BNL-104635-2014-TECH

AGS/AD/Tech Note No. 208;BNL-104635-2014-IR

AGS STANDARD PACKAGE FOR ELECTRONIC CONTROLS

K. Kohler

October 1984

Collider Accelerator Department

Brookhaven National Laboratory

U.S. Department of Energy

USDOE Office of Science (SC)

DISCLAIMER

Accelerator Department
BROOKHAVEN NATIONAL LABORATORY
Associated Universities, Inc.
Upton, New York 11973

AGS Division Technical Note
No. 208

AGS STANDARD PACKAGE FOR ELECTRONIC CONTROLS

K. Kohler

October 4, 1984

Introduction

The computer control and data acquisition systems in the AGS and its surrounding complex operate under what only can be defined as hostile conditions for electronics. Briefly, these conditions can be described as: 1) mechanical stress, such as heat, moisture, and vibration, 2) electrical stress, such as from large magnetic fields, and electrical noise, and 3) general physical abuse due to constant activity in the areas where equipment is located. With these problems in mind, a study group was formed to define a standard package for electronic controls that would tolerate the above conditions as much as possible, still meet the needs of the controls medium, and be of use to other, non-controls specialists who may have similar packaging problems. The following document is a short description of the packaging scheme which evolved as a direct result of the study group's deliberations.

"Package" Description

1. The Chassis

The package consists of a 19" rack mountable, 0.063" thick aluminum chassis, approximately 21" long, 17" wide and 11-1/2" high. It is designed to be mounted on slides for ease of service to the electronics contents. One can see from the information in Appendix 4 that the difference in the amount of rf shielding by either aluminum or steel when proper design is used is not enough to compensate for the reduced aluminum weight and the ease of working aluminum. Physically, the chassis is divided into two compartments by a bulkhead, with the front compartment containing power supplies for the electronics which are contained in the rear compartment. If a user has an application that demands more space than the electronic compartment contains, he may dispense with the bulkhead and place his electronics and power supplies at any convenient location in the chassis, keeping in mind the cooling capacity that has been provided. The separate compartment configuration is specifically intended for controls applications. The top and bottom are divided so that access to each compartment can be made separately either from the top or the bottom. The front panel contains handles, an A/C ON light and power supply test jacks, one for each voltage provided by the power supplies. The back panel is a flat sheet approximately 195 square inches and is provided with holes only for the on/off circuit breaker and a/c cord. It is left to the user to punch holes for connectors he wishes to use, in whatever configuration best meets his or her specifications. It is expected that the chassis will be fabricated by an outside vendor and be purchased broken down for ease of storage. It will be assembled by the user. With this in mind, Pemnuts have been used as much as possible for ease of assembly. It should be noted that the chassis is reversible in that holes are provided to interchange the front and rear panels and the compartments so that connectors will then appear at the front of the rack rather than the rear.

2. The Electronics Compartment

The electronics compartment is designed to contain various configurations of MULTIBUS crates (card cages), and/or DIN spec. Eurocard crates as follows:

a. Three each, two each, or one each 4 position multibus card crates National Semiconductor Corp. Part No. SBC604. See Illustration #3.

b. One each, 3 to 15 position card crate, Electronic Solutions Inc. for multibus cards. See Illustration #4.

c. One each, 4 position card crate and one each card frame DIN spec. to accept 3U/220 mm long cards.

3. The Power Supply Compartment

The package is designed so that one of two optional configurations can be specified by the user and placed in the power supply compartment. The power supplies are installed so that they can be easily replaced if failure occurs by simply unplugging the outputs, inputs and removing four screws.

a. The first option is a Power One Inc. Model CP255. This is a multi-output supply with suitable outputs for the multibus standard providing positive 5 and 12 volts at 30 and 4.5 amps, and a negative 5 and 12 volts each at 1.75 amps. See Illustration #1.

b. The second option consists of two separate multi-output supplies. Condor Inc. Model DBB-105W and a Condor Inc., Model BAA-40W. See Illustration #2. One supply provides 5 volts at 12 amps and plus or minus 12 volts at 1.7 amps, or plus or minus 15 volts at 1.5 amps. The second supply provides plus 5 volts at 3 amps, also plus or minus 15 volts at 0.8 amps. The dual supply option is designed to be used where the supplies need to be isolated from each other for the digital oriented multibus and any linear circuits the package may contain, i.e., cards in the DIN spec. card cage. See Illustration #2.

c. An rf filter Mallory Part No. 10VB1 is part of the package design and is placed immediately after the on/off circuit breaker.

4. Package Cooling

Package cooling is provided by fans, four each for the electronics compartment and two each for the power supplies. These are capable of supporting 200 watts of electronics. Tests have been made with the power supplies under full load and the cooling has proven adequate to keep the internal temperatures of the package such that it meets the temperature specifications of most electronics components. See Appendix 2.

5. Package Documentation

See Appendix 3 for a list of mechanical drawings for the electronic cooling package.

Conclusion

The above described standard electronic package is mechanically strong, gives superior RFI/EMI protection, compares very favorably in terms of cost effectiveness to a purchased package with the same specifications, and meets the needs of packaging electronic controls for the present and future in the Accelerator Department.

Acknowledgments

While the information presented here represents the conclusions of the study group listed in Appendix 1, we acknowledge the many useful suggestions from other interested persons in the Accelerator Department.

Appendix 1

Study Group

R. Frankel

K. Kohler

W. Leonhardt

D. Pope

L. Sadinsky

F. Toldo

Appendix 2

Memo to R. Frankel from W. Leonhardt; re: multibus power supply heat transfer, 4/19/84.

Appendix 3

Reference Print Numbers

Job Number: D09-1M-15

Drawing Numbers: D09-M-374-3
D09-M-375-4
D09-M-376-3
D09-M-377-3
D09-M-378-3
D09-M-379-3
D09-M-380-3
D09-M-381-3
D09-M-382-3

Appendix 4

Excerpts from "Micro Controller Handbook", Intel Corp., section on "Designing Microcontroller Systems for Electrically Noisy Environments".

mvh

4-19-84

MEMO

TO: R. FRANKEL
FROM: W. LEONHARDT
RE: MULTI-BUS POWER SUPPLY HEAT TRANSFER

I HAVE RUN AN EXPERIMENT ON THE MULTI-BUS UNIT TO ACCESS THE TEMPERATURE RISE OF THE POWER SUPPLY DURING OPERATION. THE UNIT WAS RUN IN A RACK WITH ALL COVERS ON. POWER RESISTORS WERE CONNECTED TO THE POWER SUPPLY IN A FASION WHICH CAUSED IT TO RUN AT "HALF CURRENT", A CONDITION DESIGNED TO DISSIPATE THE MAXIMUM POWER. THERMOCOUPLES WERE USED TO MEASURE THE INLET & OUTLET AIR TEMPERATURES AND TEMPERATURES AT FOUR LOCATIONS ON THE POWER SUPPLY. AFTER SEVERAL HOURS OF RUNNING WITH AN INLET TEMPERATURE OF 29°C, THE MAX SUPPLY TEMPERATURE WAS READ AT THE UPPER POWER TRANSISTOR PLATE AS 66°C. THIS THEN REPRESENTS A 37°C RISE OVER AMBIENT WHICH CAN BE SCALED UP CONSERVATIVELY. I ALSO RAN FOR A TIME WITH THE POWER SUPPLY COVER OFF WHICH CAUSED THE POWER SUPPLY MAX TEMP TO RISE TO 69-71°C WITH THE SAME INLET TEMP.

PREVIOUS ANALYSIS OF THE CARD SECTION INDICATES THAT IT IS THERMALLY O.K.

cc: E. JABLONSKI D. POPE F. TAIDA

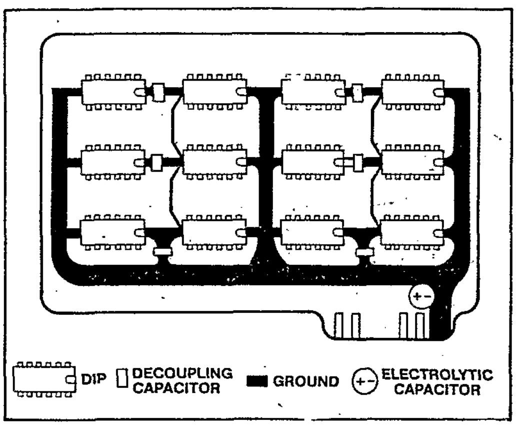


Figure 8. PCB with Gridded Ground

but you still get a mathematically optimal distribution of currents in the grid structure, such that the current loop produces less magnetic flux than if the return path were restrained to follow any single given ground trace. The key to attaining minimum loop areas for all the current loops together is to let the ground currents distribute themselves around the entire area of the board as freely as possible. They want to minimize their own magnetic field. Just let them.

RF SHIELDING

A time-varying electric field generates a time-varying magnetic field, and vice versa. Far from the source of a time-varying EM field, the ratio of the amplitudes of the electric and magnetic fields is always 377 ohms. Up close to the source of the fields, however, this ratio can be quite different, and dependent on the nature of the source. Where the ratio is near 377 ohms is called the far field, and where the ratio is significantly different from 377 ohms is called the near field. The ratio itself is called the wave impedance, E/H.

The near field goes out about 1/6 of a wavelength from the source. At 1MHz this is about 150 feet, and at 10MHz it's about 15 feet. That means if an EMI source is in the same room with the victim circuit, it's likely to be a near field problem. The reason this matters is that in the near field an RF interference problem could be almost entirely due to E-field coupling or H-field coupling, and that could influence the choice of an RF shield or whether an RF shield will help at all.

In the near field of a whip antenna, the E/H ratio is higher than 377 ohms, which means it's mainly an E-field generator. A wire-wrap post can be a whip antenna. Interference from a whip antenna would be by electric field coupling, which is basically capacitive coupling. Methods to protect a circuit from capacitive coupling, such as a Faraday shield, would be effective against RF interference from a whip antenna. A gridded-ground structure would be less effective.

In the near field of a loop antenna, the E/H ratio is lower than 377 ohms, which means it's mainly an H-field generator. Any current loop is a loop antenna. Interference from a loop antenna would be by magnetic field coupling, which is basically the same as inductive coupling. Methods to protect a circuit from inductive coupling, such as a gridded-ground structure, would be effective against RF interference from a loop antenna. A Faraday shield would be less effective.

A more difficult case of RF interference, near field or far field, may require a genuine metallic RF shield. The idea behind RF shielding is that time-varying EMI fields induce currents in the shielding material. The induced currents dissipate energy in two ways: I^2R losses in the shielding material and radiation losses as they re-radiate their own EM fields. The energy for both of these mechanisms is drawn from the impinging EMI fields. Hence the EMI is weakened as it penetrates the shield.

More formally, the I^2R losses are referred to as absorption loss, and the re-radiation is called reflection loss. As it turns out, absorption loss is the primary shielding mechanism for H-fields, and reflection loss is the primary shielding mechanism for E-fields. Reflection loss, being a surface phenomenon, is pretty much independent of the thickness of the shielding material. Both loss mechanisms, however, are dependent on the frequency (ω) of the impinging EMI field, and on the permeability (μ) and conductivity (σ) of the shielding material. These loss mechanisms vary approximately as follows:

reflection loss to an E-field (in dB) $\sim \log \frac{\sigma}{\omega\mu}$

absorption loss to an H-field (in dB) $\sim t\sqrt{\omega\sigma\mu}$

where t is the thickness of the shielding material.

The first expression indicates that E-field shielding is more effective if the shield material is highly conductive, and less effective if the shield is ferromagnetic, and that low-frequency fields are easier to block than high-frequency fields. This is shown in Figure 9.

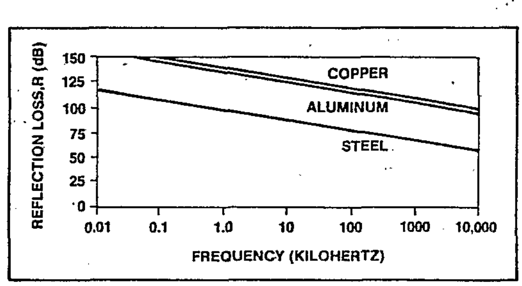


Figure 9. E-Field Shielding

4-2

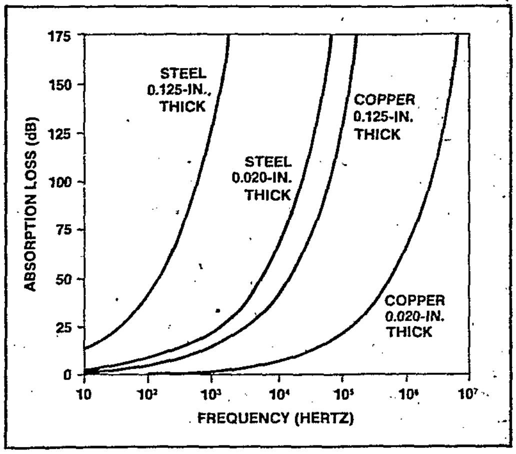


Figure 10. H-Field Shielding

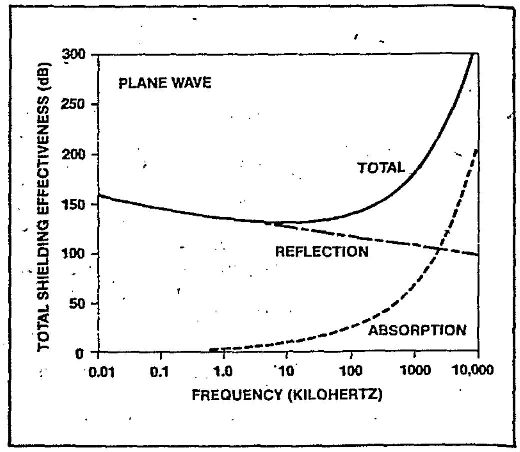


Figure 11. E- and H-Field Shielding

Copper and aluminum both have the same permeability, but copper is slightly more conductive, and so provides slightly greater reflection loss to an E-field. Steel is less effective for two reasons. First, it has a somewhat elevated permeability due to its iron content, and, second, as tends to be the case with magnetic materials, it is less conductive.

On the other hand, according to the expression for absorption loss to an H-field, H-field shielding is more effective at higher frequencies and with shield material that has both high conductivity and high permeability. In practice, however, selecting steel for its high permeability involves some compromise in conductivity. But the increase in permeability more than makes up for the decrease in conductivity, as can be seen in Figure 10. This figure also shows the effect of shield thickness.

A composite of E-field and H-field shielding is shown in Figure 11. However, this type of data is meaningful only in the far field. In the near field the EMI could be 90% H-field, in which case the reflection loss is irrelevant. It would be advisable then to beef up the absorption loss, at the expense of reflection loss, by choosing steel. A better conductor than steel might be less expensive, but quite ineffective.

A different shielding mechanism that can be taken advantage of for low frequency magnetic fields is the ability of a high permeability material such as mumetal to divert the field by presenting a very low reluctance path to the magnetic flux. Above a few kHz, however, the permeability of such materials is the same as steel.

In actual fact the selection of a shielding material turns out to be less important than the presence of seams, joints and holes in the physical structure of the enclosure. The shielding mechanisms are related to the induction of currents in the shield material, but the currents must be allowed to flow freely. If they have to detour around slots and holes, as shown in Figure 12, the shield loses much of its effectiveness.

As can be seen in Figure 12, the severity of the detour has less to do with the area of the hole than it does with the geometry of the hole. Comparing Figure 12C with 12D shows that a long narrow discontinuity such as a seam can cause more RF leakage than a line of holes with larger total area. A person who is responsible for designing or selecting rack or chassis enclosures for an EMI environment needs to be familiar with the techniques that are available for maintaining electrical continuity across seams. Information on these techniques is available in the references.

Grounds

There are two kinds of grounds: earth-ground and signal ground. The earth is not an equipotential surface, so earth ground potential varies. That and its other electrical properties are not conducive to its use as a return conductor in a circuit. However, circuits are often connected to earth ground for protection against shock hazards. The other kind of ground, signal ground, is an arbitrarily selected reference node in a circuit—the node with respect to which other node voltages in the circuit are measured.

SAFETY GROUND

The standard 3-wire single-phase AC power distribution system is represented in Figure 13. The white wire is earth-grounded at the service entrance. If a load circuit has a metal enclosure or chassis, and if the black wire develops a short to the enclosure, there will be a shock hazard to operating personnel, unless the enclosure itself is earth-grounded. If the enclosure is earth-grounded, a

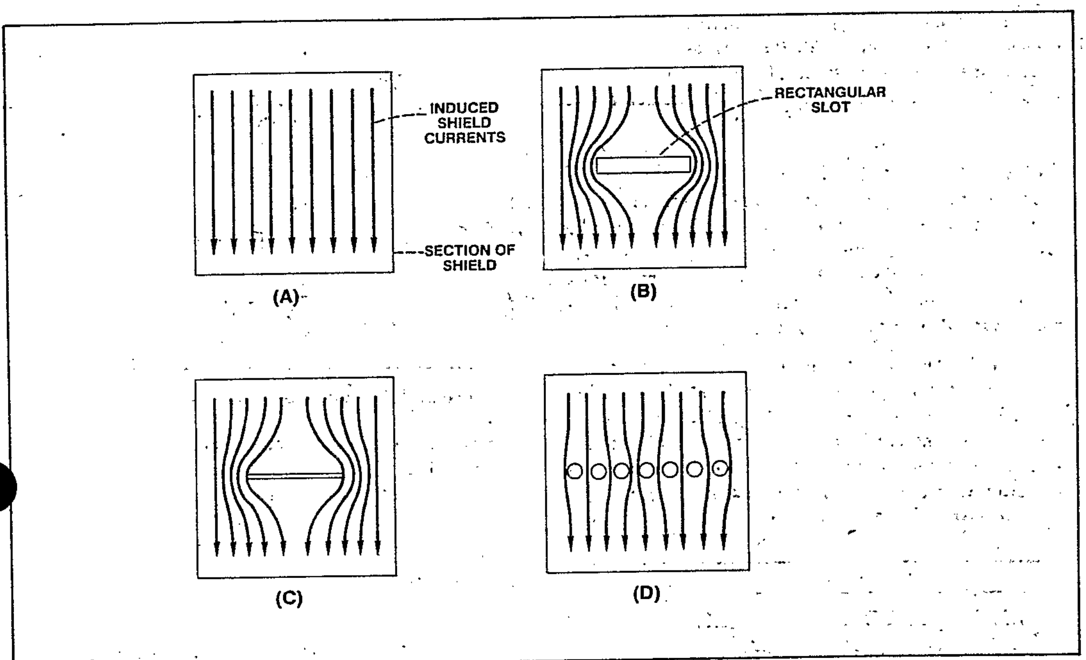


Figure 12. Effect of Shield Discontinuity on Magnetically Induced Shield Current

short results in a blown fuse rather than a "hot" enclosure. The earth-ground connection to the enclosure is called a safety ground. The advantage of the 3-wire power system is that it distributes a safety ground along with the power.

Note that the safety-ground wire carries no current, except in case of a fault, so that at least for low frequencies it's at earth-ground potential along its entire length. The white wire, on the other hand, may be several volts off ground, due to the IR drop along its length.

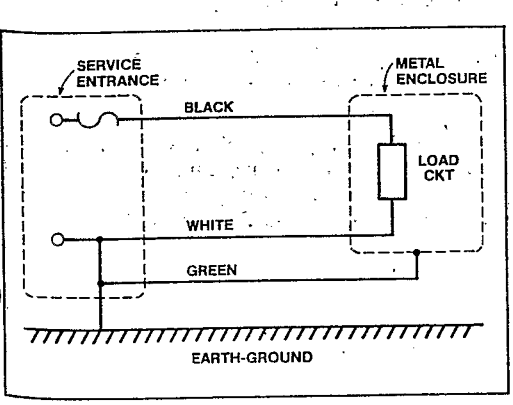


Figure 13. Single-Phase Power Distribution

SIGNAL GROUND

Signal ground is a single point in a circuit that is designated to be the reference node for the circuit. Commonly, wires that connect to this single point are also referred to as "signal ground." In some circles "power supply common" or PSC is the preferred terminology for these conductors. In any case, the manner in which these wires connect to the actual reference point is the basis of distinction among three kinds of signal-ground wiring methods: series, parallel, and multipoint. These methods are shown in Figure 14.

The series connection is pretty common because it's simple and economical. It's the noisiest of the three, however, due to common ground impedance coupling between the circuits. When several circuits share a ground wire, currents from one circuit, flowing through the finite impedance of the common ground line, cause variations in the ground potential of the other circuits. Given that the currents in a digital system tend to be spiked, and that the common impedance is mainly inductive reactance, the variations could be bad enough to cause bit errors in high current or particularly noisy situations.

The parallel connection eliminates common ground impedance problems, but uses a lot of wire. Other disadvantages are that the impedance of the individual ground lines can be very high, and the ground lines themselves can become sources of EMI.

POWER-ONE INC.
D.C. POWER SUPPLIES

Application Data Including:

1. Schematic
2. Parts List
3. Specification
4. Outline & Mounting Drawing
5. General User Information

MODEL CP255

SPECIFICATIONS

INPUT: 100/115/215/230 VAC ±10% 47-63HZ

OUTPUT:	V	I	OVP
	+5V	30A	6.2 ± .4
	-5V	1.75A	-6.2 ± .4
	+12V	4.5 A	15 ± 1
	-12V	1.75A	15 ± 1

ADJUSTMENT RANGE: ±5% min.
LINE REGULATION: ±0.1% for 10% line change
LOAD REGULATION: ±0.1% for 50% load change. Outputs loaded one at a time
RIPPLE AND NOISE: 10mv pk-pk
TRANSIENT RESPONSE: Less than 50 u sec for 50% load change
REMOTE SENSING: Provided on +5V at connector P-8.
STABILITY: ±0.05% for 8 hours after 30 min. warm-up
AMBIENT TEMP: 0°C to 70°C with 70 CFM moving air
TEMP. COEFICIENT: ±0.02% per °C max.

SPECIAL OUTPUTS

1. Power Fail (AC low)
   Provides a TTL active high signal when AC line fails. Signal is activated at approx. 98/196 VAC and reset at approx. 104/208 VAC. (Open collector output device).
2. Storage
   After "AC fail" all outputs will remain in regulation a minimum of 7.5m sec (115 VAC line input).

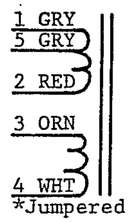
ADDITIONAL INFORMATION

This power supply is also available as a CP255-1. The only difference is connector P-2 which is made a 5-pin (Molex 03-09-2052) connector instead of the standard 4-pin connector supplied with the CP255. The 5-pin AC connector allows all jumpering for input changes to be done at the connector without removing and rewiring the transformer.
NOTE: Intel uses the 4-wire scheme. National Semiconductor uses the 5-wire scheme.

OPTIONAL TRANSFORMER CONNECTIONS

Range	Input	Input Source	Input Return	Connections Required P2	Fusing
103.5-125.5	115	1	2	1-3, 2-4	5A
207-253	230	1	4	2-3	5A
193.5-236.5	215	5	4	2-3	2.5A
90-110	100	5	2	1-3*, 2-4	2.5A

*For 100/215 VAC operation, move gray wire from terminal 1 to terminal 5. (For 100 VAC operation, terminal 1 must be jumpered to terminal 3 at the transformer).



CONNECTOR INFORMATION

P6, P8 Molex
09-50-7071-housing
08-56-0106-pin
15-04-0219-key

Molex
03-09-2042-housing
02-09-2118-pin

P8U
1 KEY
2 GND (+5)
3
4
5 +5V
6 +5V
7 GND

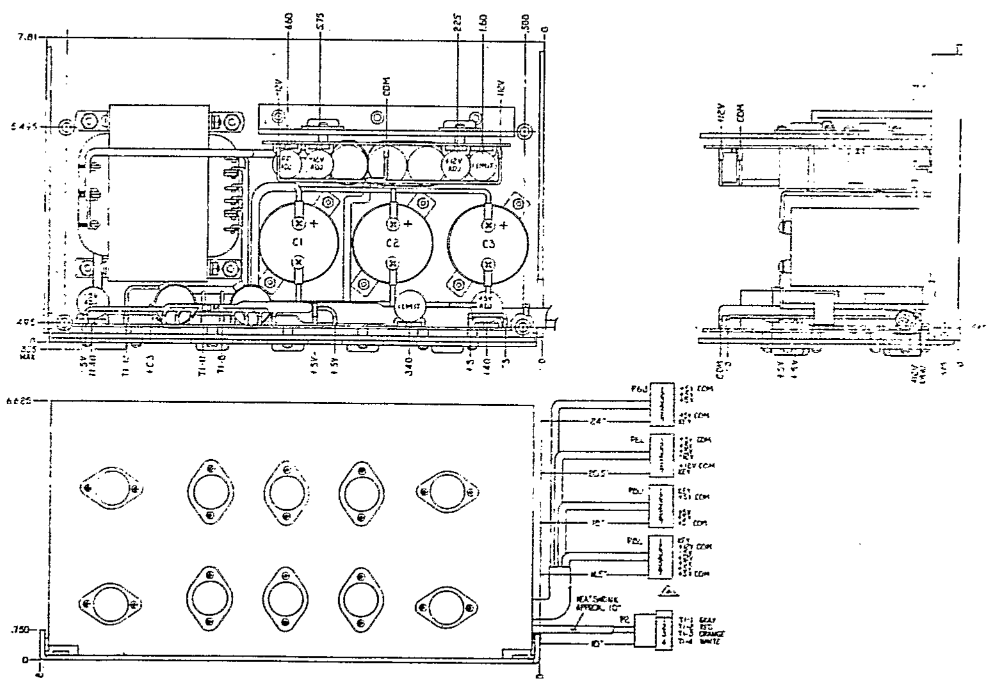
P8L
1 KEY
2 +12 COM
3 -5V
4 +12V
5 +5V
6 +5V
7 +5 COM

P6U
1 GND
2 +5V
3 +5V
4
5
6 GND
7 KEY

P6L
1 +5 COM
2 +5V
3 +5V
4 -12V
5
6 +12V COM
7 KEY

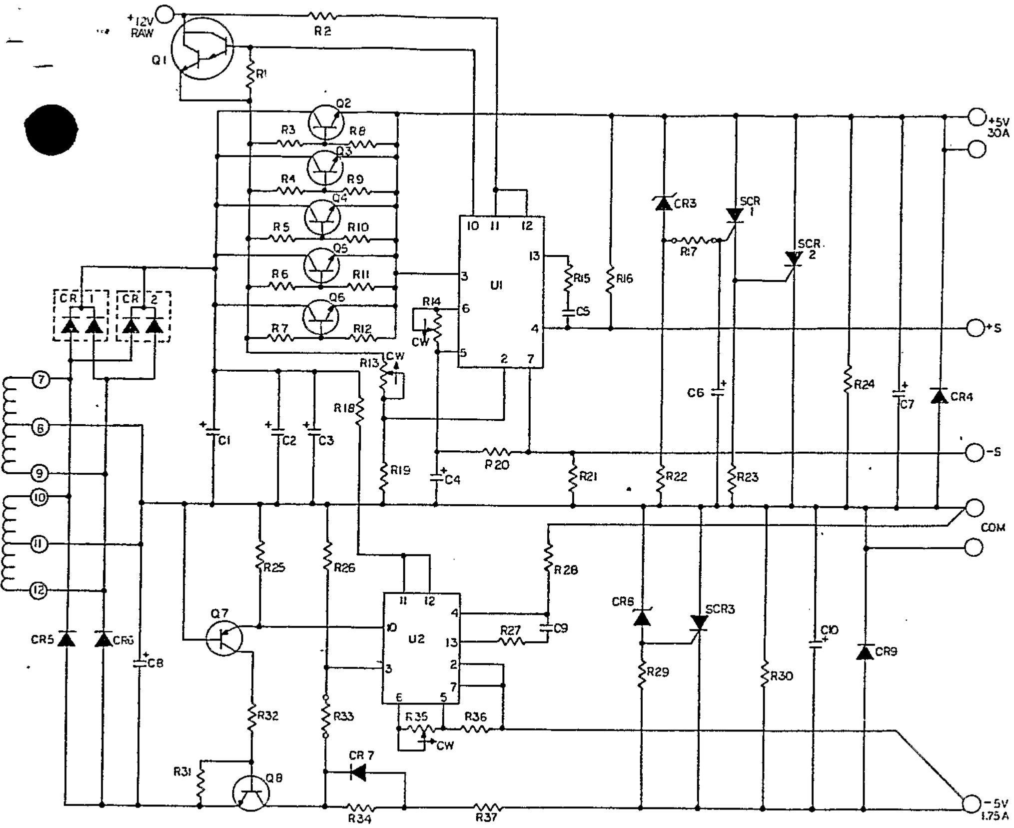
P2
1 GRY
2 RED
3 ORN
4 WHT

Weight: 21 lbs.



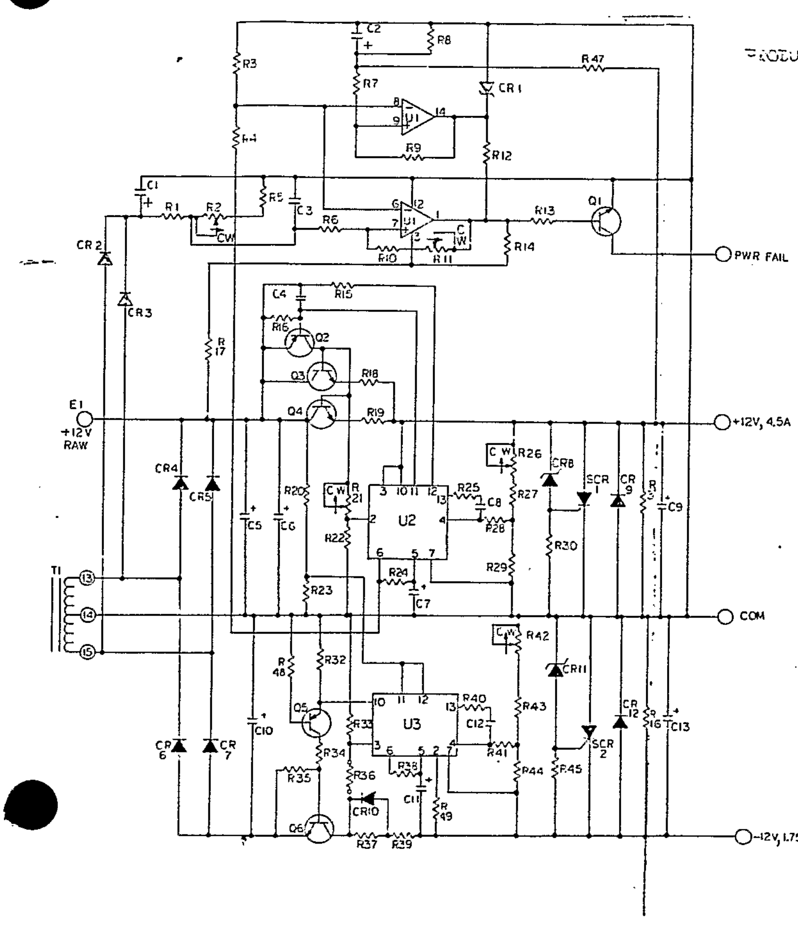
(2)

POWER-ONE CP255



C1,2,3	64000/15	CAPACITOR ELECT	103-10030
C4,6	1/50	ELECT	101-10111
C5	.01/100	MYLAR	104-10095
C7,8	9000/15	ELECT	102-10097
C9	.1/100	MYLAR	104-10094
C10	220/16	CAPACITOR ELECT.	101-10107
CR1,2	6731	DIODE BRIDGE	140-10254
CR3,4	1N7[illegible]2A	ZENER	112-1[illegible]
CR4,5,6,7	[illegible]	3A,100V	111-10252
CR9	MR 750	DIODE 6A,50V	111-10256
SCR 1,3	S0303LS3	SCR 3A, 30V	16[illegible]-10253
SCR 2	MCR649 P1	SCR 20A, 25V	16[illegible]-10257
Q1	2N6055	TRANSISTOR	171-10263
Q2,3,4,5,6	2N3055		171-10243
Q7	2N2907A		172-10248
Q8	2N3055	TRANSISTOR	171-10262
U1,2		IC SOCKET, 14 PIN	321-10679
U1,2	μA 723	IC VOLTAGE REGULATOR	130-10287
R1,19,26,31	2.2 K	RESISTOR 1/4W 5% CF	151-10373
R2,15,22,23,24,25, R28,29,30,32,17	82 Ω		151-10339
R3,4,5,6,7,34	2.7 Ω		151-10305
R8,9,10,11,12	22 Ω		151-10325
R16,27,18,21	6.8 Ω	5% CF	151-10313
R20,36	2.2 K	2% MF	152-10513
R33	330 Ω	1/2W 5% CF	151-10353
R37	.22 Ω	RESISTOR 2W 10% BWH	158-10279
R13,14,35	1.5 K	POTENTIOMETER	155-10086
T1		TRANSFORMER (REF)	082-13909
PCB		PC BOARD	505-13[illegible]
REF DES	PART OR IDENTIFYING NO	NOMENCLATURE OR DESCRIPTION	POWER-ONE STD P/N
PARTS LIST			

INSTALL SOCKET FOR U1,2.
R17 MAY BE TRIMMED IN TEST TO HELP SET OVP TO SPECS.
INSURE Q7 BODY IS WITHIN 1/8" OF PCB.
MI[illegible]UE FOR C8 IS 9000/15V, ANYTHING LESS IS NOT ACCEPTABLE.
[illegible]TES [illegible]RWISE SPECIFIED



PRODUCTION NOTES:

1. SET PF. TO GO HIGH AT 104 VAC WITH +12V AND +5V FULLY LOADED.

C1,2,7,[illegible]	1/50	CAPACITOR ALUM ELECT	101-10111
C5,6	7300/35		102-10098
C9	330/35		10[illegible]-10109
C10	5300/35		10[illegible]-[illegible]097
C13	100/35	ALUM ELECT	101-10110
C3,4,8	.0[illegible]/100	MYLAR	104-10095
C12	.0033/100	CAPACITOR, MYLAR	104-10[illegible]2
			402-13920
CR2,3,9	[illegible]	DIODE 1A 200V	111-10251
CR4,5	MR750		111-10256
CR6,7,10,12	[illegible]	3A 100V	111-10252
CR8,11	1N965B	ZENER	112-10009
CR1	[illegible]	DIODE ZENER	[illegible]
SCR1	S[illegible]LS3	SCR 8A	160-10[illegible]
SCR2	[illegible]LS[illegible]	SCR 3A	1[illegible]
Q1	[illegible]	TRANSISTOR	[illegible]
Q2	2N[illegible]554		1[illegible]-[illegible]50
Q3,4,6	[illegible]		171-[illegible]262
Q5	2N2907	TRANSISTOR	172-10248
R1	[illegible]	RESISTOR 1/4W 5% CF	151-10377
R2,33,35	4.7K		[illegible]
R28,41,46,23,16,31	2.2K		151-10373
R5	330 Ω		151-10353
R38,45,20,40,17,49	[illegible] Ω		151-[illegible]
R15,24,30,32,34,36	500 Ω		151-[illegible]
R7,48	1.		151-10365
R5,6,2	6.8 Ω		151-10313
R31	2.7 Ω		151-10305
R9	200 [illegible]	5% CF	151-10420
R13	47K	2% MF	152-10521
R3,4	2.4K		152-10514
R10	1K		152-10[illegible]5
R14,47,22	10K		152-10529
R29,44	2.2K		152-10513
R27,43	1.2K	1/4W 2% MF	152-10507
R39,18,19	.22 Ω	RESISTOR 2W BWH	158-10079
R2,11,26,21,42	1.5K	POTENTIOMETER	155-10086
U1	[illegible]	I.C. VOLTAGE REGULATOR	[illegible]
U2,3	μA 723	I.C. VOLTAGE REGULATOR	130-10267
PCB		PRINTED CIRCUIT BOARD	505-13[illegible]
T1		TRANSFORMER (REF)	082-13909
BRACKET [illegible]		BRACKET (REF)	41[illegible]-13903
QTY REQD / CODE IDENT	PART OR IDENTIFYING NO	NOMENCLATURE OR DESCRIPTION	[illegible]
PARTS LIST			

ILLUST #2

CONDOR INC.
D.C. POWER SUPPLIES
4811 CALLE ALTO
CAMARILLO, CALIF. 93010
(805) 484-2851

Information contained;
1. Schematic
2. Parts List
3. Specifications
4. Outline and Mounting
5. General User Information

MODEL
DBB-105W

APPLICATION DATA
DWG NO 11297 | SIZE C | REV A | SHEET 1 OF 1 | SCALE –
DATE 6/20/79 | APPROVALS | DRAWN | CHECKED | ISSUED | CONTRACT NO

REVISIONS

LTR	DESCRIPTION	DATE	APPROVED
A	APP'D FOR PRODUCTION	6-22-79	

SPECIFICATIONS

AC Input:	115/230vac±10% 47-440Hz. (Derate output current 10% for 50Hz Operation.)
DC Output:	Refer to Voltage/Current Rating Chart. Voltage adjustable ±5% minimum.
Input Fusing:	Refer to AC Connection Table.
Line Regulation:	±0.05% for 10% input change.
Load Regulation:	±0.05% for 50% load change.
Output Ripple:	3.0mv Pk-Pk maximum, 0.4mv RMS.
Transient Reponse:	30μ seconds for 50% load change.
Short Circuit and Overload Protection:	Automatic current limit/foldback.
Reverse Voltage Protection:	Provided on Dual and Triple output units.
Remote Sensing:	Provided on outputs above 15watts, open sense lead protection built-in.
Stability:	±0.05% for 24hours after warm-up.
Temperature Rating:	0°C to 50°C full rated, derated linearly to 40% at 70°C.
Temperature Coefficient:	±0.02%/°C maximum, 0.002%/°C typical.
Cooling:	Units are full rated 50°C in free air, must be derated or fan cooled when mounted in confined area.
Efficiency:	5V units-45%, 12 and 15V units-55%, 20 and 24V units-60% at nominal input, full load on output.
Vibration:	Per Mil-Std-810B, Method 514, Procedure I, curve AB (to 50Hz).
Shock:	Per Mil-Std-810B, Method 516, Procedure V.

AC CONNECTION TABLE

FOR USE AT	115 VAC	230 VAC
JUMPER	1 & 3, 2 & 4	2 & 3
APPLY AC AT	1 & 4	1 & 4
FUSE INPUT AT	3.0 AMPS	1.5 AMPS

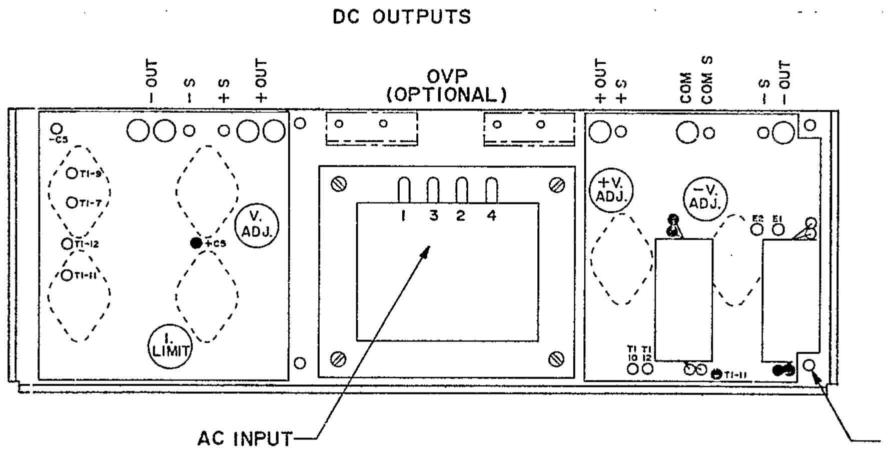
VOLTAGE/CURRENT RATING CHART

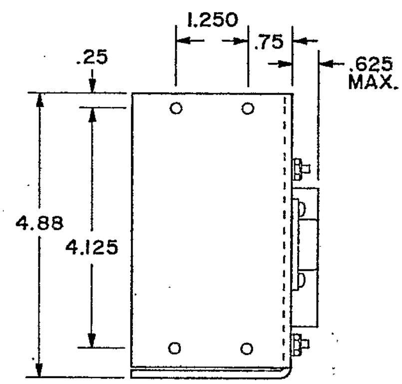
MODEL	OUTPUT RATING
DBB-105W	5V. AT 12A. W/OVP OVP SET AT 6.2±.4V.
	±12V. AT 1.7A. OR ±15V. AT 1.5A.

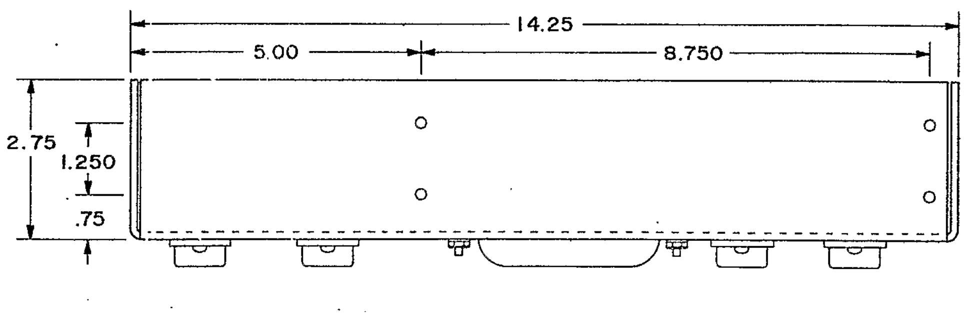
-12/-15V. USEABLE AT -5V. AT 0.7A. BY JUMPERING E1 TO E2.

2 YEAR GUARANTEE

CONDOR will repair or replace any power supply of its manufacture that does not perform to published specifications as a result of defective materials or workmanship for a period of 2 years from date of original purchase. No other obligations or liabilities are implied or expressed. Returns must be freight prepaid.







DBB CASE

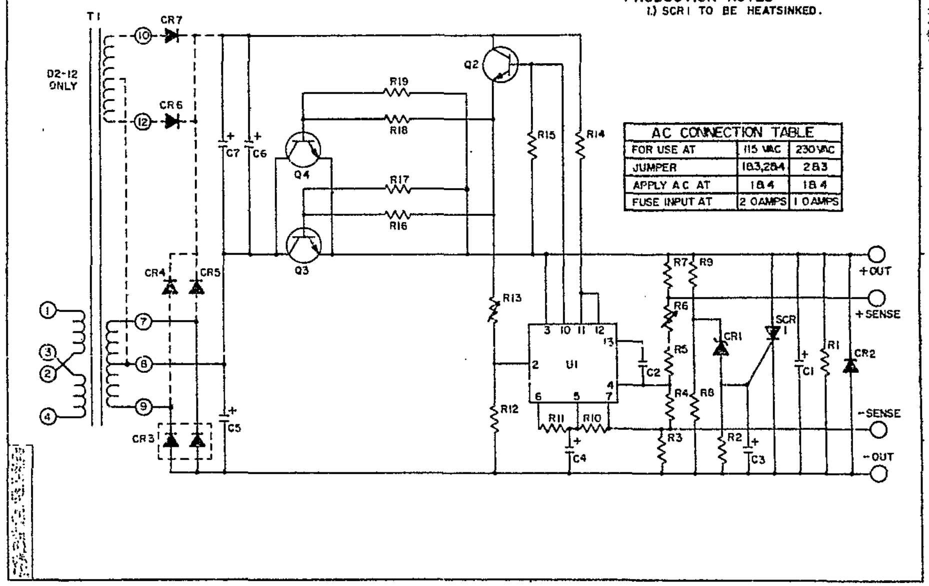
UNIT WEIGHT: 11 lbs.

CONDOR INC.
ASSEMBLY / OUTLINE & MOUNTING
DBB-105W
SIZE D | DWG NO 11236 | REV A
SCALE 1:1 | SHEET 1 OF

REF. DES.	D2-12	CONDOR P/N	QTY.	D5-12/OVP	CONDOR P/N	QTY.	DESCRIPTION
C1,6,7	1000/16	101-10108	3	1000/16	101-10108	3	CAPACITOR, ALUM., ELECT.
C3	—	—	—	10/25	101-10114	1	ALUM., ELECT.
C4	10/25	101-10114	1	10/25	101-10114	1	ALUM., ELECT.
C5	64000/15	103-10030	1	64000/15	103-10030	1	ALUM., ELECT.
C2	.0033/100	104-10092	1	.0033/100	104-10092	1	CAPACITOR, MYLAR
CR2	1N5401	111-10252	1	1N5401	111-10252	1	DIODE, RECT., 3A., 100 V.
CR3	R711A	140-10003	1	R711A	140-10003	1	BRIDGE
CR4,5	1N4003	111-10251	–	1N4003	111-10251	2	1A., 200V.
CR6,7	1N4003	111-10251	2	1N4003	111-10251	–	1A., 200V.
							RECT.,
CR1	—	112-	—	1N752A	112-10006	1	DIODE, ZENER, 5.6V.
SCR1	—	160-	—	S0508 LS3	160-10013	1	SCR, 8A., 50V.
Q1	2N6055	171-10263	—	2N6055	171-10263	—	XSTR., DARLINGTON, NPN
Q2	12500-5	171-10241	1	12500-3	171-10261	1	XSTR., POWER, NPN
Q3,4	12505-2	171-10262	2	12505-2	171-10262	2	XSTR., POWER, NPN
R1	47 Ω	151-10333	1	180 Ω	151-10347	1	RESISTOR, 1/2W., 5%, C.F.
R2	—	151-	—	47 Ω	151-10333	1	
R3,5,7	6.8 Ω	151-10313	3	6.8 Ω	151-10313	3	
R8	—	151-	—	180 Ω	151-10347	1	
R9,16,18	2.7 Ω	151-10305	3	2.7 Ω	151-10305	3	
R10	1.6K	151-10370	1	2.2K	151-10373	1	
R11	4.7K	151-10381	1	2.2K	151-10373	1	
R12	1K	151-10365	1	2.2K	151-10373	1	
R14	47 Ω	151-10333	1	47 Ω	151-10333	1	
R15	2.2K	151-10373	1	2.2K	151-10373	1	
R17,19	3.9 Ω	151-10307	2	15 Ω	151-10321	2	
		151-			151-		5%, C.F.
R4	4.7K	152-10521	1	1.6 K	152-10510	1	1%, M.F.
		152-			152-		1%, M.F.
		152-			152-		1/2W., 1%, M.F.
		158-			158-		RESISTOR, 2 W., 10%, W.W.
R6,13	1.5K	155-10085	2	1.5K	155-10085	2	POTENTIOMETER, 2W., W.W., HORZ.
U1	Ua723	130-10287	1	Ua723	130-10287	1	I.C. VOLTAGE REGULATOR
T1	11186	082-11186	1	11192	082-11192	1	TRANSFORMER, POWER
PCB	11184	505-11184	1	11184	505-11184	1	PRINTED CIRCUIT BOARD
HEATSINK	—	—	–	10669	319-10669	1	SPACER, ROUND 1" x 1/4"
CHASSIS	11003	412-11003	1	11003	412-11003	1	CHASSIS, ALUMINUM

SCHEMATIC D2-12 & D3-12/OVP 11183

PRODUCTION NOTES:
1.) SCR1 TO BE HEATSINKED.



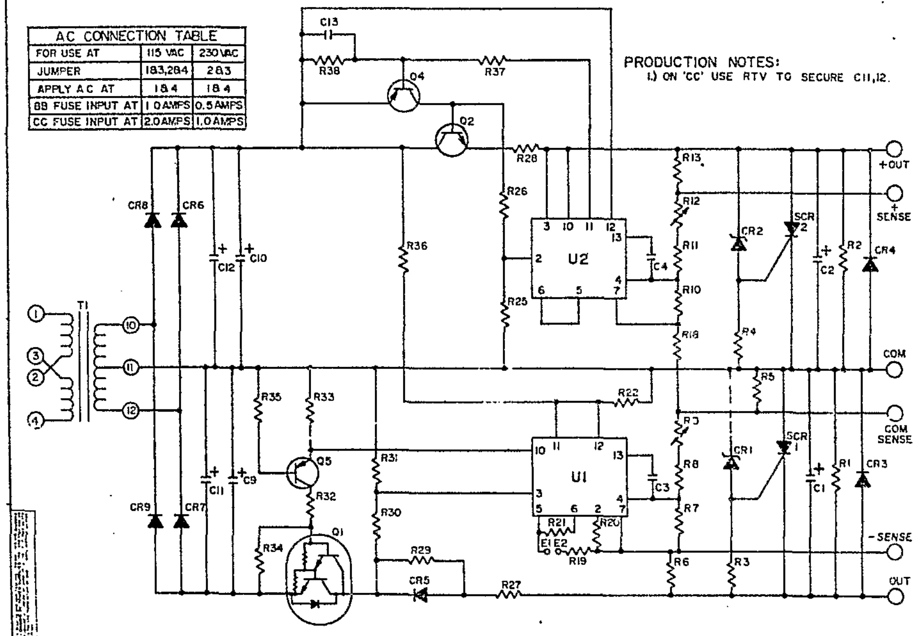
AC CONNECTION TABLE		
FOR USE AT	115 VAC	230 VAC
JUMPER	1&3, 2&4	2&3
APPLY A.C. AT	1&4	1&4
FUSE INPUT AT	2.0AMPS	1.0AMPS

REF. DES.	BB15	CONDOR P/N	QTY.	CC15	CONDOR P/N	QTY.	DESCRIPTION
C1,2	100/35	101-10110	2	100/35	101-10110	2	CAPACITOR, ALUM., ELECT.
C9,10	3300/35	102-10099	2	3300/35	102-10099	2	ALUM., ELECT.
C11,12	—	—	—	3300/35	102-10099	2	ALUM., ELECT.
C3	.1/100	104-10094	1	.1/100	104-10094	1	CAPACITOR, MYLAR
C4,13	.01/100	104-10095	2	.01/100	104-10095	2	CAPACITOR, MYLAR
CR3,4	1N4003	111-10251	2	1N4003	111-10251	2	DIODE, RECT., 200V, 1A.
CR5,6,7,8,9	1N5401	111-10252	5	1N5401	111-10252	5	100V., 3A.
							RECT.,
CR1,2	—	112-	—	—	112-	—	DIODE, ZENER
SCR1,2	—	160-	—	—	160-	—	SCR
Q1	2N6055	171-10263	1	2N6055	171-10263	1	XSTR., DARLINGTON, NPN
Q2	12500-5	171-10241	1	12500-5	171-10241	1	XSTR., POWER 40V, 1.7A.
Q3							XSTR., POWER
Q4	2N2905A	172-10248	1	2N6554	172-10250	1	XSTR., SIGNAL 60V. PNP
Q5	2N2905A	172-10248	1	2N2905A	172-10248	1	XSTR., SIGNAL 40V. PNP
R1,2,20,35,38	1K	151-10365	5	1K	151-10365	5	RESISTOR, 1/2W., 5%, C.F.
R3,4	47 Ω	151-10333	2	47 Ω	151-10333	2	
R5,6,13,18	6.8 Ω	151-10313	4	6.8 Ω	151-10313	4	
R8,11	180 Ω	151-10347	2	180 Ω	151-10347	2	
R22	1.6K	151-10370	1	1.6K	151-10370	1	
R25,31	4.7K	151-10381	3	4.7K	151-10381	3	
R26	300 Ω	151-10352	1	300 Ω	151-10352	1	
R29	2.7 Ω	151-10305	1	2.7 Ω	151-10305	1	
R30	270 Ω	151-10351	1	270 Ω	151-10351	1	
R32,33,36,37	330 Ω	151-10353	4	330 Ω	151-10353	4	
R34	—	151-	—	—	151-	—	
		151-			151-		5%, C.F.
R7,10	1.2K	152-10507	2	1.2K	152-10507	2	1%, M.F.
R19	2.7K	152-10515	1	2.7K	152-10515	1	1%, M.F.
R21	2.2K	152-10513	1	2.2K	152-10513	1	1/2W., 1%, M.F.
R27,28	.22 Ω	158-10079	2	.12 Ω	158-10077	2	RESISTOR, 2 W., 10%, W.W.
R9,12	1.5K	155-10085	2	1.5K	155-10085	2	POTENTIOMETER, 2W., W.W.
U1,2	Ua723	130-10287	2	Ua723	130-10287	2	I.C. VOLTAGE REGULATOR
T1	11265	082-11265	1	11375	082-11375	1	TRANSFORMER, POWER
PCB	11263	505-11263	1	11263	505-11263	1	PRINTED CIRCUIT BOARD
CHASSIS	11007	412-11007	1	11008	412-11008	1	CHASSIS, ALUMINUM

SCHEMATIC BB15/CC15 11262

AC CONNECTION TABLE		
FOR USE AT	115 VAC	230 VAC
JUMPER	1&3, 2&4	2&3
APPLY A.C. AT	1&4	1&4
BB FUSE INPUT AT	1.0AMPS	0.5AMPS
CC FUSE INPUT AT	2.0AMPS	1.0AMPS

PRODUCTION NOTES:
1.) ON 'CC' USE RTV TO SECURE C11,12.



CONDOR INC.
D.C. POWER SUPPLIES
4880 ADOHR LANE
CAMARILLO, CALIF.
93010
(805) 484-2851

Information contained;
1. Schematic
2. Parts List
3. Specifications
4. Outline and Mounting
5. General User Information

MODEL
BAA-40W

SPECIFICATIONS

AC Input:	115/230vac±10% 47-440Hz. (Derate output current 10% for 50Hz Operation.)
DC Output:	Refer to Voltage/Current Rating Chart. Voltage adjustable ±5% minimum.
Input Fusing:	Refer to AC Connection Table.
Line Regulation:	±0.05% for 10% input change.
Load Regulation:	±0.05% for 50% load change.
Output Ripple:	3.0mv Pk-Pk maximum, 0.4mv RMS.
Transient Reponse:	30μ seconds for 50% load change.
Short Circuit and Overload Protection:	Automatic current limit/foldback.
Reverse Voltage Protection:	Provided on Dual and Triple output units.
Remote Sensing:	Provided on outputs above 15watts, open sense lead protection built-in.
Stability:	±0.05% for 24hours after warm-up.
Temperature Rating:	0°C to 50°C full rated, derated linearly to 40% at 70°C.
Temperature Coefficient:	±0.02%/°C maximum, 0.002%/°C typical.
Cooling:	Units are full rated 50°C in free air, must be derated or fan cooled when mounted in confined area.
Efficiency:	5V units-45%, 12 and 15V units-55%, 20 and 24V units-60% at nominal input, full load on output.
Vibration:	Per Mil-Std-810B, Method 514, Procedure I, curve AB (to 50Hz).
Shock:	Per Mil-Std-810B, Method 516, Procedure V.

AC CONNECTION TABLE

FOR USE AT	115 VAC	230 VAC
JUMPER	1 & 3, 2 & 4	2 & 3
APPLY AC AT	1 & 4	1 & 4
FUSE INPUT AT	1.0 AMPS	0.5 AMPS

VOLTAGE/CURRENT RATING CHART

MODEL	OUTPUT RATING
BAA-40W	5V. AT 3.0A W/OVP OVP SET AT 6.2±.4V.
	±12V. AT 1.0A OR ±15V. AT 0.8A.

−12/−15V. USEABLE AT −5V. AT 0.4A. BY JUMPERING E1 TO E2.

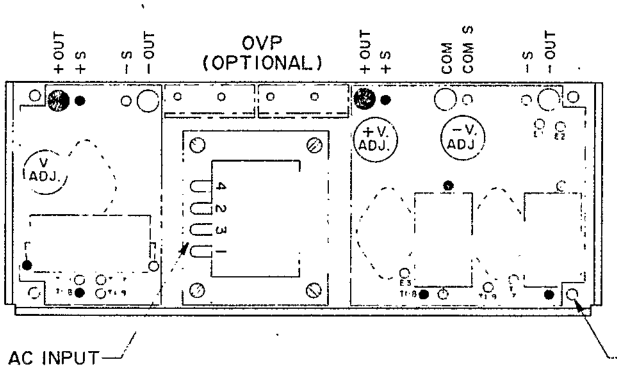
2 YEAR GUARANTEE

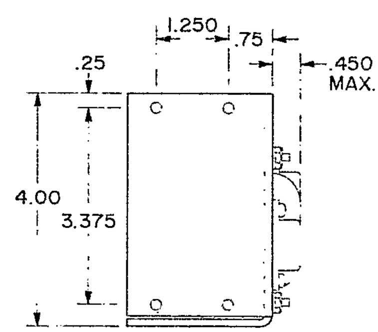
CONDOR will repair or replace any power supply of its manufacture that does not perform to published specifications as a result of defective materials or workmanship for a period of 2 years from date of original purchase. No other obligations or liabilities are implied or expressed. Returns must be freight prepaid.

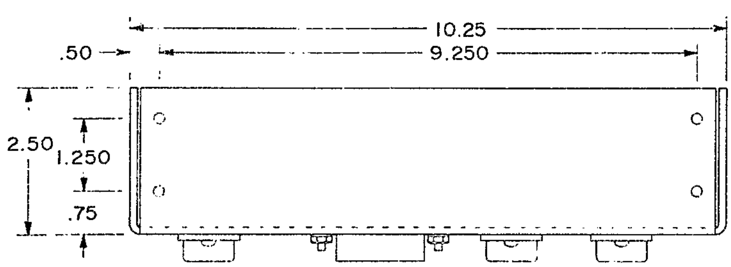
APPLICATION DATA
DWG NO 11316 · SIZE C · SHEET 1 OF 1 · REV A

REVISIONS

LTR	DESCRIPTION	DATE
A	APP'D FOR PRODUCTION	6-22-79







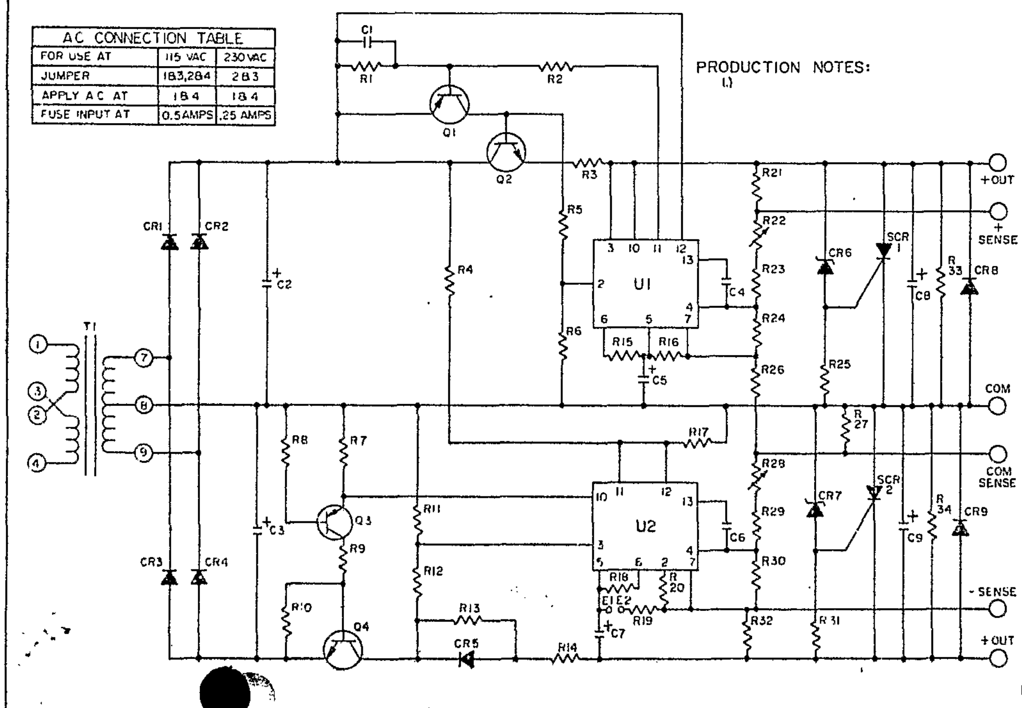
BAA CASE

UNIT WEIGHT: 5 lbs

REF. DES.	AA15-0.8	CONDOR P/N	QTY.	AA24-0.6	CONDOR P/N	QTY.	DESCRIPTION
C2,3	2200/35	102-10100	2	1000/60	102-10617	2	CAPACITOR, ALUM., ELECT.
C5,7	10/25	101-10114	—	10/25	101-10114	—	ALUM., ELECT.
C8,9	100/35	101-10110	2	100/35	101-10114	2	ALUM., ELECT.
C6	.1/100	104-10094	1	.1/100	104-10094	1	MYLAR
C1	.001/100	104-10093	—	.001/100	104-10093	—	MYLAR
C4	.01/100	104-10095	1	.01/100	104-10095	1	CAPACITOR, MYLAR
CR1,2,3,4,5,8,9	1N4003	111-10251	7	1N4003	111-10251	7	DIODE, RECT., 1A., 200V.
							RECT.,
CR6,7		112-	—		112-	—	DIODE, ZENER
SCR1,2	S0303LS3	160-10258	—	S0303LS3	160-10258	—	SCR, 3A., 30V.
	2N6055	17?-10263		2N6055	171 10263		XSTR., DARLINGTON, NPN
							XSTR., POWER
Q2,4	12500-3	171-10261	2	12500-3	171-10261	2	XSTR., POWER, 40V., 3.4A., NPN
Q1,3	2N2905A	172-10248	2	2N2905A	172-10248	2	XSTR., SIGNAL, 40V., PNP
R1,8,15,17,18	1.6 K	5 10370	5	1.6 K	151 10370	5	RESISTOR, 1/2W., 5%, C.F.
R2,5,7,9	330 Ω	151-10353	4	270 Ω	151-10351	4	
R4	330 Ω	151-10353	1	1.6 K	151-10370	1	
R6,10,11	4.7 K	151-10381	3	10 K	151-10389	3	
R12	470 Ω	151-10357	1	270 Ω	151-10351	1	
R13,20	3.9 Ω	151-10307	2	6.8 Ω	151-10313	2	
R16		151-	—		151-	—	
R21,26,27,32	3.9 Ω	151-10307	4	3.9 Ω	151-10307	4	
R25,31		151-	—		151-	—	
R33,34	1 K	151-10365	2	2.2 K	151-10373	2	
R19	1.6 K	151-10370	1		151-	—	
R23,29	180 Ω	151-10347	2	1.6K	151-10370	2	5%, C.F.
		152-			152-		1%, M.F.
		152-			152-		1%, M.F.
R24,30	1.2K	152-10507	2	1.0K	152-10505	2	1/2W., 1%, M.F.
R3,14	.56 Ω	158-10082	2	.56 Ω	158-10082	2	RESISTOR, 2 W., 10%, W.W.
R22,28	1.5 K	155-10085	2	1.5 K	155-10085	2	POTENTIOMETER, 2 W., W.W.
U1,2	Ua 723	130-10287	2	Ua 723	130-10287	2	I.C. VOLTAGE REGULATOR
T1	11096	082-11096	1	11102	082-11102	1	TRANSFORMER, POWER
PCB	11094	505-11094	1	11094	505-11094	1	PRINTED CIRCUIT BOARD
CHASSIS	11006	412-11006	1	11006	412-11006	1	CHASSIS, ALUMINUM

CONDOR INC.
SCHEMATIC AA15-0.8/AA24-0.6
11093
A APP'D FOR PRODUCTION 6-22-79

AC CONNECTION TABLE		
FOR USE AT	115 VAC	230 VAC
JUMPER	1&3, 2&4	2&3
APPLY A.C. AT	1&4	1&4
FUSE INPUT AT	0.5 AMPS	.25 AMPS

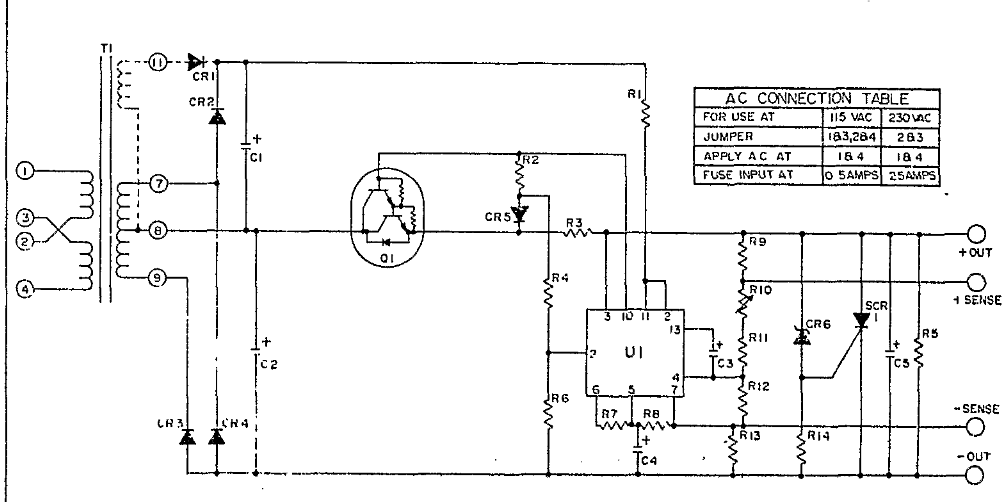


PRODUCTION NOTES:
1.)

REF. DES.	B2-3	CONDOR P/N	QTY.	B5-3	CONDOR P/N	QTY.	DESCRIPTION
C1,5	220/16	101-10107	2	220/16	101-10107	2	CAPACITOR, ALUM., ELECT.
C2	9000/15	102-10097	1	9000/15	102-10097	1	
C4	1/50	101-10111	1	1/50	101-10111	1	ALUM., ELECT
C3	.003/100	104-10092	1	.003/100	104-10092	1	MYLAR
							CAPACITOR,
CR1	1N4003	111-10251	1	-		-	DIODE, RECT.,
CR2	-		-	1N4003	111-10251	1	
CR3,4	1N5401	111-10252	2	1N5401	111-10252	2	
CR5	1N4003	111-10251	1	1N4003	111-10251	1	
							RECT.,
CR6	-	112-	-	-	112-	-	DIODE, ZENER
SCR1	-	160-	-	-	160-	-	SCR
Q1	2N6055	171-10263	1	2N6055	171-10263	1	XSTR., DARLINGTON, NPN
Q2							XSTR., POWER
Q3							XSTR., POWER
R1,2,4,5	180 Ω	151-10347	4	180 Ω	151-10347	4	RESISTOR, 1/2W., 5%, C.F.
R6	1K	151-10365	1	2.2K	151-10373	1	
R7	4.7K	151-10381	1	2.2K	151-10373	1	
R8	1 6K	151-10370	1	2.2K	151-10373	1	
R9,11,13	6 8 Ω	151-10313	3	6 8 Ω	151-10313	3	
R14	-	151-	-	-	151-	-	
		151-			151-		
		151-			151-		
		151-			151-		
		151-			151-		
		151-			151-		
		151-			151-		5%, C.F.
R12	4.7K	152-10521	1	1 6K	152-10510	1	1%, M.F.
		152-			152-		1%, M.F.
		152-			152-		1/2W., 1%, M.F.
R3	.12 Ω	158-10077	1	12 Ω	158-10077	1	RESISTOR, 2 W., 10%, W.W.
R10	1.3 K	155-10085	1	1.5 K	155-10085	1	POTENTIOMETER, 2 W., W.W.
U1	Ua 723	130-10287	1	Ua 723	130-10287	1	I.C. VOLTAGE REGULATOR
T1	11022	082-11022	1	11030	082-11030	1	TRANSFORMER, POWER
PCB	11021	505-11021	1	11021	505-11021	1	PRINTED CIRCUIT BOARD
CHASSIS	11001	412-11001	1	11001	412-11001	1	CHASSIS, ALUMINUM

CONDOR INC.
SCHEMATIC B2-3.0/B5-3.0
11018
B REDRAWN PER E.C.O. 046 3-18-80

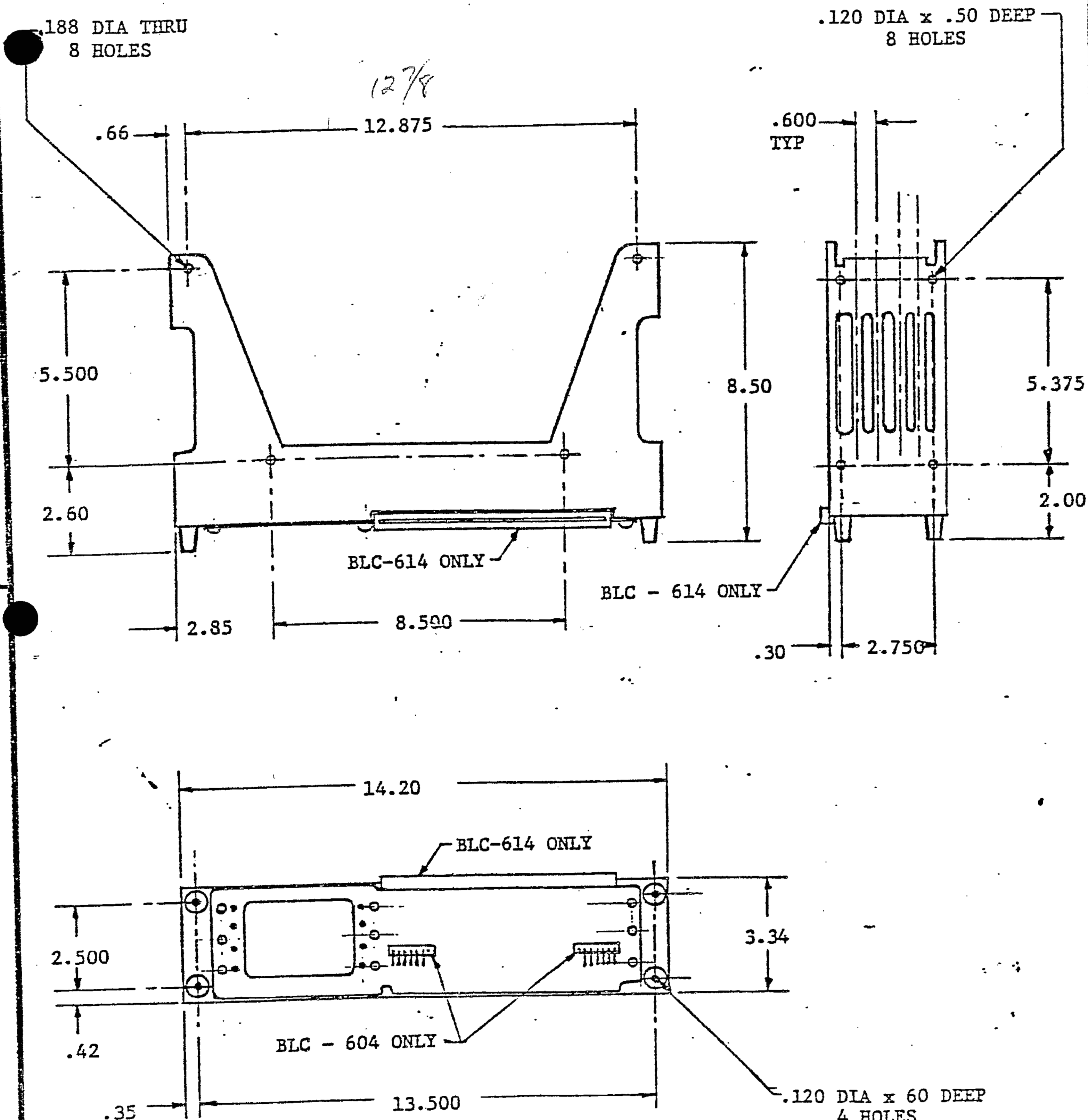
PRODUCTION NOTES:
1.)



AC CONNECTION TABLE		
FOR USE AT	115 VAC	230 VAC
JUMPER	1&3, 2&4	2&3
APPLY A.C. AT	1&4	1&4
FUSE INPUT AT	0.5 AMPS	.25 AMPS

CHASSIS OUTLINE

BLC MODULAR CARDCAGE



National Semiconductor Corporation 2900 Semiconductor Drive Santa Clara, California 95051	A	140305378	A
	SCALE .25:1	SHEET 2 OF 2	

42130007-001C

ILLUST. #4

Electronic Solutions
5780 Chesapeake Ct., San Diego, CA 92123
(714) 292-0242 (800) 854-7086
Telex II (TWX): 910-335-1169

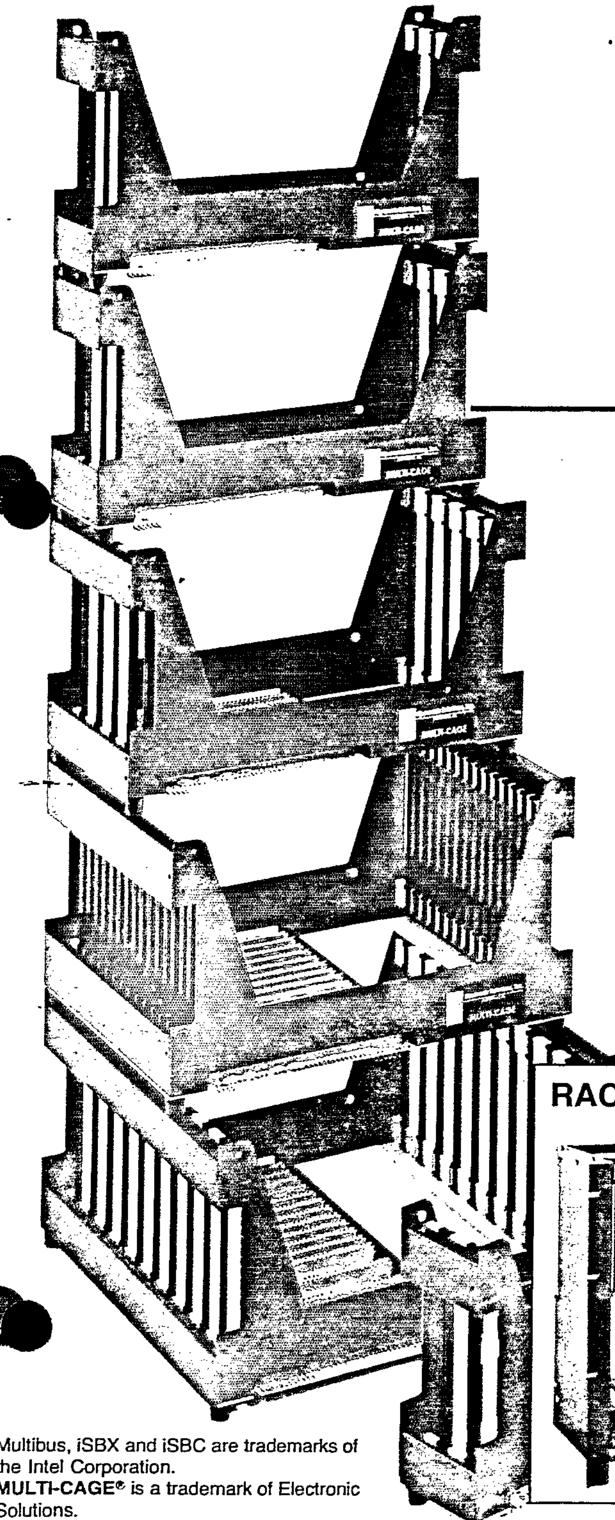
(1)

MULTI-CAGE®

Card Cages for the Multibus*

3 TO 26 SLOTS AVAILABLE

Designed To Save You Space



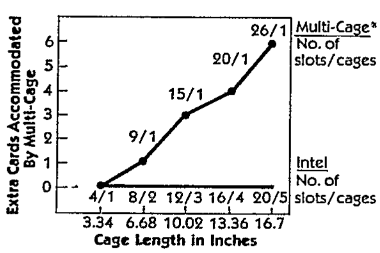
- Accepts iSBX* cards
- Accepts three-level w-w cards.
- Mates directly to Intel's iSBC* Card Cages
- Includes backplane power supply connectors
- Has smooth, easy insertion nylon card guides
- Has extensive ground plane for noise reduction
- Lightweight black anodized aluminum construction allows easy accessory mounting
- Has mounting provisions for −5V regulator (LM 320T-5.0)
- Has mounting provisions for reset switch (C&K 8121R)
- Rack mount models with vertical or horizontal slots

DESCRIPTION

The **MULTI-CAGE®** card cage with mother board backplane is designed to be 100% compatible with Intel's iSBC* 80 cards and card cages. All **MULTI-CAGE®** card cages (except the SBC 614) have resistor termination networks for bus signals. The SBC 614 has no termination network but has a female bus expansion connector added. All **MULTI-CAGES®** come with a male expansion connector. This connection may be solder plated (no suffix) or gold plated (G suffix).

More Room

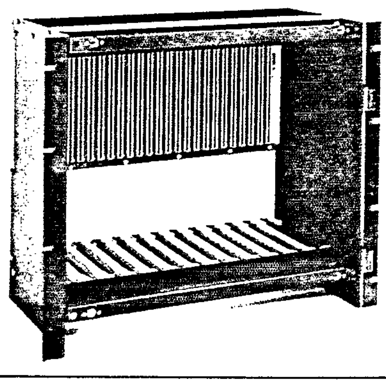
You get more room for extra cards without increasing overall size, because our design gives you greater inside dimensions.



More Reliability

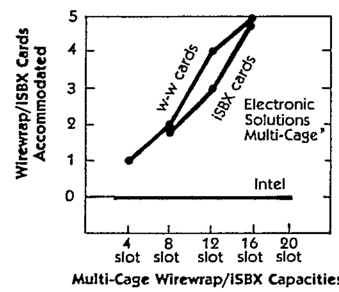
All cages are constructed of sturdy, durable anodized aluminum with a single mother board backplane ... a concept that increases reliability and minimizes interconnections.

RACK MOUNTING TOO!



More Models

We have more models than all our competitors combined. Choose a cage with 3, 4, 5, 6, 7, 8, 9, 12, 14, 15, 16, 20, 24 or 26 slots for the right solution to your problem. We have models with either 0.6″ or 0.75″ card centers and can even accommodate wirewrap and iSBX cards.



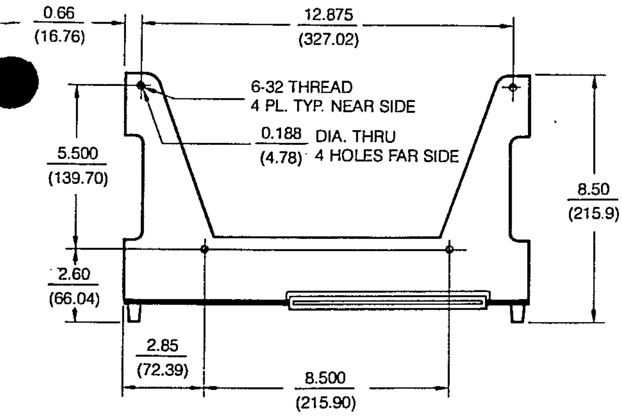
All models are electrically and dimensionally interchangeable with Intel's iSBC-80® Cages.

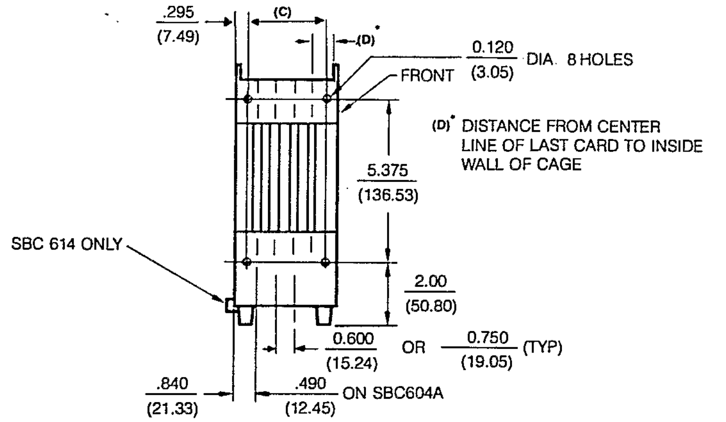
More Warranty

A three year warranty is your assurance of quality.

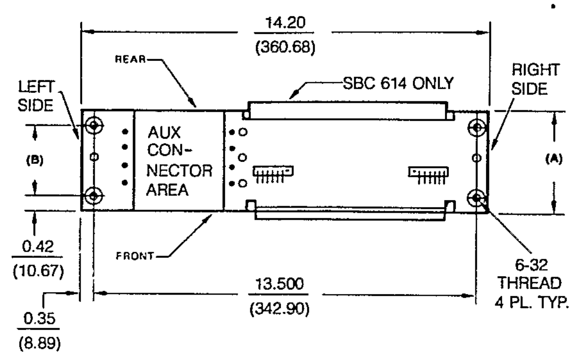
Electronic Solutions
5780 Chesapeake Ct., San Diego, CA 92123
(714) 292-0242 (800) 854-7086
Telex II (TWX): 910-335-1169

STANDARD MODELS





RIGHT SIDE VIEW

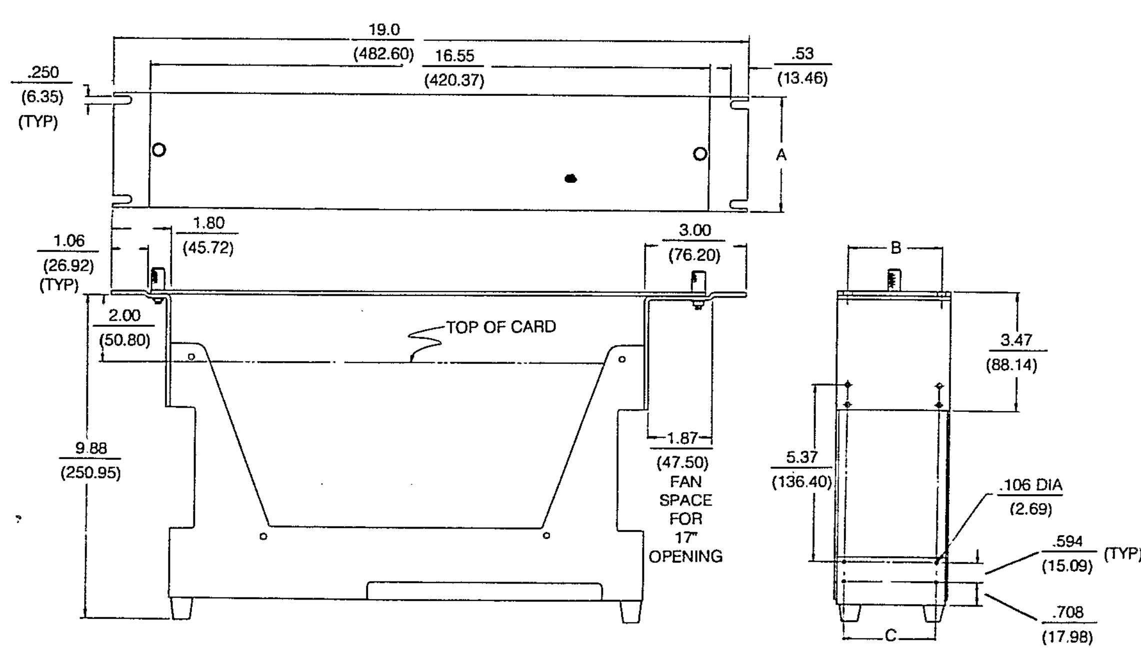


DIMENSION TABLE

Part No. .6" Center	Part No. .75" Center	A	B	C	D* .6" Center	D* .75" Center
ESBC 604 ESBC 614	SBC 753	3.34 in. (84.84) mm.	2.50 in. (63.5) mm.	2.750 in. (69.85) mm.	.61 in. (15.49) mm.	.91 in. (23.11) mm.
*SBC 604A	——	3.34 in. (84.84) mm.	2.50 in. (63.5) mm.	2.750 in. (69.85) mm.	.96 in. (24.38) mm.	——
SBC 605	SBC 754	3.94 in. (100.08) mm.	3.1 in. (78.74) mm.	3.35 in. (85.09) mm.	.61 in. (15.49) mm.	.76 in. (19.3) mm.
SBC 606	SBC 755	4.54 in. (115.32) mm.	3.7 in. (93.98) mm.	3.95 in. (100.33) mm.	.61 in. (15.49) mm.	.61 in. (15.49) mm.
SBC 608 SBC 609	SBC 757	6.68 in. (169.67) mm.	5.84 in. (148.34) mm.	6.09 in. (154.69) mm.	.95 in. (24.13) mm.	1.25 in. (31.75) mm.
SBC 6012 SBC 6014 SBC 6015	SBC 7512	10.02 in. (254.51) mm.	9.18 in. (233.17) mm.	9.43 in. (239.52) mm.	.69 in. (17.53) mm.	.84 in. (21.34) mm.
SBC 6016 SBC 6020	SBC 7516	13.36 in. (339.34) mm.	12.52 in. (318.00) mm.	12.77 in. (324.36) mm.	1.03 in. (26.16) mm.	1.18 in. (29.97) mm.
SBC 6024 SBC 6026	SBC 7521	16.7 in. (424.18) mm.	15.86 in. (402.84) mm.	16.11 in. (409.19) mm.	.77 in. (19.56) mm.	.77 in. (19.56) mm.

*This Dimension indicates clearance from the inside wall of the cage to the first card center.

HORIZONTAL RACK MOUNT MODELS



(3)

ORDERING INFORMATION

STANDARD MODELS

Models with .6 inch Card Centers				
Model	No. of Slots	No. of iSBX cards	No. of w-w cards	Price (1-4)†
ESBC 604	4	0	1	$ 195
ESBC 614G	4	0	1	220
SBC 604A	4	1	0	195
SBC 605	5	0	1	245
SBC 606	6	0	1	295
SBC 608	8	2	2	395
SBC 609	9	1	1	445
SBC 6012	12	3	4	645
SBC 6014	14	1	2	745
SBC 6015	15	0	1	795
SBC 6016	16	5	5	845
SBC 6020	20	1	1	1045
SBC 6024	24	2	3	1245
SBC 6026	26	0	1	1345

Models with .75 inch Card Centers				
Model	No. of Slots:	No. of iSBX cards	No. of w-w cards	Price (1-4)†
SBC 753	3	0	1	$ 190
SBC 754	4	0	1	235
SBC 755	5	0	1	270
SBC 757	7	1	1	380
SBC 7512	12	0	1	705
SBC 7516	16	1	1	925
SBC 7521	21	0	1	1200

†For gold expansion connector add $10 and use suffix G after Model #.

HORIZONTAL RACK MOUNTS

Models with .6 inch Card Centers				
Model	No. of Slots:	No. of iSBX cards	No. of w-w cards	Price (1-4)†
ESBC 604H	4	0	1	$ 325
SBC 604AH	4	1	0	325
SBC 605H	5	0	1	395
SBC 606H	6	0	1	445
SBC 608H	8	2	2	545
SBC 609H	9	1	1	595

Models with .75 inch Card Centers				
Model	No. of Slots:	No. of iSBX cards	No. of w-w cards	Price (1-4)†
SBC 753H	3	0	1	$ 320
SBC 754H	4	0	1	385
SBC 755H	5	0	1	420
SBC 757H	7	1	1	530

†For gold expansion connector add $10 and use suffix G after Model #.

VERTICAL RACK MOUNTS

Models with .6 inch Card Centers				
Model	No. of Slots	No. of iSBX cards	No. of w-w cards	Price (1-4)†
SBC 6012V	12	4	4	$ 895
SBC 6014V	14	2	2	995
SBC 6015V	15	1	1	1045
SBC 6016V	16	5	5	1095
SBC 6020V	20	1	1	1295
SBC 6024V	24	3	3	1495
SBC 6026V	26	0	1	1595

Models with .75 inch Card Centers				
Model	No. of Slots	No. of iSBX cards	No. of w-w cards	Price (1-4)†
SBC 7512V	12	0	1	$ 955
SBC 7516V	16	1	1	1175
SBC 7521V	21	0	1	1450

†For gold expansion connector add $10 and use suffix G after Model #.

P-2 BUS (AUXILIARY BUS)

Printed Circuit Board Only:			Assembled with connectors:		
Part Number	Number of Slots	Price Qty 1-9	Part Number	Number of Slots	Price Qty 1-9
P2-604P-*	4	$37.00	P2-604C-*	4	$ 97.00
P2-605P-___	5	38.00	P2-605C-___	5	113.00
P2-606P-___	6	39.00	P2-606C-___	6	129.00
P2-608P-___	8	40.00	P2-608C-___	8	160.00
P2-609P-___	9	40.00	P2-609C-___	9	175.00
P2-6012P-___	12	55.00	P2-6012C-___	12	235.00
P2-6014P-___	14	55.00	P2-6014C-___	14	265.00
P2-6015P-___	15	55.00	P2-6015C-___	15	280.00
P2-6016P-___	16	69.00	P2-6016C-___	16	309.00
P2-6020P-___	20	69.00	P2-6020C-___	20	369.00
P2-6024P-___	24	74.00	P2-6024C-___	24	434.00
P2-6026P-___	26	74.00	P2-6026C-___	26	464.00

* Use suffix E for PCB bused Point-to-Point, or use suffix M for PCB bused per Intel Multibus specification 9800683-02

ACCESSORIES

P2 Auxiliary Connectors (wire-wrap):		
	EZC 30 DRMD Selective Plated—Gold Contacts only	$ 7.50 ea.
	ESC 30 DRMD Gold Plated Pins	8.90 ea.
P2 Auxiliary Connectors (Solder Tab):		
	EZC 30 DTKD Selective Plated—Gold Contacts only	7.50 ea.
09-50-7071	Molex Mating Connectors, with Pins	2.50 ea.
LM 320T-5.0	−5V Regulator	12.00 ea.
8121 R	Reset Switch	8.60 ea.
FMB	Fan Mounting Bracket Kit for SBC 608, 609 and 757	12.00 ea.
MK-4	Spacer Mounting kit to replace rubber feet	3.00 ea.
PPRC-8	Eight Master Parallel Priority Resolution	55.00 ea.
PPRC-16	Sixteen Master Parallel Priority Resolution	70.00 ea.

More Information?

Call our toll free number
(800) 854-7086
In California call
(714) 292-0242

Electronic Solutions
5780 Chesapeake Ct., San Diego, CA 92123
(714) 292-0242 (800) 854-7086
Telex II (TWX): 910-335-1169