused by large transients. This protects the power components from overstress.

Trimmer R17 is used to adjust zero output current (compensating for current tolerances and offset voltage of U7).

Trimmer R18 is used to adjust for maximum current setting (compensating for tolerances in panel pot R13 and current shunt R12).

An illustration of current mode operation: If the output current approaches the current limit setting, the voltage across the sensing resistor becomes larger. This is seen as a positive error voltage at U7 pin 5, which is amplified and applied to the U7 output, pin 10. The output of U7, pin 10 (emitter) is passed through D20 to the base of the output stage of U7 at pin 13. The injected current causes the collector of U7, pin 11 to fall, reducing output. (See Voltage Mode section, para. 4.4.2, for additional details).

4.4.4 Ramp Generator, Reset Circuit and Comparator

The ramp generator consists of R69 and C23. The ramp voltage at the junction of R69/ C23 is coupled through D30 to the base of Q7. This voltage starts at a maximum level, and decreases exponentially until reset by Q8 at 8.3 millisecond intervals (each 1/2 cycle of line voltage). The reset pulse for Q8 is generated through D7/R48 as follows:

The reset circuit consists of Q8 and R68. The full wave rectified ac input from T2 is impressed across D7/R48. D7 clamps the base of Q8 at its zener level, keeping it shut off (D21 is forward biased). As the impressed voltage drops toward zero, the zener voltage follows. D21 becomes reverse biased. Q8 then turns on from base bias through R68, discharging C23 when the line voltage crosses zero.

The comparator consists of Q7/Q6, D30, R61, and R62. Comparator Q7/Q6 compares the dc signal from either the voltage or current mode amplifier (applied to Q6) with the ramp generator voltage. The varying output of Q7 (across R62) establishes the conduction angle of blocking oscillator Q9.

4.4.5 Blocking Oscillator Circuit

Q9 functions as a switch, providing the triggering voltage for D31 and D32 proportional to the error signal received from the comparator circuit. The blocking oscillator circuit functions as follows: Assume that at a given time the Q7 dc emitter voltage is several volts below the reference level provided by the reference supply circuit (paragraph 4.4.1). At a point when the ramp voltage, appearing at the base of Q7, is more negative than that on its emitter, Q7 conducts. This drives the base of Q9 positive, causing Q9 to conduct. As its collector current (Ic) increases, regenerative action occurs through pulse transformer T2, forcing Q9 into saturation. (Ic) continues to increase until T2 core saturates. Then T1 voltage decreases, removing Q9 base current. At this point Q9 comes out of saturation. The cycle is then repeated. The output of the pulse generator is a series of narrow pulses, continuing until the end of the line half-cycle.

4.4.6 Turn-On and Shut-Down Circuits

Primary components of the turn-on circuit are Q3, Q4, R56, R55, D28 and C22. Circuit operation is as follows: When power is initially applied to the unit, the bases of Q3/Q4 are driven positive, due to C22 coupling the rising voltage of Vcc. Q3 and Q4 are thus in saturation. The resultant negative voltage at the Q3/Q4 collector maintains voltage error amplifier U9 and the blocking oscillator/mixer circuits at cut off.

This action inhibits the output of the power supply from coming up. As C22 charges, the supply output will increase exponentially. Q3/Q4 gradually come out of saturation until the voltage across C22 reaches the point where they are shut off. The supply is then functioning in its normal manner.

The shut-down circuit, consisting of Q5, R58, R59, and D26/D27, cuts off the unit output when the cathode of either diode is connected to the plus sense connection. The circuit function is to actuate Q5, which turns Q3 and Q4 on. When the connection is removed, the power supply returns to normal, with the slow start described above.

D27 (TB3 pin 11) is available for customer use to shut down the dc output. Terminal 11 can be connected to +sense (TB3 Pin 1) by either an isolated relay contact or an open collector logic signal (sinking approximately 0.2mA).

D26 is used internally to shut down the DCR-B2 output when the OVP is tripped. Refer to Figures 6-1 and 6-2.

4.4.7 Power Section

The input ac voltage is applied to the primary of power transformer T1 through an SCR, (CR7). The output is rectified by a full wave bridge, and filtered by a Pi network with a damping resistor (R3). The filtered dc is then applied to the output terminals.

4.4.8 Overvoltage Protector

The OVP consists of a fast-response silicon-controlled rectifier crowbar (CR8). A reference voltage (+12V) is generated by zener D1 and R3. This reference voltage is compared to the output voltage in a bridge circuit, by the ratio of R6 to R16 plus R18 (adjust pot). The bridge output is applied to U1, pins 3 and 4. Assume that the resistor ratio is set (by adjust pot R3) to produce a balanced bridge at a specified output voltage. If the output voltage exceeds this preset value, U41, pin 3 will be driven positive relative to pin 4. The result is a positive output at pin 9 to turn on Q1. Q1 applies the +30V unregulated voltage (at P1-1) to the primary of T1. The induced current in the secondary of T1 provides a trigger for the SCR crowbar. D13 activates the SCR, causing a crowbar function across the power supply output terminals. D12 then conducts, shutting down the pulse generator (via J4-4 on the Control PCB).

The SCR recovers as soon as the output voltage is dropped, and removes the crowbar current. R8 supplies holding current to D13 to hold the crowbar on.

To reset the OVP, power must be removed from the power supply input. After a moment to reset, lower the output voltage control, and re-apply power to the input.

4.4.9 Indicator Lamps

DS2, which indicates Constant Voltage mode, is wired across P1-9 and P1-19 as shown on the Control PCB schematic, page 6-15. DS3, which indicates Constant Current mode, is wired across P1-9 and P1-19.

U8 is an operational amplifier used to drive DS2 and DS3. The lamps and IC4 are powered from the +30V supply.

The input signal to U8 determines which lamp lights, as follows:

A. Constant Current Mode (Current Limit) DS3

The input terminals of U8 are pins 2 and 3. Pin 2 is driven positive relative to pin 3 when the current amplifier (U7) output (pin 10) is in control (i.e., during current mode operation). Pin 2 positive signal will drive U8 output (pin 6) low (towards the +30V return). Pin 6 acts to reduce the voltage on DS2 and increases the voltage on DS3. DS3 is turned on brightly and DS2 is turned off.

B. Constant Voltage Mode (DS2)

During Voltage Mode operation, U8 pin 2 polarity reverses due to loss of U7 pin 10 voltage, so that U8 pin 6 output is driven high (towards +30V). This turns on DS2 and turns off DS3.

4.4.10 Changeable Current Programming Parameters

0-400 mV Operation:

Dual range current mode signal programming is controlled by SW1, U3, U2 and associated parts. The signal programming voltage is applied between TB3-8(+) and TB3-9(-) with the jumper between TB3-7 and TB3-8 removed. For 0-400mV signal control voltage, SW1 is closed. This directly connects TB3-8 to R17 as in the standard DCR-B2 current mode signal programming. SW2 and SW3 are open.

0-10V Operation:

For 0-10V signal control voltage, SW1 is open; SW2 and SW3 are closed. Thus, the input voltage goes to pin U3B-5 via R12 and R11. D3 and R12 limit the input voltage to 15V maximum. R11, R9, R10 and U3A (pins 1,2,&3) comprise an inverting amplifier with a gain of 20-25. The gain inverting amplifier is set so that the output at TP4 is equal to .4V with Vin=10V (approx. 24). As input voltage goes from 0-10V, the output voltage goes from 0-400mV.

U2 and associated parts allow the front panel control pots to output a variable voltage even when they are disconnected from the control circuitry, ie, TB3-8.

SECTION 5
MAINTENANCE

5.1 GENERAL

This section provides troubleshooting data, periodic servicing, calibration, performance and hi-pot testing procedures. The troubleshooting data should be used in conjunction with the schematic diagrams and Section 4 which outlines the principles of operation. Any questions pertaining to repair should be directed to the nearest Sorensen representative or to the factory. Include the model and serial numbers in any correspondence. Should it be necessary to return a unit to the factory for repair, prior authorization from Sorensen Company must be obtained.

5.2 PERIODIC SERVICING

Whenever a unit is removed from service, it should be cleaned, using naphtha or an equivalent solvent on painted surfaces, and a weak solution of soap and warm water for the front panel. Compressed air may be used to blow dust from in and around components.

5.3 TROUBLESHOOTING

Table 5-1 provides a list of malfunction symptoms along with a tabulation of the possible cause(s) for each symptom. Note that the failure of a single component may result in a chain reaction effect. As additional aids to troubleshooting, voltage checkpoints have been designated on the printed circuit schematic diagram.

5.4 CALIBRATION

Following repair, the unit should be recalibrated to insure that replacement components have not altered performance. Refer to Table 5-3 for unit calibration specifications. The following is the calibration procedure to ensure that full rated voltage output is available:

1. Make sure input power has been removed from unit and circuit breaker set to "OFF" position.

2. Set SW1 on PCB to "ON", "OFF", "OFF".

3. Adjust COURSE VOLTAGE knob to midpoint and COURSE CURRENT fully clockwise.

4. Set power to unit and turn circuit breaker "ON".

5. Check to see if output is approximately 1/2 rated voltage.

6. Adjust COURSE VOLTAGE fully clockwise. With maximum voltage pot (R37 on PCB) adjust output voltage to 105% of rated.

7. Set output to rated voltage with four significant digits.

8. Set both COURSE and FINE CURRENT knobs fully counter clockwise.

9. Verify unit has gone from voltage mode to current mode by noting a significant drop in output voltage, by illumination of DS3.

10. Set FINE CURRENT adjustment to midpoint and apply short circuit.

11. Using minimum current Adj. (R17 on PCB) adjust output current to exactly 0 amps.

12. Adjust FINE CURRENT fully clockwise; slowly adjust COURSE CURRENT fully clockwise.

13. Using maximum current Adj. (R18 on PCB) adjust output current to 115% of rated.

14. Turn circuit breaker "OFF".

15. Set SW1 to "OFF", "ON", "ON".

16. Turn COURSE CURRENT knob counter clockwise fully.

17. Turn circuit breaker "ON".

18. Slowly Adj. COURSE CURRENT knob fully clockwise.

19. With short circuit still applied, set current using 10V gain Adj. (R75 on PCB) to 115% of rated current.

20. Remove short circuit.

21. Turn unit "OFF". Reset SW1 to "ON", "OFF", "OFF".

22. Turn unit back "ON".

23 Apply rated load with rated voltage out.

24. With voltmeter (positive lead on inside of R21 and negative lead on cathode of D34) use R7 on front panel to set 400 MV, ±1%. Reset current meter with R6.

25. Apply pot lock to all pots, also R6 & R7.

26. Calibration complete.

Table 5-1 DCR-B2 Troubleshooting

1	No output (voltage mode)	a) Wrong input voltage b) Open fuses and circuit breaker* c) Reference voltages (check levels) d) Defective U6 or U5 e) Collector to emitter short on Q8, Q6, Q3, Q5 or Q4 f) Q9 open or shorted
2	Fuse opens or circuit breaker trips	a) CR7 shorted* b) Input capacitors shorted* c) D32, D33 shorted or open*
3	High output voltage (meter pointer pegs)	a) Sensing or programming leads or link open* b) Defective U6 or U5 c) Q7 shorted collector to emitter d) Q6 open collector to emitter e) CR7 shorted*
4	No output (current mode), or unit will not current limit	a) Defective U7 b) C7 shorted c) D20 open d) Shorted COARSE CURRENT potentiometer* e) Collector to emitter short on Q8, Q6, Q3, Q5 or Q4 f) Q9 open or shorted
5	Output oscillates (current mode)	a) Potentiometer R36 on unit PCB improperly adjusted

*Chassis components (ref. page 6-6)

5.5 PERFORMANCE TESTING

Sensitive instruments like the DCR-B2 require rigorous testing methods if a true performance evaluation is to be made. Wherever possible, twisted leads should be used with test equipment to reduce stray pickup. At the power supply terminal board, these leads must be firmly held by the terminal screws. Alligator clips and similar types of connectors are not suitable. Grounding techniques in which more than one device in the setup is grounded may introduce extraneous ripple that, although unrelated to the power output ripple, is displayed on the test oscilloscope.

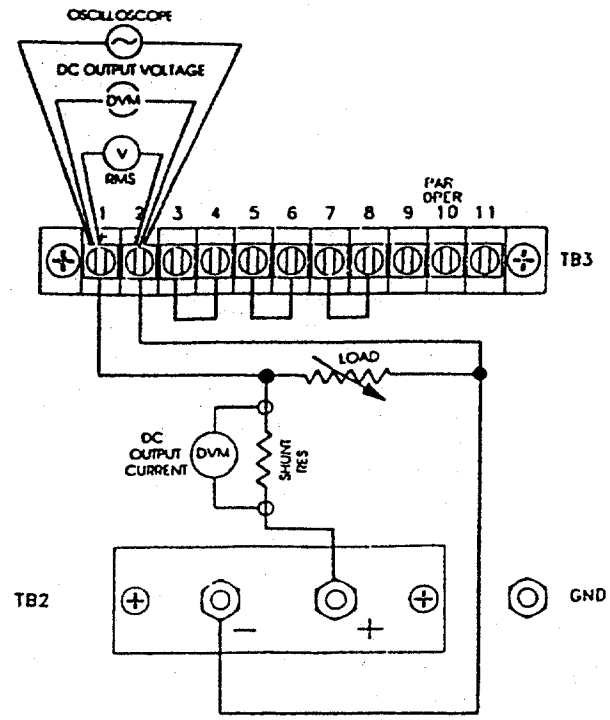


FIGURE 5-1 Performance Test Setup

5.5.1 Voltage Mode Regulation and Ripple

To check voltage mode regulation and ripple, proceed as follows:

1. Connect a sensitive digital voltmeter and an RMS ac voltmeter across unit output terminals per Figure 5-1. Select a current shunt per Table 5-2 with a DVM for current output readings.

   Use an autotransformer for AC line input with a current rating that exceeds the maximum unit input current called out in the unit specifications.

NOTE

Input devices such as autotransformers or line regulators can distort the input wave sufficiently to adversely affect performance measurements.

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2. Apply high ac line input per specifications and remove load. Set the POWER switch to ON.

3. Rotate COARSE CURRENT control fully clockwise.

4. Use COARSE and FINE VOLTAGE controls to obtain rated output voltage. Note DVM reading after a few minutes of warm up time.

5. Decrease ac input voltage to low line specification. Output voltage change should not exceed limits specified in Table 5-3.

6. Close load switch and adjust load for rated current. Using high ac line specification and full load, verify ripple meets specification.

5.5.2 Current Mode Regulation

To check current mode regulation, proceed as follows:

1. At no load, adjust output to maximum rated voltage, and set COARSE CURRENT control fully clockwise.

2. Connect a sense resistor (Table 5-2) or a precision meter shunt in series with a variable load across the output terminals.

3. Connect input power at low line per unit specifications. Apply load until rated current of supply is reached. (Unit has voltage mode indicated.) Adjust COARSE CURRENT control until CURRENT mode indicator is lit and output voltage drops at least 5% of full scale value.

4. Connect a digital voltmeter across the sensing resistor, and note the indication.

5. Increase input voltage until voltage is at high line, and reduce the load resistance to zero (short). Note indication on the DVM. Change in voltmeter reading (expressed in millivolts) should be divided by sense resistor value to obtain regulation in milliamperes. Limits are provided in Table 5-3.

5.5.3 Transient Response

Test for transient response as follows:

1. Connect an oscilloscope across the unit output terminals.

2. Set unit POWER switch to ON. Adjust COARSE VOLTAGE control for rated output, and COARSE CURRENT control fully clockwise.

3. Apply half load, and then abruptly apply full load (or switch from full load to half load). Return to steady state operation should occur within 50 milliseconds (typical). See Table 5-3 for typical transient deviation voltage values.

NOTE

Load switching time should be less than 3 milliseconds.

Table 5-2
Sensing Resistor Values (Current Mode Regulation Check)

DCR MODEL	SENSE RESISTOR (Ohms)
10-120B2	0.01, 50W
20-80B2	0.01, 50W
40-40B2	0.01, 50W
60-30B2	0.1, 25W
150-12B2	0.1, 25W
300-6B2	1.0, 10W
600-3B2	1.0, 10W

Table 5-3
Unit Calibration Specifications

DCR Model	Regulation Voltage Mode (mV)	Regulation Current Mode (mA)	Ripple Volt Mode (mV)	Transient Deviation (Volts)	Maximum Compliance (Vdc)	Cur. Mode Upper Lim. Set Pt. (A)
10-120B2	3	300	65	0.6	10	46
20-80B2	6	200	65	1.2	20	28.75
40-40B2	12	100	90	2.4	40	14.95
60-30B2	18	75	125	3.6	60	10.35
150-12B2	45	32	300	9.0	150	3.45
300-6B2	90	16	700	18	300	1.725
600-3B2	180	8	1200	36	600	0.8625

5.6 HI-POT TEST PROCEDURE

High potential test procedures have been carefully carried out at the factory. These units are 100% tested and should not require further testing in the field.

CAUTION

High potential test can overstress or destroy the power semiconductors in this power supply if improperly applied.

Isolation measurements may be made using a standard VOM (Simpson 260 or equivalent) on the highest resistance scale available.

If it is essential to use the high potential test method, please contact the factory for information on special precautions that should be taken.

CAUTION

Sorensen cannot be held liable for any malfunctions resulting from the application of a high potential test (greater than 100V). See standard Sorensen warranty.

SECTION 6
DRAWINGS AND PARTS LISTS

6.1 GENERAL

This manual contains schematic diagrams, PCB parts location drawings, and replaceable parts lists. The parts lists are keyed to the applicable schematic diagrams.

6.2 TABLE HEADINGS DEFINED

6.2.1 Circuit Symbol

This is an alpha-numeric identification of the component as called out on the unit drawings.

6.2.2 Sorensen Part Number

This number should be used when ordering parts directly from:

SORENSEN
Sales & Technical Support
9250 Brown Deer Road
San Diego, CA 92121-2294
1-800-525-2024
Tel: (858) 450-0085
Fax: (858) 458-0267
E-mail: sales @ sorensen.com
www.sorensen.com

Replacement Parts List

Circuit Symbol	DCRB2 1800 WATT MODEL							Description	Sorensen Part No.
	40-40			60-30					
	20-80				150-12				
	10-120					300-6			
							600-3		
								Miscellaneous Cont'd	
	X	X	X	X	X	X	X	Top Cover	1063955-70
	X	X	X	X	X	X	X	Cover Term Board	140-853
	X	X	X	X	X	X	X	Handles (2 Req'd)	30-786
	X							Control PCB Assembly	1063005-2
		X						Control PCB Assembly	1063005-3
			X					Control PCB Assembly	1063005-4
				X				Control PCB Assembly	1063005-11
					X			Control PCB Assembly	1063005-7
						X		Control PCB Assembly	1063005-28
							X	Control PCB Assembly	1063005-9
	X	X	X	X	X	X	X	Thermostat	861-671-00

Replacement Parts List
(Control Printed Circuit Board)

Circuit Symbol	DCRB2 1800 WATT MODEL							Description	Sorensen Part No.
	40-40			60-30					
	20-80			150-12					
	10-120			300-6					
				600-3					
								Resistors Cont'd (ohms, 1/4W, unless noted)	
R73	X	X	X	X	X	X	X	2.74K, Mfilm	586055-95
R74	X	X	X	X	X	X	X	4.99K, Mfilm	586055-187
R75	X	X	X	X	X	X	X	Pot, 500, 1/2W, Cermet	1058959-6
R76	X	X	X	X	X	X	X	390, 3W, WWD	167401-103
R77	X	X	X	X	X	X	X	649, Mfilm	586055-65
R78	X	X	X	X	X	X	X	100, 1/2W, Mfilm	1063040-74
R79	X	X	X	X	X	X	X	4.99K, Mfilm	586055-187
								Transformer	
T1	X	X	X	X	X	X	X	Trans, Pulse, 115, DC	589333-1
T2	X	X	X	X	X	X	X	Trans, Pulse, XXX, DC	586897-1
								Miscellaneous	
SW1	X	X	X	X	X	X	X	Switch Dip 3 PST	1060392-3
F1	X	X	X	X	X	X	X	Fuse SB, Small Miniature Pigtail, .5A, 250V	1063539-3

Replacement Parts List
(Control Printed Circuit Board)

Circuit Symbol	DCRB2 1800 WATT MODEL 10-120	20-80	40-40	60-30	150-12	300-6	600-3	Description	Sorensen Part No.
								Resistors Cont'd (ohms, 1/4W, unless noted)	
R6	X							9.09K, Mfilm	586055-120
		X	X					11.5K, Mfilm	586055-125
				X		X	X	6.81K, Mfilm	586055-114
					X			5.62K, Mfilm	586055-110
R7	X	X	X	X	X	X	X	30.1K, Mfilm	586055-145
R8	X	X	X	X	X	X	X	1.21K, Mfilm	586055-78
R9, R10, R11	X	X	X	X	X	X	X	100K, Mfilm	586055-170
R12	X	X	X	X	X	X	X	100K, Mfilm	586055-74
R13	X	X	X	X	X	X	X	1.21K, Mfilm	586055-78
R14	X	X	X	X	X	X	X	3.65K, Mfilm	586055-101
R15	X	X	X	X	X	X	X	243, Mfilm	586055-200
R16	X	X	X	X	X	X	X	2.2K, 3W, WWD	167401-6
R17	X	X	X	X	X	X	X	200K, 1/2W, V	1058959-5
R18	X	X	X	X	X	X	X	5K, 1/2W, V	1058959-9
R19	X	X	X	X	X	X	X	2.05, Mfilm	586055-89
R20	X	X	X	X	X	X	X	9.09, Mfilm	586055-120
R21	X	X	X	X	X	X	X	2.15K, Mfilm	586055-90
R22	X	X	X	X	X	X	X	100, Mfilm	586055-170
R23	X	X	X	X	X	X	X	487, Mfilm	586055-59
R24	X	X	X	X	X	X	X	9.09K, Mfilm	586055-120
R25	X	X	X	X	X	X	X	100K, Mfilm	586055-74
R26-R27	X	X	X	X	X	X	X	3.32K, Mfilm	586055-99
R28	X	X	X	X	X	X	X	100K, Mfilm	586055-74
R29-R30	X	X	X	X	X	X	X	6.65K, Mfilm	586055-188
R31	X	X	X	X	X	X	X	3.92K, Mfilm	586055-202
R32	X	X	X	X	X	X	X	12.1K, Mfilm	586055-126
R33	X	X	X	X	X	X	X	330, 3W, WWD	167401-101
R34	X	X	X	X	X	X	X	39.2K, Mfilm	586055-203
R35	X	X	X	X	X	X	X	4.70K, Mfilm	586055-207
R36-R37	X	X	X	X	X	X	X	10K, 1/2W, Cermet	1058959-10
R38	X	X	X	X	X	X	X	53.6K, Mfilm	586055-157
R39	X	X	X	X	X	X	X	8.66K, Mfilm	586055-119
R40	X	X	X	X	X	X	X	1.21K, Mfilm	586055-78
R41	X	X	X	X	X	X	X	1.82K, Mfilm	586055-205

Replacement Parts List
(Control Printed Circuit Board)

Circuit Symbol	DCRB2 1800 WATT MODEL 10-120	20-80	40-40	60-30	150-12	300-6	600-3	Description	Sorensen Part No.
								Resistors Cont'd (ohms, 1/4W, unless noted)	
R42	X							10K, Mfilm	586055-122
		X						20K, Mfilm	586055-194
			X					40.2K, Mfilm	586055-151
				X				59K, Mfilm	586055-159
					X			150K, Mfilm	586055-236
						X		301K, Mfilm, 1/2W	1063040-215
							X	604K, Mfilm, 1W	1063041-250
R43								Not Used	
R44	X	X		X				681, Mfilm	586055-66
			X		X		X	1.82K, Mfilm	586055-205
						X		3.01K, Mfilm	586055-97
R45	X	X	X	X	X	X	X	1.82K, Mfilm	586055-205
R46	X	X	X	X	X	X	X	47.5, Mfilm	586055-209
R47	X	X	X	X	X	X	X	150, Mfilm	586055-210
R48	X	X	X	X	X	X	X	1.50K, 10W, WWD	167403-41
R49	X	X	X	X	X	X	X	1.21K, Mfilm	586055-78
R50	X	X	X	X	X	X	X	182, Mfilm	586055-206
R51-R52	X	X	X	X	X	X	X	332, Mfilm	586055-211
R53	X	X	X	X	X	X	X	620, 3W, WWD	167401-108
R54	X	X	X	X	X	X	X	4.70K, Mfilm	586055-207
R55	X	X	X	X	X	X	X	274K, Mfilm	586055-192
R56	X	X	X	X	X	X	X	4.70K, Mfilm	586055-207
R57	X	X	X	X	X	X	X	47.5, Mfilm	586055-209
R58	X	X	X	X	X	X	X	100, Mfilm	586055-170
R59	X	X	X	X	X	X	X	10K, Mfilm	586055-122
R60	X	X	X	X	X	X	X	681, Mfilm	586055-66
R61	X	X	X	X	X	X	X	3.32K, Mfilm	586055-99
R62	X	X	X	X	X	X	X	5.62K, Mfilm	586055-110
R63	X	X	X	X	X	X	X	39.2K, Mfilm	586055-203
R64	X	X	X	X	X	X	X	12.1K, Mfilm	586055-126
R65	X	X	X	X	X	X	X	332, Mfilm	586055-51
R66	X	X	X	X	X	X	X	10, 1/2W, Mfilm	1063040-226
R67	X	X	X	X	X	X	X	22.1, 1/2W, Mfilm	1063040-229
R68	X	X	X	X	X	X	X	39.2K, Mfilm	586055-203
R69	X	X	X	X	X	X	X	22.1K, Mfilm	586055-204
R70-R71	X	X	X	X	X	X	X	47.5, Mfilm	1063040-243
R72	X	X	X	X	X	X	X	332, Mfilm	586055-51

Replacement Parts List
(Control Printed Circuit Board)

Circuit Symbol	DCRB2 1800 WATT MODEL 40-40 20-80	10-120	60-30 150-12	300-6	600-3	Description	Sorensen Part No.
						Assy. Control PCB	
		X				10V	1063005-2
			X			20V	1063005-3
				X		40V	1063005-4
					X	60V	1063005-11
				X		150V	1063005-7
					X	300V	1063005-28
						600V	1063005-9
						Capacitors (μF, unless noted)	
C1	X	X	X	X	X	FI, .47, 100V	24-2015-30
C2	X	X	X	X	X	AL, .1, 250V	1063059-1
C3	X	X	X	X	X	AL, 150, 50V	1063060-1
C4	X	X	X	X	X	CE, .1, 50V	980707-3
C5	X	X	X	X	X	FI, .01, 400V	587626-89
C6	X	X	X	X	X	TA, 1, 35V	235-7395P76
C7	X	X	X	X	X	TA, 3.3, 35V	586058-13
C8	X	X	X	X	X	TA, 6.8, 25V	235-7395P64
C9	X	X	X	X	X	FI, .01, 630V	24-2015-1
C10	X	X	X	X	X	FI, 47, 50V	1064980-1
C11	X	X	X	X	X	TA, 6.8, 35V	586058-17
C12	X	X	X	X	X	TA, 22, 25V	235-7395P67
C13	X	X	X	X	X	FI, .1, 100V	24-2037-7
C14	X	X	X	X	X	TA, 1.0, 25V	235-7395P61
C15	X	X		X		TA, 33, 20V	235-7395P55
			X		X	TA, 15, 20V	586385-5
C16	X	X	X	X	X	TA, 15, 20V	586385-5
C17	X	X	X	X	X	CE, 1, 50V	1033981-47
C18	X	X	X	X	X	AL, 220, 25V	1064980-2
C19	X	X	X	X	X	FI, 47, 50V	1064980-1
C20	X	X	X	X	X	FI, .068, 250V	24-2015-11
C21	X	X	X	X	X	TA, 47, 20V	235-7395P56
C22	X	X	X	X	X	MY, 4.7, 100V	235-7440P3
C23	X	X	X	X	X	FI, .47, 100V	24-2037-15
C24	X	X	X	X	X	FI, 0.15, 400V	24-2015-3
C25	X	X	X	X	X	FI, .01, 400V	587626-89
C26	X	X	X	X	X	FI, .0033, 200V	24-2409-4
C27	X	X	X	X	X	TA, 22M, 25V	235-7395P67

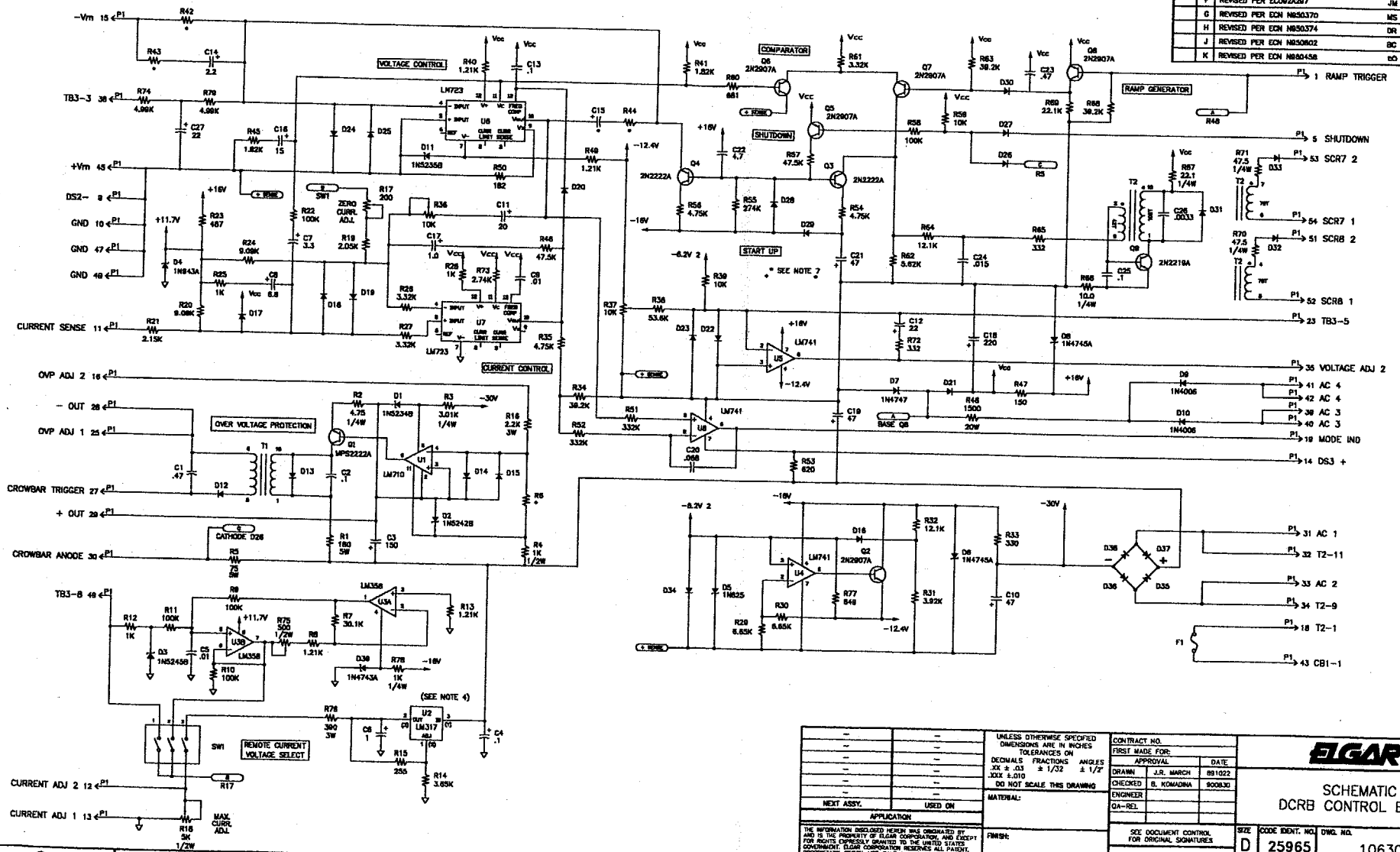
Replacement Parts List
(Control Printed Circuit Board)

Circuit Symbol	DCRB2 1800 WATT MODEL 40-40 20-80	10-120	60-30 150-12	300-6	600-3	Description	Sorensen Part No.
						Diodes	
D1	X	X	X	X	X	1N5234B, Zener	588101-9
D2	X	X	X	X	X	1N5242B	588101-15
D3	X	X	X	X	X	1N5245B, Zener	588101-17
D4	X	X	X	X	X	1N943A	588105-7
D5	X	X	X	X	X	1N825	588105-3
D6	X	X	X	X	X	1N4745A	588102-12
D7	X	X	X	X	X	1N4747A	588102-13
D8	X	X	X	X	X	1N4745A	588102-12
D9-D10	X	X	X	X	X	Rect, PWR, 1A, 600V	322-7236P6
D11	X	X	X	X	X	1N5235B	588101-10
D12-D38	X	X	X	X	X	Rect, PWR, 1A, 200V	322-7236P6
D39	X	X	X	X	X	1N4743A, 1W, Zener	588102-10
						Integrated Circuits (Linear)	
U1	X	X	X	X	X	LM710CM	386-7277P4
U2	X	X	X	X	X	LM317T	984405-1
U3	X	X	X	X	X	LM358 OP-AMP	1058985-1
U4-U5	X	X	X	X	X	741 OP-AMP	586372-3
U6-U7	X	X	X	X	X	723 V. REG.	586062-1
U8	X	X	X	X	X	741 OP-AMP	586372-3
						Transistors	
Q1	X	X	X	X	X	MPS2222A TO-9	1064104-2
Q2	X	X	X	X	X	2N2907A TO-9	11Q0001-000
Q3-Q4	X	X	X	X	X	MPS2222A	1064104-2
Q5-Q8	X	X	X	X	X	2N2907R	11Q0001-000
Q9	X	X	X	X	X	2N2219A	386-7249P32
						Resistors (ohms, 1/4W, unless noted)	
R1	X	X	X	X	X	180, 5W, WWD	586054-40
R2	X	X	X	X	X	4.75, 1/2W, Mfilm	1063040-221
R3	X	X	X	X	X	301, 1/2W, Mfilm	1063040-97
R4	X	X	X	X	X	1K, 1W, Mfilm	1063041-74
R5	X	X	X	X	X	75, 5W, WWD	586054-80

NOTES: UNLESS OTHERWISE SPECIFIED.

1. ALL CAPACITORS IN MFD'S UNLESS OTHERWISE SPECIFIED.
2. ALL RESISTORS IN OHMS AND 1/4W ±1% UNLESS OTHERWISE SPECIFIED.
3. * THESE COMPONENTS ARE ADDED BY SORENSEN, DEPENDING ON MODEL.
4. NUMBERS IN PARENTHESES ARE FOR THE LM317H, NUMBERS NOT IN PARENTHESES ARE FOR THE LM317T.
5. NEXT AVAILABLE DESIGNATORS ARE: R80,C28,D40,Q10,U9,T3,SW2,TB4,F2
6. DESIGNATORS NOT USED ARE: TB1,TB2.

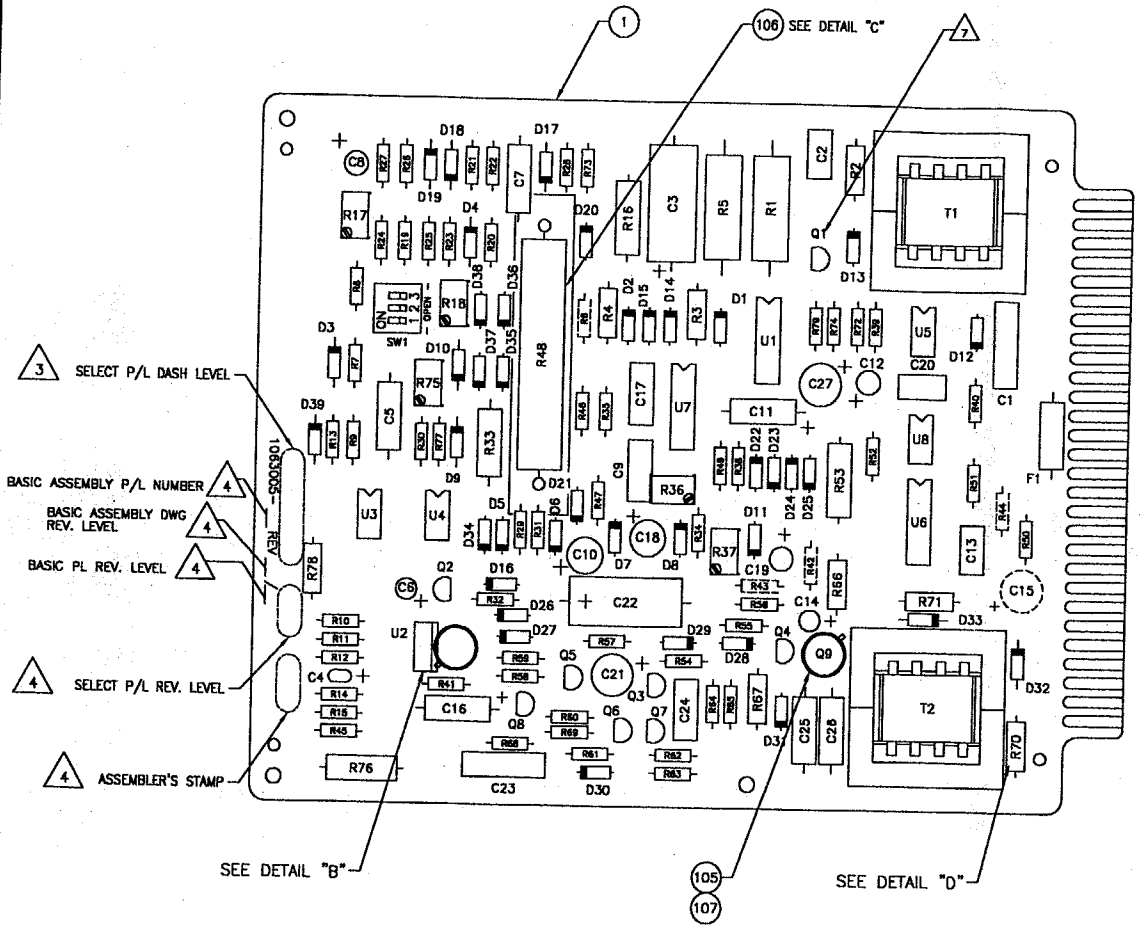
REVISIONS				
ZONE	REV	DESCRIPTION	DATE	APPROVED
	–	ORIGINATED	891022	
	A	REVISED PER ECO89A377	891118	
	B	REVISED PER ECO90A152	900308	
	C	REVISED PER ECO90A216	900405	
	D	REVISED PER ECO90A702	900830	
	E	REVISED PER ECO92A148	920420	
	F	REVISED PER ECO92A297 JM	920828	
	G	REVISED PER ECN M950370 MS	950510	
	H	REVISED PER ECN M950374 DR	950602	ML
	J	REVISED PER ECN M950802 BC	951020	ML
	K	REVISED PER ECN M960458 BC	960823	ML



–	–	UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON DECIMALS FRACTIONS ANGLES .XX ± .03 ± 1/32 ± 1/2° .XXX ±.010 DO NOT SCALE THIS DRAWING	CONTRACT NO.	ELGAR	
–	–		FIRST MADE FOR:		
–	–		APPROVAL DATE		
–	–		DRAWN J.R. MARCH 891022	SCHEMATIC DCRB CONTROL BOARD	
–	–		CHECKED B. KOMADINA 900830		
–	–		ENGINEER		
–	–		QA-REL		
NEXT ASSY.	USED ON	MATERIAL:	SEE DOCUMENT CONTROL FOR ORIGINAL SIGNATURES	SIZE D	CODE IDENT. NO. 25965
APPLICATION		FINISH:		DWG. NO. 1063006	REV K
THE INFORMATION DISCLOSED HEREIN WAS ORIGINATED BY AND IS THE PROPERTY OF ELGAR CORPORATION, AND EXCEPT FOR RIGHTS EXPRESSLY GRANTED TO THE UNITED STATES GOVERNMENT, ELGAR CORPORATION RESERVES ALL PATENT, PROPRIETARY, DESIGN, USE, SALE, MANUFACTURING AND REPRODUCTION RIGHTS THERETO.				SCALE NONE	SHEET 1 OF 1

1063006

6-15



ZONE	REV	DESCRIPTION	DATE	APPROVED
	A	ORIGINATED	890412	
	B	REVISED	890512	
	C	REVISED	890807	
	D	REVISED PER ECO 89A377	891116	
	E	REVISED PER ECO 92A148	920420	
	F	REVISED PER ECO 92A537	921002	
	G	REVISED PER ECO 92A713	921106	
	H	REVISED PER ECO 92A242	940630	
	J	REVISED PER ECN N940122	941213	
	K	REV PER ECN N940147	950510	
	L	REV PER ECN N950370	950512	
	M	REV PER ECN N950374 DR	950802	ML
	N	REVISED PER ECN #N960079	02/05/96	ML
	P	REVISED PER ECN #N960100	03/11/96	ML
	R	REVISED PER ECN #N960165	04/29/96	ML
	T	REVISED PER ECN #N981232	12/4/98	STAPP

6 DETAIL A

DETAIL B

NOTES: UNLESS OTHERWISE SPECIFIED.

1. ASSEMBLE PER ELGAR WORKMANSHIP STANDARD DOCUMENT NO. 0050003-01.
2. REFERENCE SCHEMATIC NUMBER 1063006
3. ELECTRICAL COMPONENTS ARE KEYED TO PARTS LIST BY REFERENCE DESIGNATORS

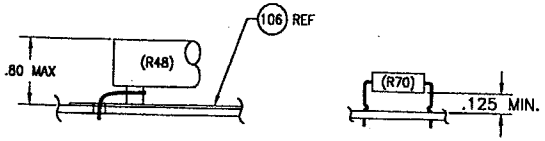
4 INK STAMP APPROPRIATE REVISION LEVEL USING BLACK EPOXY INK

5. COMPONENTS SHOWN DASHED ARE TO BE INSTALLED AT ANOTHER ASSEMBLY DASH LEVEL
   MASK HOLES, MUST BE KEPT SOLDER FREE

6 COMPONENTS 2W OR LARGER MUST BE ELEVATED WITH FORMED LEADS RESISTORS AFFECTED ARE R1,R4, R5, R16, R33, R48, R53 AND R76, AND F1 ALSO (SEE DETAIL A)

7 REMOVE Q1 ON -XM61 VERSION.

8. ELECTROSTATIC DISCHARGE CONTROL PROGRAM FOR PROTECTION OF ELECTRICAL AND ELECTRONIC PARTS, ASSEMBLIES AND EQUIPMENT PER IP 0460007-01.



DETAIL C

DETAIL D

CAUTION
SENSITIVE ELECTRONIC COMPONENTS

SEE SEPARATE PARTS LIST : 1063005-XXX

–	–	UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON DECIMALS .XX ± .03 .XXX ±.010 FRACTIONS ± 1/32 ANGLES ± 1/2 DO NOT SCALE THIS DRAWING	CONTRACT NO.	ELGAR		
–	–		FIRST MADE FOR:			
–	–		APPROVAL	DATE	ASSEMBLY, PCB DCRB CONTROL BOARD	
–	–		DRAWN V. ANDERSON	890412		
–	–		CHECKED J.R. MARCH	890525		
–	–		ENGINEER			
NEXT ASSY.	USED ON		QA-REL			
APPLICATION		MATERIAL:			SIZE D CODE IDENT. NO. 25965 DWG. NO. 1063005 REV T	
THE INFORMATION DISCLOSED HEREIN WAS ORIGINATED BY AND IS THE PROPERTY OF ELGAR CORPORATION, AND EXCEPT FOR RIGHTS EXPRESSLY GRANTED TO THE UNITED STATES GOVERNMENT, ELGAR CORPORATION RESERVES ALL PATENT, PROPRIETARY, DESIGN, USE, SALE, MANUFACTURING AND REPRODUCTION RIGHTS THEREIN.		FINISH:			SCALE 2/1	SHEET 1 OF 1

Capacitor Configuration B

Replacement Parts List

Circuit Symbol	DCRB2 1800 WATT MODEL 10-120	20-80	40-40	60-30	150-12	300-6	600-3	Description	Sorensen Part No.
								Capacitor (µF, -10 +100, unless noted)	
C1	X							129K, 15V	1063254-1
		X						55K, 25V	1063869-2
			X	X				25K, 75V	1063869-4
					X			3500, 200V	1063254-6
						X		1700, 400V	1063254-7
							X	830u, 400v	1068608-1
C2	X							129K, 15V	1063254-1
		X						55K, 25V	1063869-2
			X	X				25K, 75V	1063869-4
					X			3500, 200V	1063254-6
						X		1700, 400V	1063254-7
							X	830u, 400V	1068608-1
C3	X							55K, 25V	1063869-2
		X		X	X	X	X	Not Used	
			X					25K, 75V	1063869-4
C4	X	X						55K, 25V	1063869-2
			X	X	X	X	X	Not Used	
C5	X	X						55K, 25V	1063869-2
			X	X				25K, 75V	1063869-4
					X			3500, 200V	1063254-6
						X		1700, 400V	1063254-7
							X	830u, 400V	1068608-1
C6	X	X						55K, 25V	1063869-2
			X	X				25K, 75V	1063869-4
					X			3500, 200V	1063254-6
						X	X	1700, 400V	1063254-7
C7	X	X						55K, 25V	1063869-2
			X	X				25K, 75V	1063869-4
					X	X	X	Not Used	

Replacement Parts List

Circuit Symbol	DCRB2 1800 WATT MODEL 10-120	20-80	40-40	60-30	150-12	300-6	600-3	Description	Sorensen Part No.
								Capacitor Cont'd (µF, -10 +100, unless noted)	
C8	X	X						55K, 25V	1063869-2
			X	X	X	X	X	Not Used	
C9	X	X	X	X	X	X	X	.1, .250V	587626-65
C10	X	X	X	X	X	X	X	.1, 250	587626-65
C11 - C17								Not Used	
								Resistor	
R3A	X							.22, 12.5W, WWD	27-590-9
		X						.15, 12.5W, WWD	27-590-5
			X					.33, 12.5W, WWD, 10%	27-590-13
				X				.33, 12.5W, WWD, 10%	27-590-13
					X			4.7, 12.5W, WWD, 5%	27-590-41
						X		15, 12.5W, WWD, 5%	27-590-53
							X	.1, 10W, WWD 10%	27-590-1
R3B	X							.1, 10W, WWD, 10%	27-590-1
		X	X	X	X	X	X	Not Used	

Note: The following units were supplied with two Capacitor arrangements. Use caution when replacing Capacitors. Applicable for the following units:

DCR 10-120B2 DCR 20-80B2
DCR 40-40B2 DCR 60-30B2

Replacements should be made only with same values as values removed. Refer to schematic on page 6-4 of manual.

Capacitor Configuration A

Replacement Parts List

Circuit Symbol	DCRB2 1800 WATT MODEL 40-40	20-80	10-120	60-30	150-12	300-6	600-3	Description	Sorensen Part No.
								Capacitor (μF, -10+100%, unless noted)	
C1			X					129K, 15V	1063254-1
		X						55K, 25V	1063869-2
	X							40K, 50V	1063254-7
				X				34K, 75V	1063254-4
					X			3500, 200V	1063254-6
						X	X	1700, 400V	1063254-7
C2			X					129K, 15V	1063254-1
		X						55K, 25V	1063869-2
	X							40K, 50V	1063254-7
				X				34K, 75V	1063254-4
					X			3500μF, 200V	1063254-6
						X		Not Used	
							X	1700μF, 400V	1063254-7
C3			X					55K, 25V	1063869-2
		X		X	X	X	X	Not Used	
	X							40K, 50V	1063254-3
C4			X					55K, 25V	1063869-2
	X							40K, 50V	1063254-3
				X	X	X	X	Not Used	
C5			X					55K, 25V	1063869-2
		X						40K, 50V	1063254-3
				X				25K, 75V	1063869-4
					X			3500μF, 200V	1063254-6
						X	X	1700μF, 400V	1063254-7
C6			X					55K, 25V	1063869-2
		X						40K, 50V	1063254-3
				X				25K, 75V	1063869-4
					X			3500μF, 200V	1063254-6
						X	X	1700μF, 400V	1063254-7

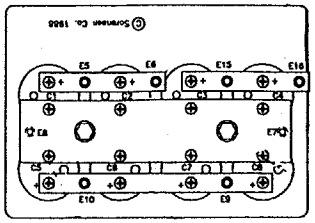
Replacement Parts List (Con't)

Circuit Symbol	DCRB2 1800 WATT MODEL 40-40	20-80	10-120	60-30	150-12	300-6	600-3	Description	Sorensen Part No.
								Capacitor Cont'd (μF, -10+100%, unless noted)	
C7	X	X						55K, 25V	1063869-2
			X	X				25K, 75V	1063869-4
					X	X	X	Not Used	
C8	X	X						55K, 25V	1063869-2
			X					40K, 50V	1063254-3
				X	X	X	X	Not Used	
C9	X	X	X	X	X	X	X	.1μF, 250V	587626-65
C10	X	X	X	X	X	X	X	.1μF, 250V	587626-65
								Resistor (ohms, 5%, WWD, unless noted)	
R3A	X							.10, 10W, WWD, 10%	1063244-10
		X						.15, 12.5W, WWD, 10%	1063244-1
			X	X				.33, 12.5W, WWD, 10%	1063244-2
					X			2.2, 12.5W, WWD,5%	1063244-5
						X		15, 12.5W, WWD, 5%	1063244-6
							X	68, 12.5W, WWD, 5%	1063244-13

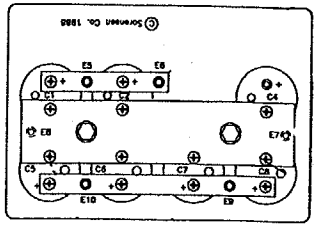
Note: The following units were supplied with two Capacitor arrangements. Use caution when replacing Capacitors. Applicable for the following units:

DCR 10-120B2 DCR 20-80B2
DCR 40-40B2 DCR 60-30B2

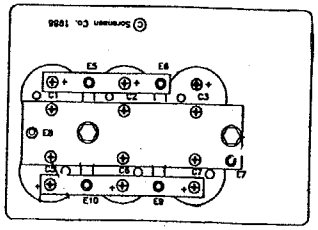
Replacements should be made only with same values as values removed. Refer to schematic on page 6-5 of manual.



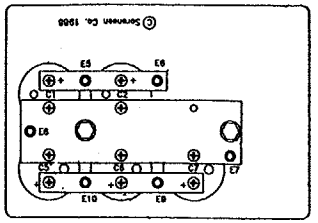
DCR 10-120B2
(1063229-5)



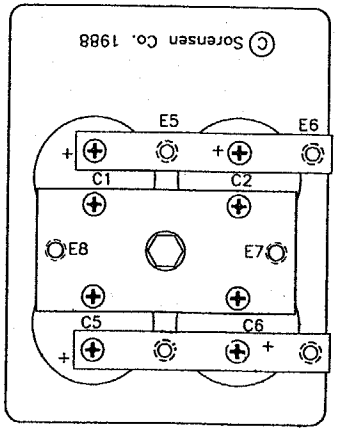
DCR 20-80B2
(1063229-6)



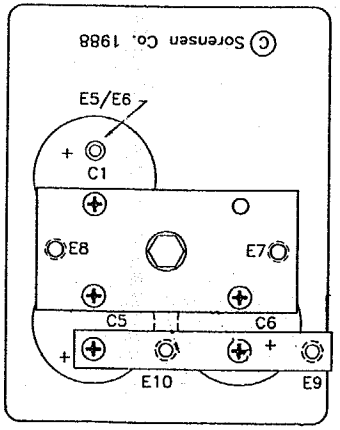
DCR 40-40B2
(1063229-3)



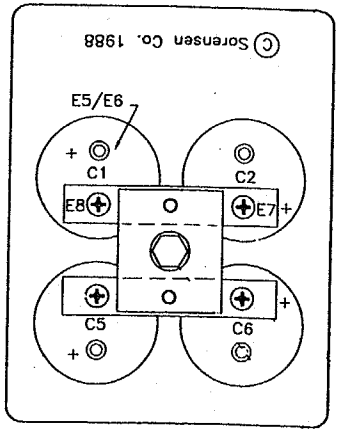
DCR 60-30B2
(1063229-9)



DCR 150-12B2
(1063228-5)



DCR 300-6B2
(1063228-6)



DCR 600-3B2
(1063228-7)

Replacement Parts List

Circuit Symbol	DCRB2 1800 WATT MODEL 40-40 / 20-80 / 10-120			60-30 / 150-12 / 300-6 / 600-3				Description	Sorensen Part No.
								Resistors Cont'd (Ohm, 5%, unless noted)	
R11	X	X	X	X	X	X	X	Pot, 100, 2W, WW	1065765-3
R12	X	X	X	X	X	X	X	Pot, 750, 2W, WW	1065765-5
R13	X	X	X	X	X	X	X	Pot, 100, 2W, WW	1065765-3
R14 - R17								Not Used	
R18	X	X						Pot, 10K, 2W, Cermet	589343-51
			X	X				Pot, 50K, 2W, Cermet	589343-56
					X			Pot, 100K, 2W, Cermet	589343-58
						X		Pot, 250K, 2W, Cermet	589343-61
							X	Pot, 500K, 2W, Cermet	589343-63
R19	X							3.34, 95W, WWD, 10%	1059432-15
		X						13.34, 95W, WWD, 10%	1059432-17
			X					50, 95W, WWD, 10%	1059432-19
				X				100, 95W, WWD, 5%	1059432-5
					X			666, 95W, WWD, 10%	1059432-21
						X		2666, 95W, WWD, 10%	1059432-24
							X	4000, 95W, WWD, 10%	1059432-30
R20	X							3.34, 95W, WWD, 10%	1059432-15
		X						13.34, 95W, WWD, 10%	1059432-17
			X					50, 95W, WWD, 10%	1059432-19
				X				100, 95W, WWD, 5%	1059432-5
					X			666, 95W, WWD, 10%	1059432-21
						X		2660, 95W, WWD, 10%	1059432-24
							X	4000, 95W, WWD, 10%	1059432-30
R21 & R22								Not Used	
R23	X	X	X	X	X			Not Used	
						X	X	5.36, 50W, WWD, 3%	586677-167
R24								Not Used	
R25A	X							Shunt	1063221-1
		X						Shunt	1063221-2
			X					Shunt	1063221-3

Replacement Parts List

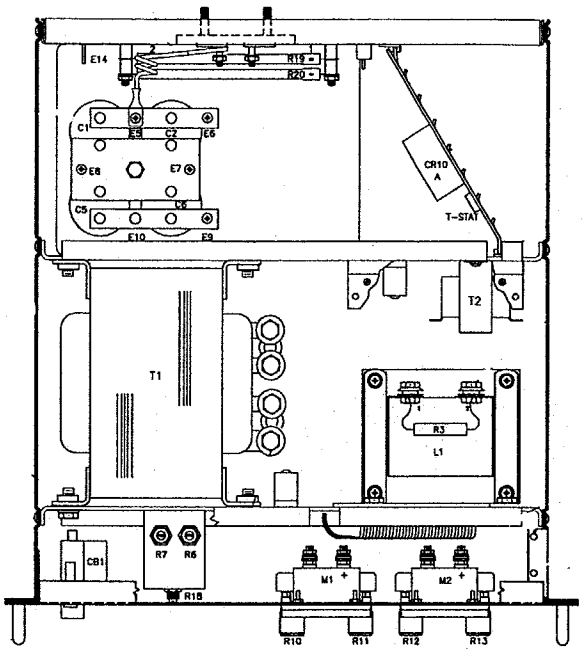
Circuit Symbol	DCRB2 1800 WATT MODEL 40-40 / 20-80 / 10-120			60-30 / 150-12 / 300-6 / 600-3				Description	Sorensen Part No.
								Resistors Cont'd (Ohm, 5%, unless noted)	
				X				Shunt	1063221-4
					X			Shunt	1063221-5
						X		Shunt	1063221-6
							X	Shunt	1063221-7
R25B	X							Shunt, 70A	1064279-1
		X	X	X	X	X	X	Not Used	
								Transformer	
T1	X							Power Transformer	1063138-8
		X						Power Transformer	1063138-9
			X					Power Transformer	1063138-10
				X				Power Transformer	1063138-11
					X			Power Transformer	1063138-12
						X		Power Transformer	1063138-13
							X	Power Transformer	1063138-13
T2	X	X	X	X	X	X	X	Control Transformer	588240-1
								Miscellaneous	
	X	X	X	X	X	X	X	Knobs (Control)	42-274
TB1	X	X	X	X	X	X	X	Term Block, 3 Pos.	587924-103
TB2	X	X	X	X	X	X	X	Assy. TB2	1064404-1
TB3	X	X	X	X	X	X	X	Term Block, 11 Pos.	1063181-1
	X	X	X	X	X	X	X	Fan, Die Cast Metal	1064519
	X							Front Panel	1063142-9
		X						Front Panel	1063142-10
			X					Front Panel	1063142-11
				X				Front Panel	1063142-12
					X			Front Panel	1063142-13
						X		Front Panel	1063142-14
							X	Front Panel	1063142-15

Replacement Parts List

Circuit Symbol	DCRB2 1800 WATT MODEL 10-120	20-80	40-40	60-30	150-12	300-6	600-3	Description	Sorensen Part No.
CB1	X	X	X	X	X	X	X	**Circuit Breaker**, 50A, 125V	588764-1
								Diodes	
CR1 - CR6	X	X	X	X	X	X	X	Not Used	
CR7	X	X	X	X	X	X	X	Thyristor, 600V, 40A	1063180-1
CR8	X	X	X	X	X	X	X	Thyristor/Diode PWR, 600V	1063611-2
CR9	X	X	X	X	X	X	X	Not Used	
CR10A	X							Rect. Power, 90A, 400V	1063503-1
		X						Rect. Power, 90A, 400V	1063195-1
			X	X				Rect. Bridge, 100A, 200PRV	1063087-2
					X			Rect. Bridge, 50A, 400V	1063088-4
						X		Rect. Bridge, 12A, 400V	1063089-4
							X	Rect. Bridge, 12A, 800V	1063089-6
CR10B	X							Rect. PWR, 90A, 400V	1063503-1
		X						Rect. PWR, 90A, 400V	1063195-1
			X	X	X	X		Not Used	
							X	Rect. Bridge, 12A, 800V	1063089-6
CR11 - CR16								Not Used	
								Lamps	
DS1	X	X	X	X	X	X	X	Power, Indicator, White	43-357
DS2	X	X	X	X	X	X	X	Voltage Indicator, Red	1058485-1
DS3	X	X	X	X	X	X	X	Current Indicator, Red	1058485-1
								Fuse	
F1								Not Used	
XF1								Not Used	

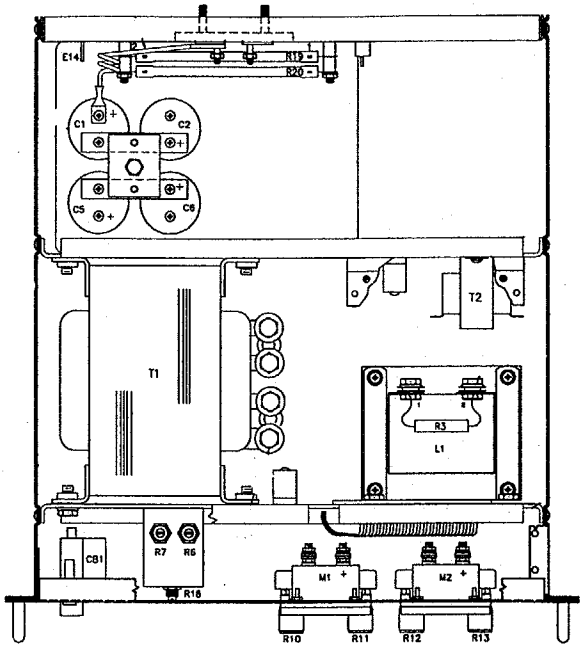
Replacement Parts List

Circuit Symbol	DCRB2 1800 WATT MODEL 10-120	20-80	40-40	60-30	150-12	300-6	600-3	Description	Sorensen Part No.
								Filter Choke	
L1	X							Inductor	1063139-9
		X						Inductor	1063139-10
			X					Inductor	1063139-11
				X				Inductor	1063139-12
					X			Inductor	1063139-13
						X		Inductor	1063139-14
							X	Inductor	1063139-15
								Panel Meters	
M1	X							Voltmeter, 0-12V	94-579-1
		X						Voltmeter, 0-25V	94-579-2
			X					Voltmeter, 0-50V	94-579-3
				X				Voltmeter, 0-80V	94-579-4
					X			Voltmeter, 0-200V	94-579-6
						X		Voltmeter, 0-400V	94-579-7
							X	Voltmeter, 0-800	94-579-8
M2	X							Ammeter, 0-150A dc	1063179-1
		X						Ammeter, 0-100A dc	1063179-3
			X					Ammeter, 0-50A dc	1063179-4
				X				Ammeter, 0-40A dc	1063179-5
					X			Ammeter, 0-15A dc	1063179-7
						X		Ammeter, 0-8A dc	1063179-9
							X	Ammeter, 0-5A dc	1063179-10
								Resistors (Ohm, 5%, unless noted)	
R1 & R2								Not Used	
R4 & R5								Not Used	
R6 & R7	X	X	X	X	X	X	X	Pot, 50, 2W, Cermet	589343-36
R8 & R9								Not Used	
R10	X	X	X	X	X	X	X	Pot, 15, 2W, WW	1065765-4



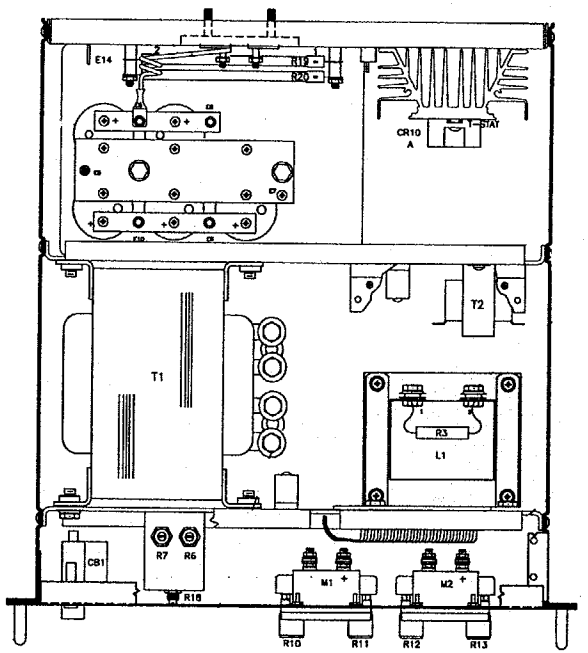
1063236
(Model: DCR 150-12B)

Component Layout, Typical Assembly



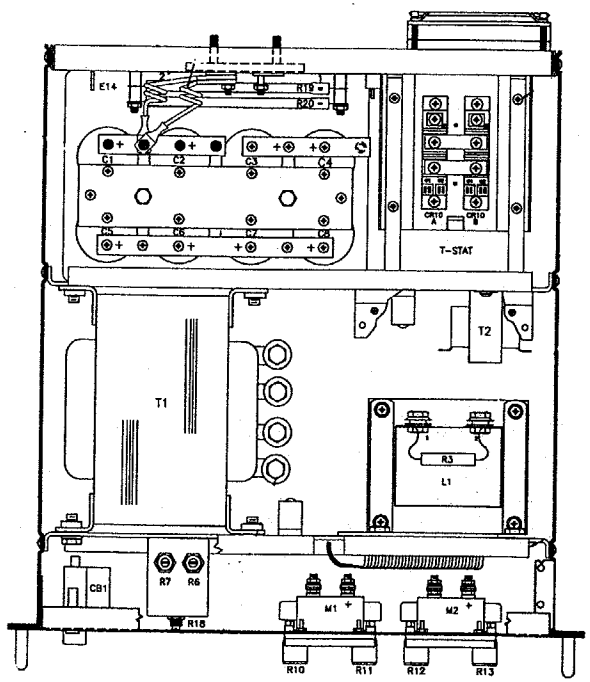
1063237
(Models: DCR 300-6B, DCR 600-3B)

Component Layout, Typical Assembly



1063240
(Models: DCR 40-40B, DCR 60-30B)

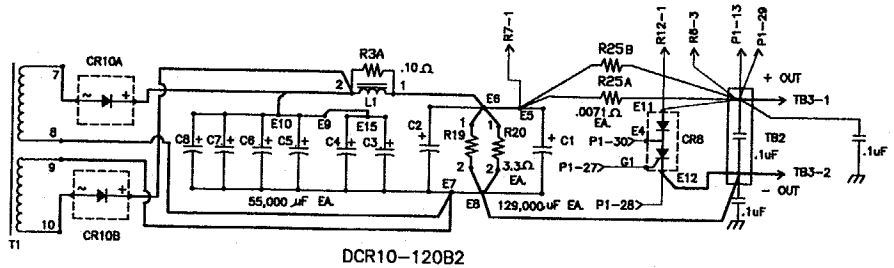
Component Layout, Typical Assembly



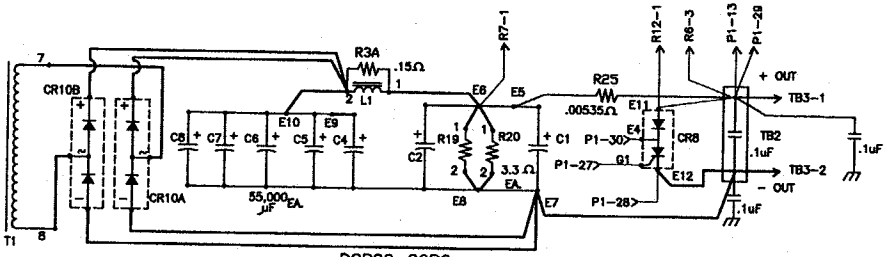
1063239
(Models: DCR 10-120B, DCR 20-80B)

Component Layout, Typical Assembly

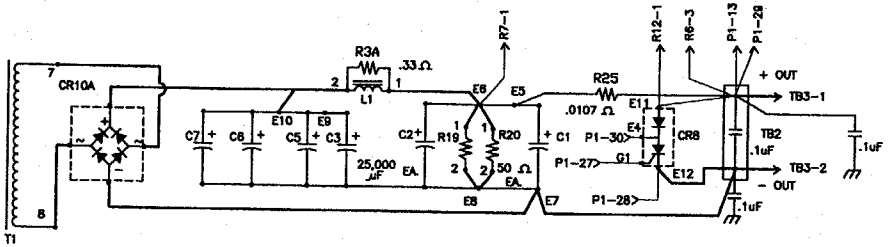
REVISIONS				
ZONE	REV	DESCRIPTION	DATE	APPROVED
		SEE SHEET 1		



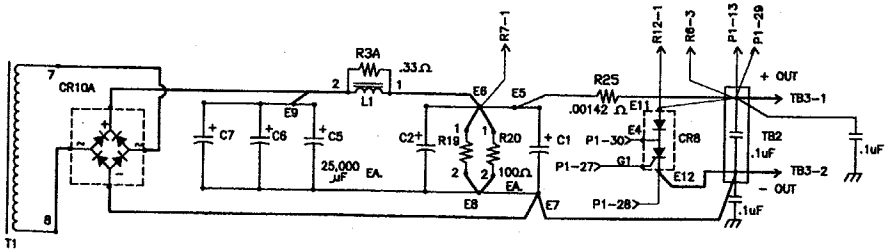
DCR10–120B2



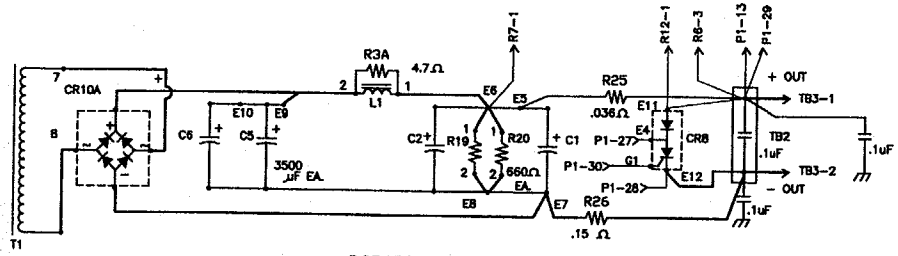
DCR20–80B2



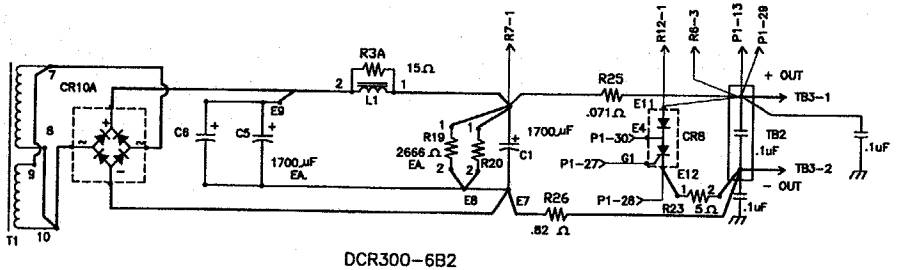
DCR40–40B2



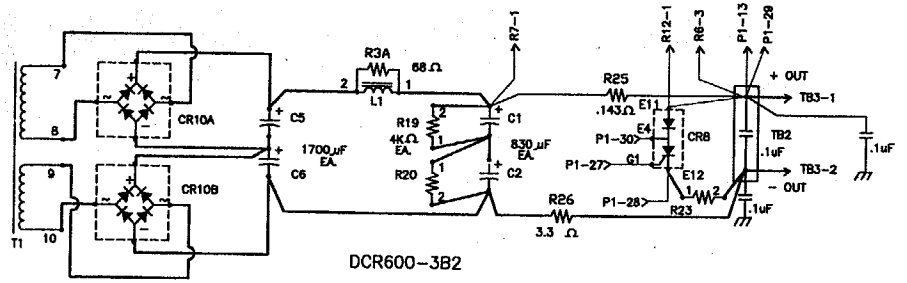
DCR60–30B2



DCR150–12B2



DCR300–6B2

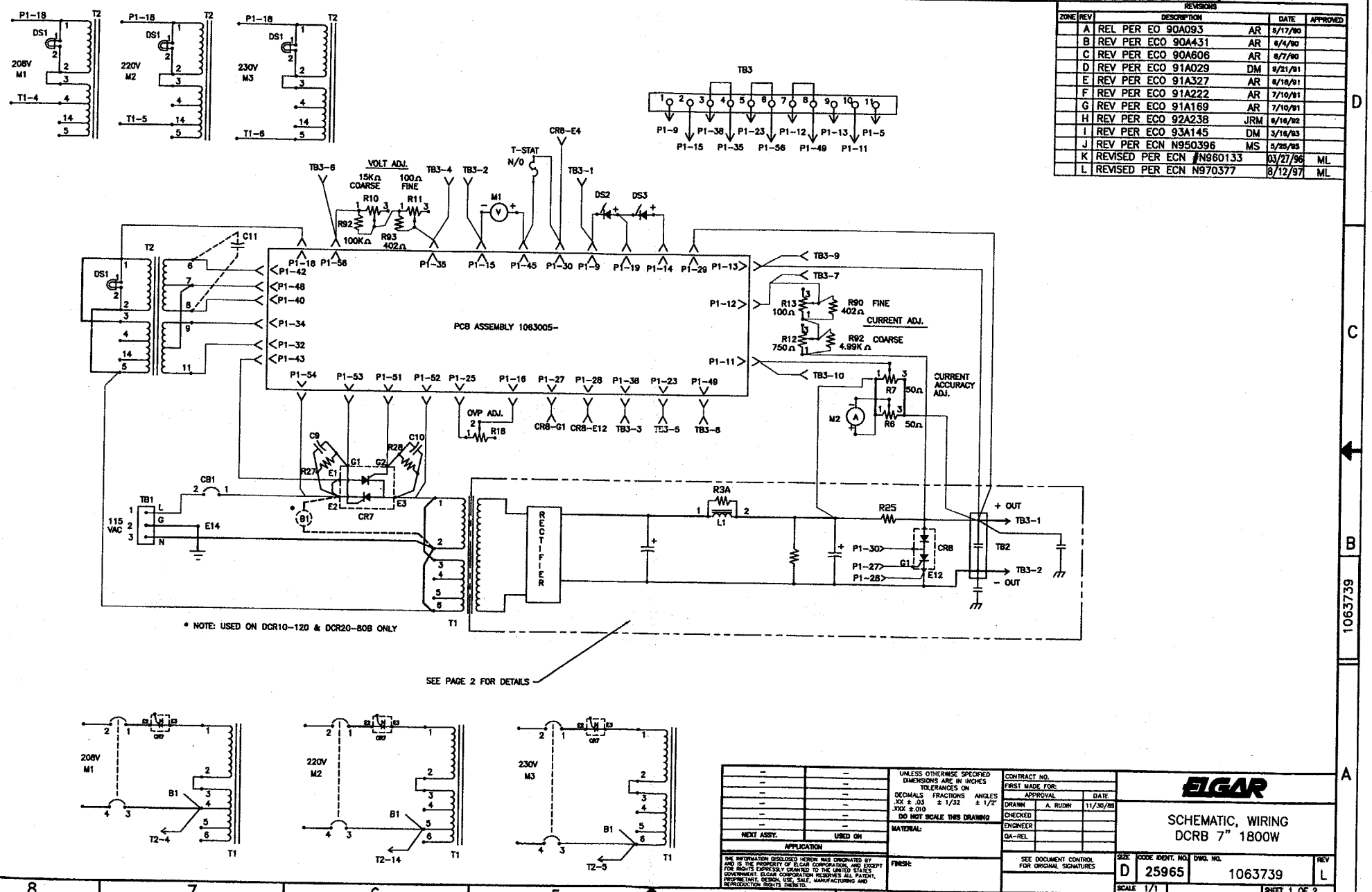


DCR600–3B2

SIZE	CODE IDENT. NO.	DWG. NO.	REV
D	25965	1063739	L
SCALE 1/1		SHEET 2 OF 2	

1063739

6-4



REVISIONS				
ZONE	REV	DESCRIPTION	DATE	APPROVED
	A	REL PER EO 90A093 AR	5/17/90	
	B	REV PER ECO 90A431 AR	6/4/90	
	C	REV PER ECO 90A606 AR	6/7/90	
	D	REV PER ECO 91A029 DM	8/21/91	
	E	REV PER ECO 91A327 AR	8/16/91	
	F	REV PER ECO 91A222 AR	7/10/91	
	G	REV PER ECO 91A169 AR	7/10/91	
	H	REV PER ECO 92A238 JRM	9/16/92	
	I	REV PER ECO 93A145 DM	3/16/93	
	J	REV PER ECN N950396 MS	5/25/95	
	K	REVISED PER ECN #N960133	03/27/96	ML
	L	REVISED PER ECN N970377	8/12/97	ML

–	–	UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON DECIMALS XX ± .03 .XXX ± .010 FRACTIONS ± 1/32 ANGLES ± 1/2° DO NOT SCALE THIS DRAWING	CONTRACT NO. FIRST MADE FOR:
–	–		APPROVAL / DATE
–	–		DRAWN A. RUDIN 11/30/89
–	–	MATERIAL:	CHECKED
–	–		ENGINEER
–	–		QA-REL
NEXT ASSY.	USED ON	FINISH:	SEE DOCUMENT CONTROL FOR ORIGINAL SIGNATURES
APPLICATION			

ELGAR

SCHEMATIC, WIRING
DCRB 7" 1800W

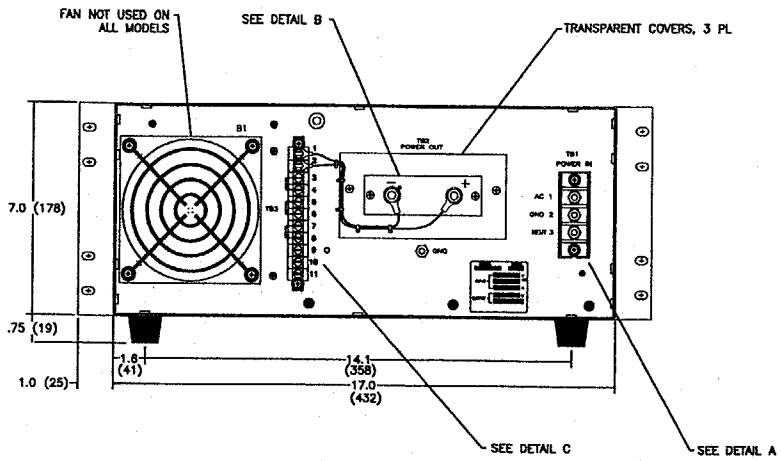
SIZE	CODE IDENT. NO.	DWG. NO.	REV
D	25965	1063739	L

SCALE 1/1 SHEET 1 OF 2

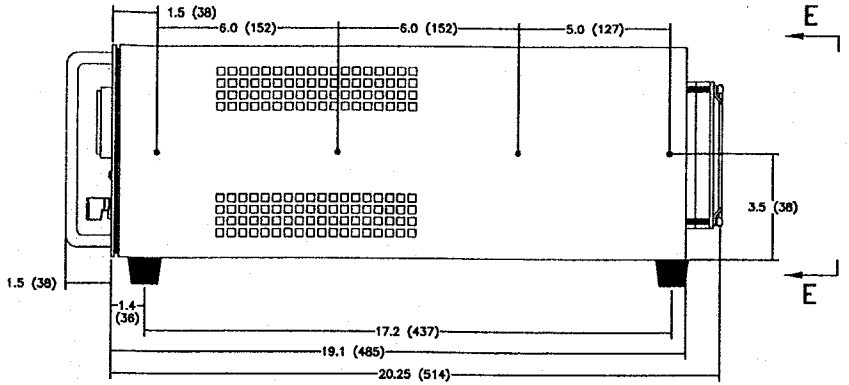
1063739

6-3

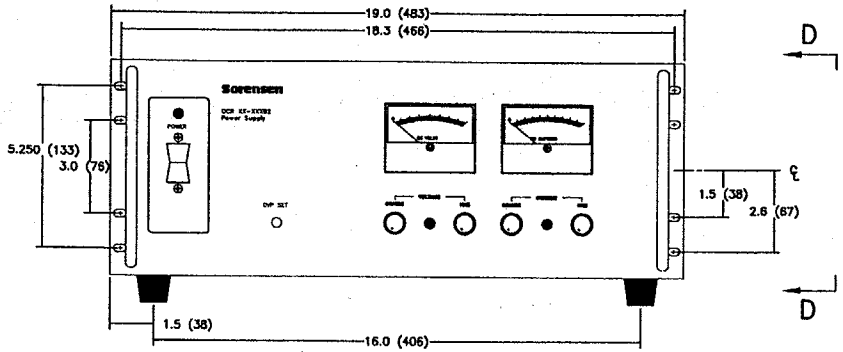
REVISIONS					
ZONE	REV	DESCRIPTION		DATE	APPROVED
	A	RELEASED TO PROD. PER EO	AR	11/29/89	
	A1	ADDED SLIDE HOLES & DIM.	AR	12/19/89	
	A2	ADDED DIMENSION	AR	12/26/89	
	B	REVISED PER EO 90A023	AR	1/18/90	
	C	REVISED PER EO 90A431	AR	6/4/90	
	C1	ADDED DIM NO EO	AR	9/4/90	
	D	REVISED PER ECN N950396	MS	5/25/95	

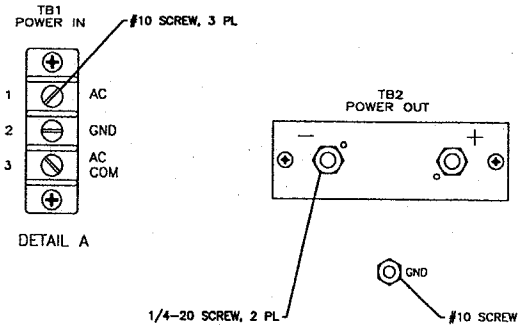


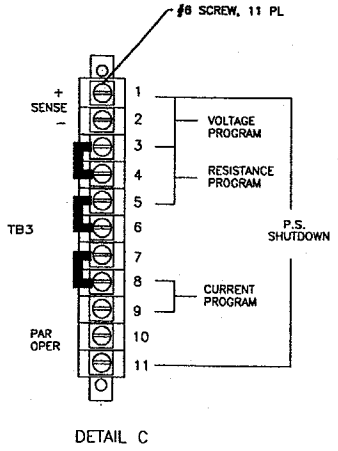
VIEW E-E



VIEW D-D







DETAIL C

–	–	UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON DECIMALS .XX ± .03 .XXX ± .010 FRACTIONS ± 1/32 ANGLES ± 1/2° DO NOT SCALE THIS DRAWING	CONTRACT NO.	ELGAR	
–	–		FIRST MADE FOR:		
–	–		APPROVAL	DATE	UNIT CONTROL DRAWING DCRB 7"
–	–		DRAWN A. RUDIN	11/29/89	
–	–		CHECKED		
–	–		ENGINEER		
–	DCRB2 7"	MATERIAL:	QA-REL		
NEXT ASSY.	USED ON				
APPLICATION		FINISH:	SEE DOCUMENT CONTROL FOR ORIGINAL SIGNATURES	SIZE D / CODE IDENT. NO. 25965 / DWG. NO. 1064088 / REV D	
				SCALE 1/2	SHEET 1 OF 1

1064088