

2704 Inverter/2705 Battery Pack Instruction Manual

Operators Safety Summary

The general safety information in this part of the summary is for both operating and servicing personnel. Specific warnings and cautions will be found throughout the manual where they apply but may not appear in this summary.

Terms in this manual

CAUTION statements identify conditions or practices that could result in damage to the equipment or other property.

WARNING statements identify conditions or practices that could result in personal injury or loss of life.

Terms as marked on equipment

CAUTION indicates a personal injury hazard not immediately accessible as one reads the markings, or a hazard to property, including the equipment itself.

DANGER indicates a personal injury hazard immediately accessible as one reads the marking.

WARNING

This instrument is not rated for outdoor use. Use in inclement weather conditions can result in an electric shock.

AC POWER

The 2704 DC Inverter requires ac power to operate the internal battery charger. The 2705 Battery Pack is not connected directly to ac power.

Source voltage

The ac power source for the 2704 must not apply more than 250 V rms between the supply conductors or between either supply conductor and ground.

Grounding

This instrument is grounded through the grounding conductor of the power cord. To avoid electrical shock, ensure that the power source receptacle is properly wired before connecting it.

Danger from loss of ground

Upon loss of the protective ground connection, all accessible conductive parts (including knobs and controls that may appear to be insulating) can render an electric shock.

Use the proper power cord

See Section 1 for a list of Power Cord Options.

Use the proper fuse

For continued fire protection, observe the fuse specifications located on the front panel of the 2704.

DC POWER

The 2704 DC Inverter is powered by the 2705 Battery Pack or by an external +12 V dc supply. The 2705 Battery Pack is recharged by the 2704 DC Inverter.

Chassis (frame) ground

The frame of the 2704 DC Inverter is connected directly to the negative dc power input, the grounding conductor of the ac output cord, and the grounding conductor of the ac power cord. When the 2704 and 2705 are used to power the 2710 Spectrum Analyzer, the frames of all three instruments are floating with respect to earth ground unless the frame of the 2704 or the 2710 is connected to a ground (earth) reference.

When the 2704 DC Inverter powers the 2710 Spectrum Analyzer from an external dc source, the frames of the 2704 and 2710 are at the potential of the negative terminal of the dc source. Observe the following precautions when using an external dc power source:

Do not supply dc power to the 2704 from "positive ground" vehicle electrical systems.

Ensure that the outputs of the dc power source are completely isolated from earth ground (floating) or, alternatively, ensure that the negative output is connected to earth ground.

Dc power cord

Use only a dc power cord assembled in accordance with the instructions given in this manual. Use only a dc power cord that is in good condition.

BATTERY

WARNING - The battery in the 2705 Battery Pack is capable of delivering a large amount of current in a short time. The 2704 DC Inverter contains circuits to limit the current that the battery can deliver. Do not use the 2705 Battery Pack to supply power to any instrument other than the 2704 DC Inverter.

Use only the 2704 DC Inverter to recharge the 2705 Battery Pack.

Recharge the 2705 Battery Pack in a well ventilated location well away from any source of open flame or sparks.

Do not operate in explosive atmospheres

To avoid explosion, do not operate this product in an explosive atmosphere.

Do not remove covers or panels

To avoid personal injury, do not remove the product covers or panels. Do not operate the product without the covers and panels properly installed.

General Information

Introduction

Description

The TEKTRONIX 2704 DC Inverter and the 2705 Battery Pack form a complete portable ac power source for use with the Tektronix 2710 Spectrum Analyzer. They are designed to allow operation of the 2710 in locations where ac power is not available. The 2704 and 2705 will operate the 2710 for a minimum of one hour. An additional 2705 Battery Pack, or an external 12 volt dc source, can be connected to the 2704 DC Inverter to extend operating time to two hours or more.

The 2705 Battery Pack contains a rechargeable, 15 ampere-hour, sealed lead-acid battery that supplies 12 V dc (nominal) to the 2704 DC Inverter. The 2704 converts the 12 V dc at its input to 115 V ac which it supplies to the instrument it is powering. The 2704 also contains a battery charger to recharge the 2705 and a +18 V dc output to power devices such as LNAs and LNBs used in satellite downlink applications.

The 2704 DC Inverter and the 2705 Battery Pack can be attached to the bottom of the 2710. Alternatively, they can be attached together and carried separately from the 2710.

Standard Accessories

The 2704 is shipped with the following standard accessories:

- 1 Instruction Manual
- 2 Mounting adaptor and hardware to attach 2704 and 2705 to the 2710 Spectrum Analyzer
- 3 DC input connector

Optional Accessories

The following optional accessories are available for the 2704

- 1 AC power cord. The following cord options are available
- 2 DC power cord. The following cord options are available:
 - a) 1.5 meter cord with connector for 2704 on one end and auto cigarette lighter plug on other end,
 - b) 1.5 meter cord with connector for 2704 on one end and bare wires on other end.

Specifications

1. 2704 Electrical Specifications

1.1	DC input voltage range	10 VDC to 15 VDC (for proper operation) 0 VDC to 20VDC (no damage)
1.2	Battery protection shut-down limit	10 VDC \pm 5%
1.3	Voltage required to restart after battery protection shutdown	11.5 VDC \pm 5%
1.4	Low battery warning	Audible alarm at least 5 minutes prior to shutdown
1.5	Output voltage	115 VAC rms \pm 10% (must be measured with true rms measuring meter)
1.6	Output frequency	60 Hz \pm 5%
1.7	Output waveform Crest factor	Quasi-sinusoid (see Figure 1-1) 1.3
1.8	Maximum output power - continuous	125 watts (Operating time limited by battery)
	- peak	180 watts
1.9	Battery charger input voltage	90 to 250 VAC 50/60 Hz 90 to 125 VAC 400 Hz
1.10	Battery charger power consumption	70 watts maximum
1.11	Auxiliary supply output voltage	18 volts DC \pm 10%
1.12	Auxiliary supply ripple and noise	100 millivolts pk-pk maximum.
1.13	Auxiliary supply output current	1.2 amperes maximum (current limited)

2. 2705 Electrical Specifications

2.1	Battery type	Sealed lead-acid. 12V, 15 amp-hr.
2.2	Battery voltage range	10 VDC to 14.4 VDC
2.3	Minimum battery operating time (with 2710 Spectrum Analyzer as load, aux supply providing no power, and battery fully charged)	1 hour when ambient temperature is 10°C to 40°C 45 min. when ambient temperature is 0°C to 10°C

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|-----|---|--|
| 2.4 | Battery charging time (using charger in 2704) | 8 hours from a fully discharged state at ambient temperatures between 0°C to 40°C when only one 2705 pack is being charged. 12 to 16 hours when two 2705 packs are being recharged simultaneously. |
| 2.5 | Battery charge retention (@ 20°C) | >95% at 1 month (recharge battery after 6 to 9 months of storage) |
| 2.6 | Battery cycle life | >150 charge/discharge cycles to 100% discharge (assuming batteries are never left in discharged state for more than 8 hours) |

3. Environmental Characteristics

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|------|--|--|
| 3.1 | Operating temperature | 0° C to 40° C |
| 3.2 | Storage temperature | -20° C to 50° C (Battery will self-discharge at an accelerated rate above 30° C) |
| 3.3 | Humidity | Five cycles (120 hours) in accordance with MIL-Std-28800D, class 5 |
| 3.4 | Operating and charging altitude | 4600 meters (15,000 ft.) max. Maximum operating temperature decreases by 1° C for each 300 meters (1000 ft) above 1500 meters. |
| 3.5 | Storage altitude | 15,200 meters (50,000 ft.) maximum. |
| 3.6 | Vibration (units <u>not</u> mounted to 2710 Spectrum Analyzer) | MIL-Std-28800D. Method 514 Procedure X (modified). |
| 3.7 | Shock (operating and non-operating) (Units <u>not</u> mounted to 2710 Spectrum Analyzer) | Three guillotine-type shocks of 30g, one-half sine, 11 ms duration each direction along each major axis; total of 18 shocks. |
| 3.8 | Transit Drop (free fall) (Units <u>not</u> mounted to 2710 Spectrum Analyzer) | 8 inch, one per each of 6 faces and 8 corners. |
| 3.9 | Electromagnetic Interference | Meets FCC Part 15, sub-part J, Class A limits for radiated and conducted emission. |
| 3.10 | Electrical Safety | Design complies with UL Standard 1244 for Measuring and Testing Equipment, CSA 231 (proposed), and IEC 348. |

4. Physical Characteristics

4.1 Dimensions

2704		
Width		265 mm (10.4 in)
Height		85 mm (3.3 in)
Depth		152 mm (6 in)

2705		
Width		265 mm (10.4 in)
Height		85 mm (3.3 in)
Depth		195 mm (7.7 in)

4.2 Weight

2704	1.4 kg (3.1 lb)
2705	6.6 kg (14.5 lb)

Preparation For Use

Refer to the "Operators Safety Summary" at the front of this manual for power source, grounding, and other safety considerations pertaining to the use of the 2704 and 2705. Before connecting the the 2704 to a dc power source other than the 2705, carefully read the following information about the dc voltage and the dc power cord.

DC Voltage Source

The 2704 DC Inverter is intended to operate from a power source of 10 Vdc to 15 Vdc. The input voltage must be at least 11.5 volts for the 2705 to start operation. The output resistance of the external dc source must be $\leq 0.05 \Omega$ and it must be able to deliver at least 12 amperes of current.

The 2704's battery protection shutdown circuit may shut the inverter down even though the dc source voltage appears to be above 10 volts. This can be caused by one of the following conditions:

DC source with poor voltage regulation.

DC input cable with a high resistance causing a higher than normal voltage drop (see next section).

Weak or discharged batteries.

Dc power supply with inadequate current rating.

DC Input Power Cord

The 2704 is supplied with an Amp circular plastic connector which attaches to the auxiliary dc

power input on the 2704. A qualified service person may connect a cord to this connector and then attach the desired plug or connector to the other end of the cord to produce a dc input power cord for use with an auxiliary dc power source.

The pin configuration for the Amp connector is shown in Figure 2-1. The cord conductors and connectors must be sized to carry up to 12 amperes. The total resistance of the cord and connectors should not exceed 0.1Ω.

Overload and Thermal Protection

To protect the 2704 components from damage, the instrument ac output will shut down when the ac power output becomes excessive or if the 2704 is overheating because of improper ventilation. During the shut-down period the low battery alarm will sound. To turn the alarm off and return the 2704 to normal operation, follow this procedure:

1. Disconnect the output load.
2. Ensure that all ventilation openings are unobstructed.
3. Set the 2704 power switch to "Standby".
4. Wait 5 minutes.
5. Set the 2704 power switch to "On"

If the audible alarm tone returns, refer the instrument to a qualified service person.

If the 2704 returns to normal operation, reconnect the output load. If the output shuts down again, check that the instrument being powered is one of the specified load instruments and is functioning properly.

Instrument Cooling

The 2704 is fan cooled. To prevent internal components from overheating, at least 2 inches clearance must be allowed at the sides of the 2704 to allow the fan to draw adequate air into the intake on one side and expel it out the exhaust on the other side.

Inspection

The 2704 and 2705 were inspected both mechanically and electrically before shipment. They should be free of mechanical damage and meet or exceed all electrical specifications. Instruments that are damaged or do not perform correctly should be referred to a qualified service person.

Repackaging for Shipment

When the 2704 or the 2705 are to be shipped to a Tektronix Service Centre for service or repair, attach a tag that shows:

- the owner and address
- the name of the individual at your location who may be contacted

- the complete instrument serial number (2704 only)
- a description of the service required.

The 2705 Battery Pack must be fully recharged before it is shipped.

Use the original shipping container or one of equivalent test strength and inside dimensions. Surround the instrument with plastic sheeting to protect the finish. Cushion the instrument on all sides with packing material or plastic foam.

Storage

For **Short Term** (less than 90 days) store the instruments in an environment that meets the non-operating environmental specifications. See Specifications Section 2. Recharge the 2705 Battery Pack fully before storing it. For maximum battery life, do not store the 2705 Battery Pack in locations where the ambient temperature exceeds 30° C.

For **Long Term** (more than 90 days) use the original shipping container to repackage the instrument. Package the instrument in a vapor bag with a drying material and store in a location that meets the non-operating environmental specifications.

The 2705 Battery Pack should not be stored in a location where the ambient temperature exceeds 30° C. Recharge the 2705 fully before storing it and recharge it every 180 days if the storage temperature is below 30° C. If the storage temperature exceeds 30° C, recharge every 90 days.

Installation on the 2710 Spectrum Analyzer

Two mounting straps, with slots at each end, are welded on the bottom of the 2710 Spectrum Analyzer. These mounting straps with the conversion kit supplied with the 2704 DC Inverter provide the means to attach the 2704 and 2705 to the Spectrum Analyzer. The following procedure describes the process for installing the 2704 DC inverter and the 2705 Battery Pack.

1. Lay the 2710 Spectrum Analyzer on its top so that the underside is exposed. Note the two straps, with slots at each end, welded to the bottom of the instrument.
2. Slide the four (4) stud plates, from the mounting kit, into the slots on the mounting strip.
3. Now place the adapter plate, with the oval carrying hole facing the front of the 2710, on the mounting studs and bolt it on to the studs using the plain washers and the 8-32 nuts supplied with the conversion kit. Using a 5/16 inch wrench, tighten the nuts holding the adapter plate on to the studs.
4. The 2704 DC Inverter is equipped with guides on its top that fit over the sides of the adapter plate. Slide the 2704 on to the adapter plate from the front of the 2710 with the front panel of the 2704 facing forward. Slide the 2704 on until the adapter plate hits the stops on the guides.
5. Plug the ac output cord on the rear of the 2704 DC Inverter into the ac input receptacle at the rear of the 2710 Spectrum Analyzer. Arrange the cord so that it runs straight back down the middle of the adapter plate. Set the DC Power switch on the 2704 to "Standby".

6. The 2705 Battery Pack is also equipped with guides on its top that fit over the sides of the adapter plate. Slide the 2705 on to the adapter plate from the rear of the 2710 with the feet of the 2705 facing backwards. Slide the 2705 on to the adapter plate for 2 to 3 inches.
7. Connect the DC Output cord from the 2705 Battery Pack to the Battery Input receptacle on the rear of the 2704 DC Inverter.
8. Slide the 2705 on to the adapter plate until it mates with the rear of the 2704.
9. Using the latches on the sides of the 2704, attach the 2705 to the 2704.
10. The 2710 Spectrum Analyzer is now ready for battery power operation.

Controls and Connectors

2704 Front Panel

Refer to Figure 2-2 for location of items 1 through 5.

1. AC Input Receptacle - This receptacle accepts the standard or any of the optional power cords. It is used to supply power to the internal battery charger.
2. Auxiliary Output - This receptacle provides +18 V dc (1 ampere maximum) to power devices such as LNAs and LNBs used in satellite downlink applications. The receptacle is a standard miniature phone jack that accepts a 3.5 mm Ø miniature phone plug. Polarity of the miniature phone plug is as follows:

Tip	+18V
Barrel	0 V (common to frame of 2704)

3. Battery Charge Status Indicators - These indicators are active when ac power is applied to the ac input receptacle on the 2704.
 - Charging indicator lights when ac power is applied to the ac input receptacle, indicating that the battery charger circuit is active.
 - 60% Charged indicator lights when the battery has been charged to approximately 60% of its capacity.
 - 100% Charged indicator lights when the battery is completely charged.
4. Battery Power Switch and Indicator - The switch connects power from the battery or auxiliary power input receptacles to the inverter and the auxiliary dc supply when it is in the "On" position. The switch should be set to the other (standby) position when the 2704 is not in use in order to minimize battery drain.

The indicator lamp indicates that battery power is connected when it is glowing steadily. If it is blinking, it indicates that the battery must be recharged.

5. Auxiliary Power Input - This receptacle accepts power from an external dc power source such as an extra 2705 Battery Pack or a vehicle's 12V electrical system. When dc sources are connected

to both the auxiliary power input and the battery input on the 2704, power is drawn only from the auxiliary input. Refer to Section 1 for information on the characteristics required for the external dc source and the specifications for the dc power cord.

This receptacle is connected to the output of the battery charger in the 2704, allowing it to be used to recharge extra 2705 Battery Packs.

2704 Rear Panel

6. AC Output Cord - A permanently attached three-wire ac power cord is used to connect the output ac voltage of the 2704 to the instrument to be driven. At the end of the ac power cord is a three-contact polarized ac plug for connection to the instrument.

7. Battery Input - This receptacle provides the connection point for the 2705 Battery Pack.

2705 Battery Pack

8. Battery Connection Cord - Connects the 2705 to the battery input or the auxiliary power input of the 2704 DC Inverter. The cord is stored inside the chassis of the 2705.

Operation

Operating Time The 2710 will operate for a minimum of one hour from a new, fully charged 2705 Battery Pack when the ambient temperature is above 10° C. Operating time will be less if the battery pack has experienced a number of charge-discharge cycles, if it isn't fully charged, or if the temperature is below 10° C.

Operating time can be extended to two hours by connecting a second fully charged 2705 Battery Pack to the auxiliary dc input on the 2704 when the low battery warning sounds. The 2704 is designed to switch to the new battery source without interrupting ac power to the 2710.

Even longer operating times can be achieved if the 2704 can be connected to a 12 V vehicle electrical system. A typical 60 amp-hr automobile battery will allow 2 to 3 hours of operation before the vehicle's engine must be started to recharge the battery.

Low Battery Warning and Shutdown The 2704 will sound an audible alarm when the dc input voltage drops below 10.5 volts. If the dc power source is the 2705 Battery Pack, the alarm indicates that there is only five minutes of operating time left. This warns the user to prepare to shut down the 2710 or to plug in an auxiliary power source to extend the operating time.

The 2704 will automatically shut down when the dc input voltage reaches 10 volts. This protects battery sources from damage due to over-discharge. The low battery alarm will continue to sound. The alarm can be turned off by setting the Battery Power switch to the standby position. The red indicator lamp beside the switch will then begin to blink as a reminder that the battery must be recharged.

CAUTION

The battery in the 2705 must be recharged as soon as possible after it has been completely discharged. Storing the battery in the discharged state for more than a few days may result in sulphation of its plates, which will decrease its capacity.

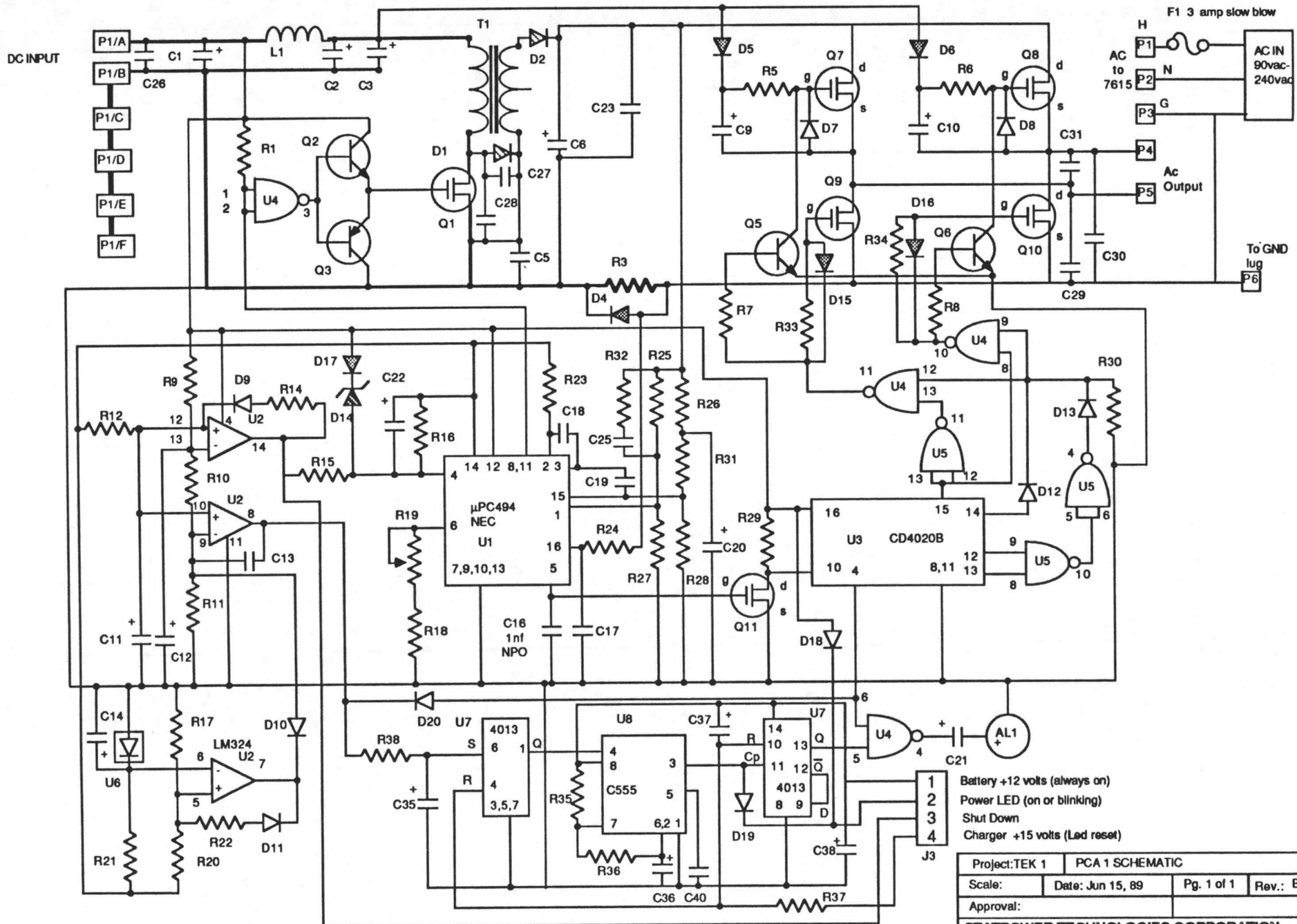
Charging The 2704 can charge up to two 2705 Battery Packs simultaneously. The Battery Packs must be connected to the battery input or the auxiliary dc input. The inverter does not operate while charging is in progress. Charging starts when the 2704 is connected to ac power. Charging can be stopped by disconnecting the ac power.

Charging time Charging a fully discharged 2705 Battery Pack requires approximately 8 hours. When two fully discharged 2705 Battery Packs are being charged simultaneously, 14 to 16 hours are required. The battery charger switches to a float charge mode after the battery is fully charged, so the charger may be left on indefinitely.

Equalization charge A 2705 Battery Pack may be used before it is fully recharged, if necessary. However, the 2705 should be completely recharged (as indicated by the 100% Charged indicator), to equalize the cells in the battery, if it has been partially recharged more than 10 times in succession.

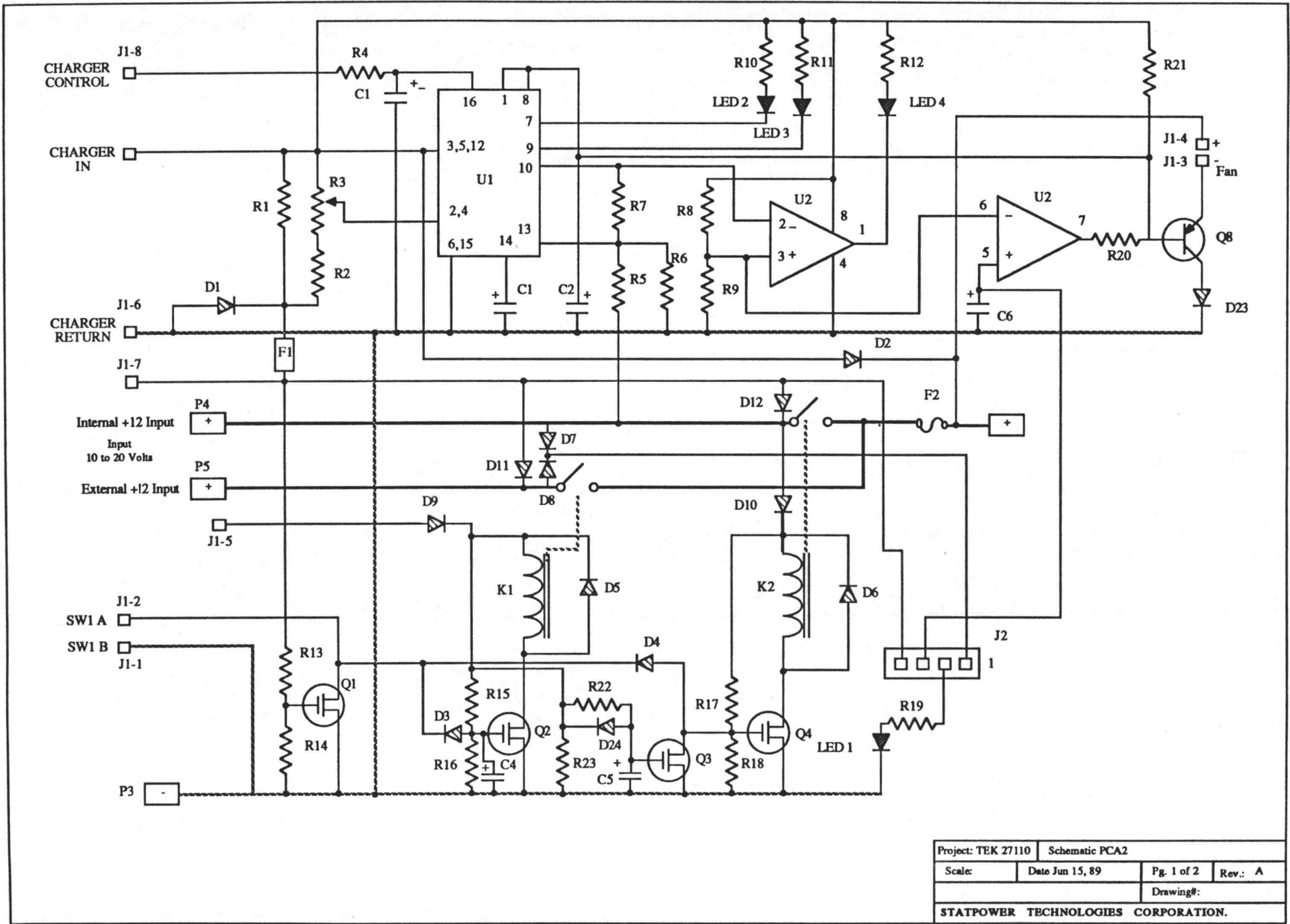
Battery Charge Status The battery charge status indicators are controlled by the charging circuit and are only active while the charger is on. If the charger is connected to a fully charged battery, the indicators will not immediately show that it is 100% charged. The charger uses battery current and voltage sensing combined with sequenced current and voltage control states to maximize battery capacity and life. It takes the charger several minutes to sequence through the states to reach the 100% charged state even when the battery is fully charged.

Theory of Operation



- 1 Battery +12 volts (always on)
- 2 Power LED (on or blinking)
- 3 Shut Down
- 4 Charger +15 volts (Led reset)

Project: TEK 1		PCA 1 SCHEMATIC	
Scale:	Date: Jun 15, 89	Pg. 1 of 1	Rev.: B
Approval:			
STATPOWER TECHNOLOGIES CORPORATION.			



Project: TEK 27110		Schematic PCA2	
Scale:	Date Jun 15, 89	Pg. 1 of 2	Rev.: A
		Drawing#:	
STATPOWER TECHNOLOGIES CORPORATION.			

Level	Designation	Qty	Description	Value	Manuf. Part #	Manufacturer	Notes
2704	Cable	1	Line Cord, Equipment	17250	17250	Belden	For powering charger
2704	H1	1	Right angle strain relief	1374(Black)	1374	Heyco	
2704	H10,11	2	Standoff	6/32/ 1/4" Round .25di nylon			For mounting small feet. Used to center screws
2704	H2,3,4,5,6	5	Standoffs	#8/ 0.25"/Hex Aluminum			For mounting PCA2 and Charger
2704	H7	1	Standoff	1/4" nylon #6 not threaded			For mounting charging supply. goes only next two ground faston!
2704	H8,9	2	Feet small	348-0991	348-0991	Comtec	mount on 2704 cover with #6 standoff in them
2704	J1,2	2	Receptacle	206060-1	206060-1	AMP	Internal and external +12 volt connectors
2704	J3	1	Housing 8 pin (conn)	CE100F24-8-	CE100F24-8-	Panduit	For main harness, connects to PCA2.
2704	J4,5	2	Housing 4 pin (conn)	CE100F24-4-	CE100F24-4-	Panduit	For main harness, connects to PCA2.
2704	J6	1	3 Pin Molex	09-062037	09-062037	Molex	For battery charger
2704	Lable	1	Lable ,Front Panel			Sytek	Not defined yet
2704	Lable	1	Rear Label			Sytek	Not defined yet
2704	M1	1	Fan	A32322	A32322-18	Nidec-Torin	Wires must be trimmed
2704	P1 to P12,P17,18,19,20	16	Fastons 1/4 inch	640903-1	640903-1	Amp	Female fastons for hardness
2704	P13,14,15,16,21,22	7	Pins Male	66099-2	66099-2	Amp	Pins for internal and external amp +12 connectors
2704	PCA3	1	Charger Power Supply	NSF40-7615	NSF40-7615	Computer Products	15 volt 3 amp charging supply
2704	Sheet Metal	1	Chassis	Drawing Item D	Drawing Item D	Acrodyne Mfg.	Anodized black
2704	Sheet Metal	4	Mounts	Drawing Item F	Drawing Item F	Acrodyne Mfg.	Anodized black
2704	Sheet Metal	2	Carrier Rails	Drawing Item E	Drawing Item E	Acrodyne Mfg.	Anodized black
2704	Sheet Metal	1	Cover	Drawing Item C	Drawing Item C	Acrodyne Mfg.	Painted tek Blue
2704	SW1	1	Switch	4440991	4440991	Carling	
2705		1	Chassis bracket			Acrodyne Mfg.	Anodized Black
2705	B1	1	Battery Sealed Lead Acid	NP15-12	8806070	Yuasa	Battery 12V / 15A
2705	H1	1	Cover	Drawing Item A	Drawing Item A	Acrodyne Mfg.	Painted Tek Blue
2705	H10,11,12,13	4	Standoff Aluminum	1/4" #6 unthreaded Aluminum			For mounting feet and securing battery
2705	H2	1	Chassis	Drawing Item B	Drawing Item B	Acrodyne Mfg.	Anodized Black
2705	H3,4	2	Rubber Feet	348-0990		C. F. Plastics	Mount on the end of the battery pack. They come as a pair and must be cut in half
2705	H5	1	Strain Relief	1150(Black)	1150	Heyco	For battery cable/ mounts to bracket
2705	H6,H7	2	Latches	07-10-301-12	07-10-301-12	Southco	latch part mounts to 2704. Keeper mounts to 2705
2705	H8	1	#10 Terminal 18 AWG	2-36154-2	2-36154-2	AMP	For black and green wires to battery
2705	H9	1	#10 Terminal 14 AWG	2-36160-1	2-36160-1	AMP	For white wire to battery
2705	J1	1	Plug, Circular Plastic AMP	206061-1	206061-1	AMP	+12 volt connector for end of power cord.
2705	P1,2,3,4	4	Pin Female	66101-2	66101-2	AMP	Female pins for +12V connector
2705	W1	1	Cable 18 AWG SVT 18/3 cor approx. 2 feet		SPU-3122-02M-BL	Pacific Electricord	This is the +12 volt power cable. The black and green are (-) white is (+)
PCA1	AL1	1	Alarm 2KHz piezo	QMB-6	QMB-6	Star	
PCA1	C1,2,3	3	Capacitor Electrolytic Radial	1500µ/25 V	SXE25VB125M16X20LL	UCC	
PCA1	C11,14,35,37,38	5	Capacitor Electrolytic Radial	10µ/25 V	ULB1H100MAA	Marcon	
PCA1	C12, 21	2	Capacitor Electrolytic Radial	1µ/50 V	50TWL1	Rubycon	
PCA1	C16,27,28	3	Capacitor Ceramic NPO	.001µ/ 50 V	C315C109D5U1CA	Kemet	
PCA1	C20	1	Capacitor Electrolytic Radial	4.7µ/100 V		Rubycon	
PCA1	C22	1	Capacitor Electrolytic Radial	47µ/35 V	16956/17544SPINTL	Rubycon	
PCA1	C23,29,30,31	4	Capacitor Film	.0068/250 V	368-55682	Philips MTK Series	
PCA1	C25	1	Capacitor Film	.047/250 V	368 MTK Series	Philips	
PCA1	C26	3	Capacitor Ceramic	3.3nf/50 V		Philips	
PCA1	C36	1	Capacitor Electrolytic Radial	100µ/25 V		Rubycon	
PCA1	C4,12,19,22	4	Capacitor film	.1µ/63v		Evox	
PCA1	C5	1	Capacitor Ceramic Z5U	.22µ/50 V		Siemens	
PCA1	C6	1	Capacitor Electrolytic Axial	68µ/180 V	042-1689	Philips	
PCA1	C9,10,13,17,18,19,40	7	Capacitor Film	0.1µ/63 V		Evox	
PCA1	D1	1	100v/1 amp FR		MUR110	Motorola	
PCA1	D14	1	ZENER Diode 13 volt 1 watt	1N4743A	1N4743A	ITT	
PCA1	D2	1	600v/4amp FR	MUR460	MUR460	Motorola	
PCA1	D4,5,6	3	200v/1 amp	1N4004	1N4002	GI	
PCA1	D7,8,9,10,11,12,13,15,16,17	10	Diode 75 w/ .2 amp	1N4148	1N4148or 1N914	or 1N914	
PCA1	F1	1	Fuse 3 amp	MDL 3	313.003	Little Fuse	AC Input fuse
PCA1	H1	1	TO-220 Nylon bushing	3102		Keystone	For IRFZ40
PCA1	H2	1	TO-220 Mica Insulator			Keystone	For IRFZ40

Level	Designation	Qty	Description	Value	Manuf. Part #	Manufacturer	Notes
PCA1	H3	1	Screw #4 X 40 X 1/2" Rob				For IRFZ40
PCA1	H4	2	PEM nut #4				For IRFZ40
PCA1	H5	1	Transformer Insulator	CE Laminate 1/32"	Drawing #017	Statpower	Placed under transformer
PCA1	H6	1	Fuse Holder		345-101	LittleFuse	
PCA1	H7	1	Shield power section		Drawing #014	Statpower	Block EMI at power section
PCA1	J1	1	AC Input	4300.0071	4300.0071	Schurter	
PCA1	J2	1	4pin Header .1" spacing	MLSS100-4-	MLSS100-4-	Panduit	
PCA1	L1	1	Inductor	150nh		Nexus	
PCA1	P1,2,3,4,5,6,7,8	8	Faston Tab PCB mount			Keystone	Inverter O/I and GND connectors
PCA1	PCB1	1	Printed Circuit Board			Circuit Graphics	
PCA1	Q1	1	MOSFET 50V/.028Ω	IRFZ40	Only Approved Manuf.	IR,MOT	
PCA1	Q11	1	MOSFET 60V/ 3Ω	VN10KM	Only Approved Manuf.	Siliconix	
PCA1	Q2	1	Trans NPN	PN2222A			
PCA1	Q3	1	Transistor PNP	PN2907A			
PCA1	Q5,6	2	Trans 300v	MPS-A42	Only Approved Manuf.	Mot,Nat,Ge,RCA	
PCA1	Q7,8,9,10	4	MOSFET 200V/0.4Ω	IRF630		MOT	
PCA1	R1,20,21	3	Resistor 1/4W 5%	1K			
PCA1	R10	1	Resistor 1/4W 1%	3.24K			
PCA1	R11	1	Resistor 1/4W 1%	47.5K			
PCA1	R14	1	Resistor 1/4W 1%	30.0K			Feed back on low voltage shut down
PCA1	R15	1	Resistor 1/4W 5%	2.7K			
PCA1	R16	1	Resistor 1/4W 5%	68K			
PCA1	R17	1	Resistor 1/4W 1%	2.49K			
PCA1	R18	1	Resistor 1/4W 1%	7K15			
PCA1	R19	1	Resistor ADJ	1K Trimmer		Beckman,Spectrol	
PCA1	R25,32	2	Resistor 1/4W 1%	499K			
PCA1	R26,31	2	Resistor 1/4W 1%	249K			
PCA1	R27	1	Resistor 1/4W 1%	17.4K			
PCA1	R30	1	Resistor 1/4W 5%	6K8			
PCA1	R35,22	2	Resistor 1/4W 1%	22K			
PCA1	R36	1	Resistor 1/4W 1%	10K			
PCA1	R37,38	2	Resistor 1/4W 5%	1M			
PCA1	R5,8,33,34	4	Resistor 1/4W 5%	330K			
PCA1	R7,8,12,23,24,29	6	Resistor 1/4W 5%	10K			
PCA1	R9	1	Resistor 1/4W 1%	49.9K			
PCA1	T1	1	Transformer			Best Coil	Transformer
PCA1	U1	1	Pulse width modulator	UC494N	Only Approved Manuf.	Unitrode	
PCA1	U2	1	Quad op-amp	LM324N	Only Approved Manuf.	Signetic	
PCA1	U3	1	CMOS 14 Stage counter	CD4020B	Only Approved Manuf.	SGS Thompson	
PCA1	U4	1	CMOS Quad Nand	CD4011B	Only Approved Manuf.	RCA	
PCA1	U5	1	CMOS Quad Nand Schmitt tr	CD4093B	Only Approved Manuf.	Toshiba	
PCA1	U6	1	Temperature Sensor	LM335Z	Only Approved Manuf.	Nat, Thompson	
PCA1	U7	1	CMOS Dual JK Flip-Flop	CD4013B	Only Approved Manuf.	RCA	
PCA1	U8	1	CMOS Timer	CM555	ICM555	Intersil	
PCA2	C1,2,3,5,6	5	Capacitor Tantalum	10μf/16 V		Kemet	
PCA2	C10,11,13,15	4	Capacitor Electrolytic Radial	1500μf/25V	SXE25VB152M16X20LL	UCC	
PCA2	C17	1	Capacitor Electrolytic Radial	10μf/25 V		Macon	
PCA2	C18,21	2	Capacitor Ceramic NPO	.001μf/ 50 V	C1315C109D5U1CA	Kemet	
PCA2	C20	1	Capacitor Ceramic	47nf/100v		Philips	
PCA2	C4,12,19,22	4	Capacitor film	1μf/63v		Evox	
PCA2	D1,22	2	Diode	1N5402		Motorola	
PCA2	D11,12	2	450v/10 amp	MBR1045		Motorola	
PCA2	D2,21	2	Diode Schottky 40v / 3 amp	1N5822		Motorola	
PCA2	D20	1	100v/1 amp	MUR 110		Motorola	
PCA2	D3,4,5,6,7,8,9,10,23,24	10	200 V 1 amp	1N4005		Motorola	
PCA2	F1,3	2	Polyswitch 5 amp	R-270	RBE270A		
PCA2	F2	1	Fuse 15 amp 32 volt			Little Fuse	

Level	Designation	Qty	Description	Value	Manuf. Part #	Manufacturer	Notes
PCA2	H1	1	Shield power section				
PCA2	H2,3	2	Fuse Clips			Little Fuse	
PCA2	J1	1	8 pin Header .1" spacing		LMSS100-8-	Panduit	
PCA2	J2	1	4 pin Header .1" spacing		LMSS100-4-	Panduit	
PCA2	J3	1	audio connector				DC output
PCA2	K1,2	2	Relay SPST 30 amp	G8P-1114P-US	G8P-1114P-US	Omron	
PCA2	L2	1	Ind.				
PCA2	LED 1	1	Red Power	HLMP-3750	HLMP-3750	General Instrument	Red, Power on
PCA2	LED 2	1	Charging	HLMP-3950	HLMP-3950	General Instrument	Green, battery is in charge
PCA2	LED 3	1	50%	HLMP-3950	HLMP-3950	General Instrument	Green, 50% charged
PCA2	LED 4	1	100%	HLMP-3950	HLMP-3950	General Instrument	Green, 100% charged
PCA2	P1,2,3,4	4	Faston Tab PCB mount			AMP	Input DC voltage connectors
PCA2	PCB1	1	Printed Circuit Board			Circuit Graphics	x
PCA2	Q1, 2,3,4	4	MOSFET 50V 0.4 Ω	MTD5N05E-1		Motorola	
PCA2	Q5	1	MOSFET 200V 0.028 Ω	IRF Z40		International Rectifier	
PCA2	Q6	1	Trans NPN	PN2222A			
PCA2	Q7,8	1	Transistor PNP	PN2907A			
PCA2	R 4	1	Resistor 1/4W 5%	20K			
PCA2	R1,36,37	3	Resistor 1W 5%	.1 Ω			
PCA2	R10,11,12,19	4	Resistor 1/4W 5%	680 Ω			
PCA2	R15,17, 32,13	4	Resistor 1/4W 5%	100 K			
PCA2	R16,18,14	3	Resistor 1/4W 5%	1 Meg			
PCA2	R2	1	Resistor 1/4W 5%	4.7K Ω			
PCA2	R20	1	Resistor 1/4W 5%	1K5			
PCA2	R21,23,35,40	4	Resistor 1/4W 5%	10K			
PCA2	R22	1	Resistor 1/4W 5%	4M7			
PCA2	R3,42	2	Resistor ADJ	1K Trimmer		Beckman, Spectrol	
PCA2	R30	1	Resistor 1/2W 5%	3K			
PCA2	R34	1	Resistor 1/4 W 1%	7K15			
PCA2	R43	1	Resistor 1/4W 1%	27K			
PCA2	R5	1	Resistor 1/4W 1%	49.9K			
PCA2	R6,33,44	3	Resistor 1/4W 1%	10K			
PCA2	R7	1	Resistor 1/4W 1%	200K			
PCA2	R8	1	Resistor 1/4W 5%	8.2K			
PCA2	R9,31	2	Resistor 1/4W 5%	1K			
PCA2	T1	1	Transformer				
PCA2	U1	1	Battery Charge Controller	UC3906N	UC3906	Unitrode	
PCA2	U2	1	Dual op-amp	LM358N	LM358N	Signetics	
PCA2	U3	1	Pulse width modulator	UC494N	UC494N	Unitrode	