

Instruction Manual



2704 Inverter & 2705 Battery Pack

070-7840-03

Warning

The servicing instructions are for use by qualified personnel only. To avoid personal injury, do not perform any servicing unless you are qualified to do so. Refer to all safety summaries prior to performing service.

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In order to obtain service under this warranty, Customer must notify Tektronix of the defect before the expiration of the warranty period and make suitable arrangements for the performance of service. Customer shall be responsible for packaging and shipping the defective product to the service center designated by Tektronix, with shipping charges prepaid. Tektronix shall pay for the return of the product to Customer if the shipment is to a location within the country in which the Tektronix service center is located. Customer shall be responsible for paying all shipping charges, duties, taxes, and any other charges for products returned to any other locations.

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EC Declaration of Conformity

We

Tektronix Holland N.V.
Marktweg 73A
8444 AB Heerenveen
The Netherlands

declare under sole responsibility that the

2704 Inverter & 2705 Battery Pack

meet the intent of Directive 89/336/EEC for Electromagnetic Compatibility.
Compliance was demonstrated to the following specifications as listed in the Official
Journal of the European Communities:

EN 50081-1 Emissions:

EN 55022	Class B Radiated and Conducted Emissions
EN 60555-2	AC Power Line Harmonic Emissions

EN 50082-1 Immunity:

IEC 801-2	Electrostatic Discharge Immunity
IEC 801-3	RF Electromagnetic Field Immunity
IEC 801-4	Electrical Fast Transient/Burst Immunity
IEC 801-5	Power Line Surge Immunity

The 2704 Inverter is certified when used with the 2705 Battery Pack and a 2700-series
spectrum analyzer.

Tektronix, Inc. claims compliance to the EMC Directive 89/336/EEC for the following
products when they are used with the above named product:

2700-Series Spectrum Analyzers.

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General Safety Summary

This general safety information is for operating and servicing personnel. Specific warnings and cautions may also be found throughout this manual where they apply.

Symbols and Terms

These two symbols appear in manuals:



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



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

These terms appear on equipment:

- **CAUTION** indicates a hazard to property, including equipment itself, and could cause minor personal injury.
- **WARNING** indicates solely a personal injury hazard not immediately accessible as you read the marking.
- **DANGER** indicates a personal injury hazard immediately accessible as one reads the marking.

These symbols appear in manuals:



This symbol indicates where applicable cautionary or other information is to be found.



Static-Sensitive Devices

These symbols appear on equipment:



DANGER
High Voltage



Protective ground
(earth) terminal



ATTENTION
Refer to
manual



Refer to
manual

Specific Precautions

Observe all of these precautions to ensure your personal safety and to prevent damage to either the instrument or equipment connected to it.



WARNING. To avoid possible serious injury or death, do not use the 2704 Inverter/2705 Battery Pack for spectrum analyzer input voltages greater than 60 VDC, unless the spectrum analyzer chassis is reliably connected to ground.

Power Disconnect

The main power disconnect is by means of the power cord, or, if provided, an AC power switch.

Use the Proper Power Cord

Use only the power cord and connector specified for your product. Use only a power cord that is in good condition. CSA Certification includes the equipment and power cords appropriate for use in the North America power network. All other power cords supplied are approved for the country of use.

Use the Proper Fuse

To avoid fire hazard, use only a fuse of correct type, voltage rating, and current rating.

Remove Loose Objects

During disassembly or installation procedures, screws or other small objects may fall to the bottom of the mainframe. To avoid shorting out the power supply, do not apply power to the instrument until such objects have been removed.

Do Not Operate Without Covers

To avoid personal injury or damage to the product, do not operate this product with covers or panels removed.

Remove From Operation

If you have reason to believe that the instrument has suffered a component failure, do not operate the instrument until the cause of the failure has been determined and corrected.

**Do Not Operate in
Wet/Damp Conditions**

Using the 2704 DC-to-AC Inverter and 2705 Battery Pack in wet/damp conditions or inclement weather may result in electric shock or damage to the instrument.

**Do Not Operate in
Explosive Atmospheres**

To avoid explosion, do not operate this product in an explosive atmosphere unless it has been specifically certified for such operation.

Service Safety Summary

Only qualified personnel should perform service procedures. Read this *Service Safety Summary* and the *General Safety Summary* before performing any service procedures.

Do Not Service Alone

Do not perform internal service or adjustments of this product unless another person capable of rendering first aid and resuscitation is present.

Disconnect Power

To avoid electric shock, disconnect the main power by means of the power cord or, if provided, the power switch.

Use Care When Servicing With Power On

Dangerous voltages or currents may exist in this product. Disconnect power, remove battery (if applicable), and disconnect test leads before removing protective panels, soldering, or replacing components.

To avoid electric shock, do not touch exposed connections.



User Information

Product Description

Description

The Tektronix 2704 Inverter and 2705 Battery Pack form a complete portable AC power source for use with Tektronix 271X-Series Spectrum Analyzers. They allow operation of AC powered instruments in locations where mains power is not available. The 2704 Inverter and 2705 Battery Pack will operate Tektronix 271X-Series Spectrum Analyzers for a minimum of 50 minutes unless otherwise noted. Additional 2705 Battery Packs, or an auxiliary 12 volt DC source, can be connected to the 2704 Inverter to further extend the operating time.

The 2704 Inverter converts 12 VDC (nominal) at its input to quasi-sinusoidal 115 VAC_{RMS} at its output and supplies it to the instrument being powered. The 2704 Inverter also contains a battery charger to recharge one or two 2705s, and a +18 VDC auxiliary output to power devices such as LNAs used in satellite downlink applications. A low battery warning and inverter shutdown circuit is standard.

The 2704 Inverter is fan cooled and provided with overload and thermal protection.

The 2705 Battery Pack contains a rechargeable, 15 ampere-hour, sealed lead-acid battery that supplies 12 VDC (nominal) to the 2704 Inverter. The battery pack mates with, and attaches to, the back of the 2704. Battery charge status indicators are provided on the 2704.

The 2704 Inverter and the 2705 Battery Pack are usually attached to the bottom of the Tektronix 271X-Series Spectrum Analyzer. The 2704 Inverter and 2705 Battery Pack can, however, be used (or carried) joined together as a separate package.

The 2704 Inverter and 2705 Battery Pack are for use with the Tektronix 271X-Series Spectrum Analyzer only.

Standard Accessories

Table 1–1 lists standard accessories provided with the 2704/2705.

Table 1–1: Standard Accessories

Description	Part Number
Instruction Manual	070-7840-XX
Mounting adapter and hardware to attach the 2704/2705 to the 271X Spectrum Analyzer.	118-8545-XX
AC power cord suitable for use in North America (alternate types A1 through A5 may be selected at time of order — see <i>Optional Accessories</i> section).	161-0104-00
Connector kit to construct a user-specific DC power cord. (see <i>Maintenance</i> section)	118-8551-XX
2705 Battery Pack carrying strap	118-8745-XX

Optional Accessories

AC Power Cord Options

Table 1–2 lists AC power cords that are available for use with the 2704 Inverter and 2705 Battery Pack.

Table 1–2: Power-Cord and Plug Identification

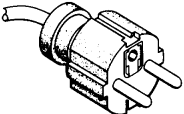
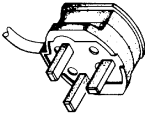
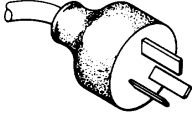
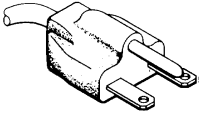
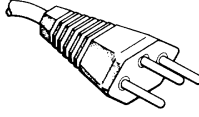
Plug Configuration	Nominal Usage	Option #	Part Number
	Europe 230 V	A1	161-0104-06
	United Kingdom 230 V	A2	161-0104-07
	Australia 230 V	A3	161-0104-05

Table 1-2: Power-Cord and Plug Identification (Cont.)

Plug Configuration	Nominal Usage	Option #	Part Number
	North America 230 V	A4	161-0134-00
	Switzerland 230 V	A5	161-0167-00

DC Power Cord Options

The following DC power cords are available for use with the 2704 Inverter and 2705 Battery Pack.

- 1.5 meter cord with a connector for the 2704 Inverter on one end and an automobile cigarette lighter plug on the other end (P/N 118-8549-XX).
- 1.5 meter cord with a connector for the 2704 Inverter on one end and alligator clips on the other end (P/N 118-8550-XX).

Specifications

This section includes electrical, environmental, and physical characteristics of the Tektronix 2704 Inverter and 2705 Battery Pack.

Electrical Characteristics

Performance Requirements – These statements define characteristics that are essential to the intended application of the product.

Supplemental Information – These statements provide more explanation about related Performance Requirements, or they describe typical performance for characteristics.

Verification of Tolerance Values

When performing compliance tests of specified limits, use measurement instruments that do not affect the values measured. Measurement tolerances of test equipment should be negligible when compared to the specified tolerance. When the tolerance of the test equipment is not negligible, add the error of the measuring device to the specified tolerance.

Table 2–1: 2704 Inverter Electrical Characteristics

Characteristic	Performance Requirement	Supplemental Information
DC Input Voltage (main and auxiliary inputs) Operating: Non operating:	11.25 VDC to +15.00 VDC 17 VDC maximum	Measured at the Input Power connector of the 2704 Inverter under full load conditions DC voltage plus any ripple present cannot go below minimum or above maximum voltage specified under full load conditions Shutdown occurs when DC input voltage is dropped or raised above operating DC input specification Shutdown occurs when continuous AC output current exceeds preset limit of approximately 1.5 ampere
AC Output Voltage	115 VAC _{RMS} ±10%	Measured with a true RMS measuring meter
AC Output Frequency	60 Hz ±5%	
AC Output Waveform		Quasi-Sinusoidal (See Figure 2–1)
AC Output Power	Continuous: 115 Watts (Max)	Peak: will power 271X instrument
Auxiliary Output Voltage	+18 VDC , ±10%	
Auxiliary Output Current	Maximum: 1 Ampere	
Auxiliary Output Ripple/Noise		200 mV (typical)
Battery Charger Input Voltage	90 to 250 VAC _{RMS}	48 to 66 Hz
Battery Charger Power Consumption		70 Watts (typical) Charger will automatically switch to float charge when battery or batteries are fully charged
Battery Charging Time		8 Hours (typical) For temperatures between 0° C and +40° C The following conditions apply when charging the 2705 Battery Pack: Two 2705 Battery Packs can be charged simultaneously in a maximum of 12 hours 100% charge is reached when the charging voltage is approximately 14.4 volts AC power can remain connected to the AC INPUT without overcharging the batteries.

Table 2-1: 2704 Inverter Electrical Characteristics (Cont.)

Characteristic	Performance Requirement	Supplemental Information
Audible Alarm Time	Minimum: 5 Minutes	When powered by 2705 Battery Pack Warning, of low battery voltage, prior to power shutdown Nominal 2 kHz Tone After audible Alarm sounds, Battery Power LED flashes when power switch is turned OFF Battery Power LED stops flashing once AC power is connected to AC Input receptacle

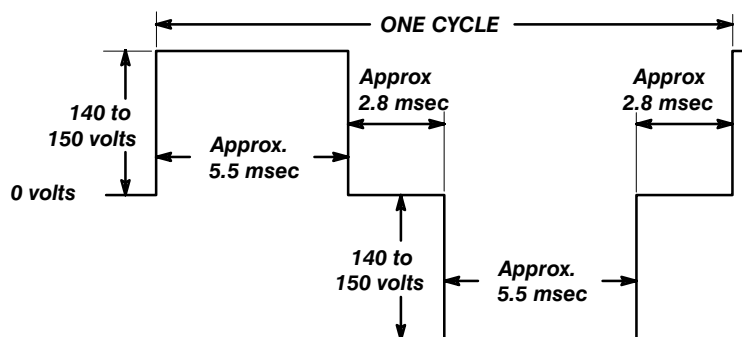


Figure 2-1: 2704 Inverter Quasi-Sinusoidal Output Waveform

Table 2–2: 2704 Inverter Environmental Characteristics

Characteristic	Description
Temperature	
Operating	0° C to +50° C
Battery Charging	0° C to +40° C
Non operating	–20° C to +60° C
Humidity	
Operating	95%, ±5% up to 30 ° C 75%, ±5% 31 ° C to 40° C 45%, ±5% 41° C to 50° C
Non operating	Five cycles (120 hours) in accordance with MIL-Std-28800E, class 5
Altitude	
Operating	15,000 feet (4600 meters)
Non operating	50,000 feet (15,200 meters)
Vibration, Operating (instrument secured to a vibration platform during test)	
Operating	MIL-Std-28800E, Paragraph 4.5.5.3.1, Table XVI Class 5 (Modified) 0.015 inch p-p displacement
Note: 2704 Inverter is attached to 2705 Battery Pack during testing.	10-55 Hz frequency sweeps for 15 minutes per axis 55 Hz frequency dwell for 10 minutes per axis
Shock (Operating and Non operating)	
Note: 2704 Inverter is attached to 2705 Battery Pack during testing.	Three guillotine-type shocks of 30 g, one-half sine, 11 ms duration each direction along each major axis; total of 18 shocks
Electromagnetic Interference (EMI)	FCC: FCC Part 15, Subpart B, Class A

Table 2-3: 2704 Inverter Physical Characteristics

Characteristic	Description
Weight	3.8 lbs (1.7 kg)
Dimensions	3.3 x 10.4 x 6.0 inches (84 x 264 x 152 mm)
Switches	Switch, titled BATTERY POWER, w/ON position shown
Indicators	Red LED illuminated when BATTERY POWER switch is in the ON position. Three battery charge status LEDs: Red LED illuminated whenever AC power is applied to charger (AC Input) Green LED illuminated when 60% charge level is reached Green LED illuminated when 100% charge level is reached
AC Input Fuse	2 Amp/250 V, 3AG Medium Blow Fuse; CSA/UL listed
AC Input Fuse Holder	User accessible, touch proof, fuse holder; CSA/UL listed
DC Input Fuse	15 Amp automotive type not accessible without removing cover; CSA/UL listed
Inputs	Battery Input AMP circular plastic connector Auxiliary Power Input AMP circular plastic connector; CSA/UL listed; Polarized AC Input Recessed AC power receptacle that accepts standard AC power cord; CSA/UL listed IEC 320/CEE-22 International Appliance connector
AC Output	25 to 26 inches of SVT cable with a right-angled connector to connect the 271X instrument AC Input connector; CSA/UL listed
Auxiliary Output	Mini jack connector

Table 2-4: 2705 Battery Pack Electrical Characteristics

Characteristic	Performance Requirement	Supplemental Information
Output Voltage		+12 VDC (nominal)
Battery Operating Time For temperatures between +10° C to +40° C For temperatures between 0 to +10° C	Minimum: 50 minutes Minimum: 45 minutes	When connected to the 2704 Inverter operating under the following conditions: 100 Watt load connected to AC Output of 2704 Inverter No load connected to Auxiliary Output of the 2704 Inverter Battery fully charged
Battery Charge Retention		>85% at 1 month When disconnected from the 2704 Inverter Recharge of the battery is recommended every six to nine months
Battery Cycle Life		>125 Charge/Discharge cycles Each cycle battery is discharged 100% Batteries must not be left in fully discharged state for more than eight hours

Table 2-5: 2705 Battery Pack Environmental Characteristics

Characteristic	Description
Temperature	
Operating	0° C to +50° C
Battery Charging	0° C to +40° C
Non operating	-20° C to +60° C
Humidity	
Operating	95%, ±5% up to 30° C 75%, ±5% 31° C to 40° C 45%, ±5% 41° C to 50° C
Non operating	Five cycles (120 hours) in accordance with MIL-Std-28800E, class 5
Altitude	
Operating	15,000 feet (4600 meters)
Non operating	50,000 feet (15,200 meters)
Vibration, Operating (instrument secured to a vibration platform during test)	
Note: 2704 Inverter is attached to 2705 Battery Pack during testing	MIL-Std-28800E, Paragraph 4.5.5.3.1, Table XVI Class 5 (Modified) 0.015 inch p-p displacement 10-55 Hz frequency sweeps for 15 minutes per axis 55 Hz frequency dwell for 10 minutes per axis
Shock (Operating and Non operating)	
Note: 2704 Inverter is attached to 2705 Battery Pack during testing	Three guillotine-type shocks of 30 g, one-half sine, 11 ms duration each direction along each major axis; total of 18 shocks
Electromagnetic Interference (EMI)	FCC: FCC Part 15, Subpart B, Class A

Table 2-6: 2705 Battery Pack Physical Characteristics

Characteristic	Description
Weight	16 lbs (7.3 kg)
Dimensions	3.3 x 10.4 x 7.7 inches (84 x 264 x 196 mm)
Construction	Sheet metal, painted Tektronix blue; styling compatible with 271X instruments
Type of Battery	Sealed lead-acid, 12 VDC

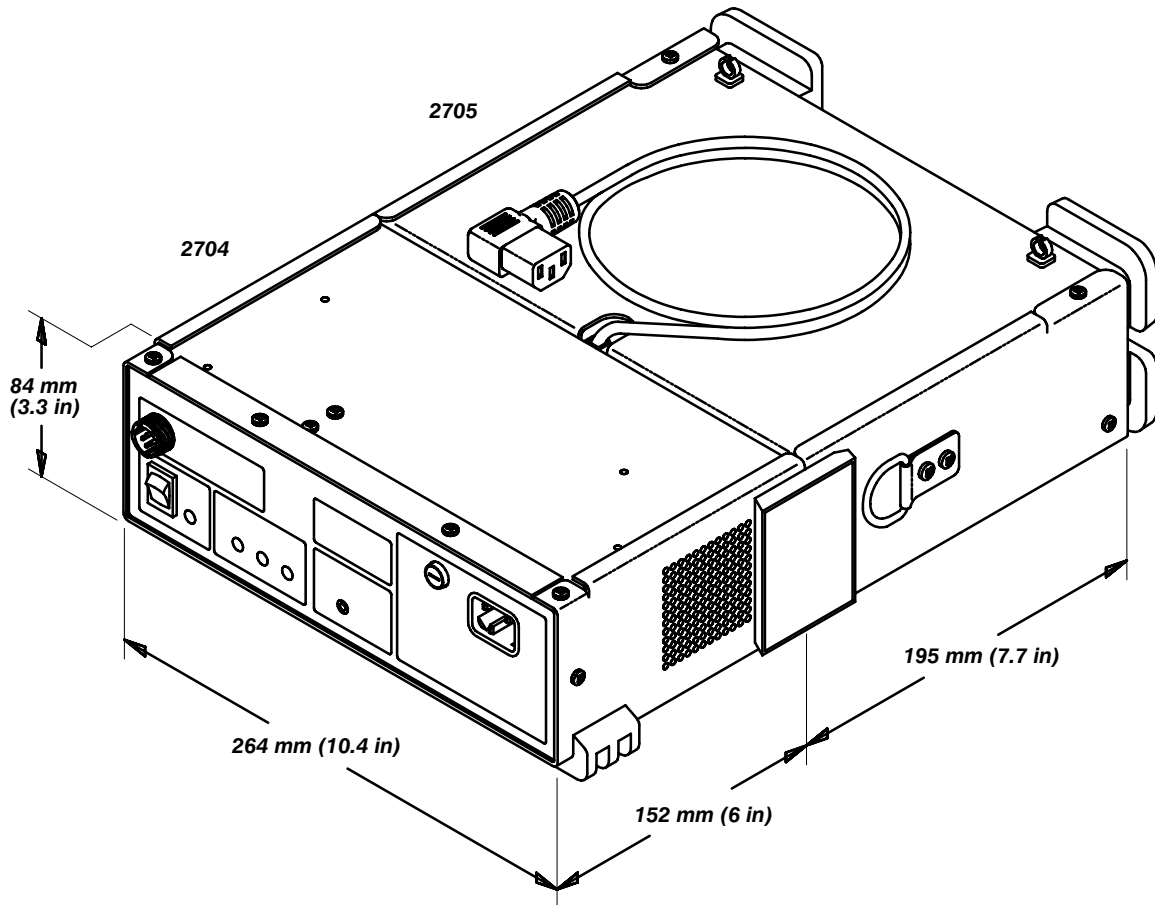


Figure 2-2: 2704 Inverter/2705 Battery Pack Outline Drawing and Dimensions

Receiving, Repackaging, and Storage

Description

The 2704 Inverter and 2705 Battery Pack are inspected and tested mechanically and electrically before shipment. Each should be free of mechanical damage and meet or exceed all electrical specifications. Inspect instruments upon receipt (see the *Preventive Maintenance* section). If they are damaged or do not perform correctly, return them to a Tektronix Service Center.

Repackaging

Whenever you ship the 2704 Inverter or 2705 Battery Pack to a Tektronix Service Center for service or repair, attach a tag that shows:

- the owner's name and address
- the name of the individual at your location who should be contacted
- the complete serial number of the instrument (or instruments) being returned
- a description of the service required

Repackage each instrument in its original shipping container or use one of equivalent test strength and inside dimensions. Surround the 2704 Inverter or 2705 Battery Pack with plastic sheeting to protect the finish. Cushion either instrument on all sides with packing material or plastic foam.

If the battery charger is operational, fully recharge the 2705 Battery Pack before it is shipped.

Short Term Storage

(less than 90 days)

Store the instrument in an environment that meets the non operating environmental specifications. See the *Specification* section.

Fully recharge the 2705 Battery Pack before storing it. For maximum battery life, do not store the 2705 Battery Pack in locations where the ambient temperature exceeds 30° C.

If the 2705 Battery Pack is stored connected to the 2704 Inverter, a slight power drain will occur (approximately 15 mA).

Long Term Storage

(more than 90 days)

Use the original shipping container to repackage the inverter or battery pack. Seal the device in a vapor-proof bag with a drying material and store it in a location that meets the non operating environmental specifications. See the *Specification* section.

Recharge the 2705 Battery Pack fully before storing it. Ideally, storage temperature should be kept below 30° C to prevent accelerated internal discharging of the battery. When the storage temperature is below 30° C, recharge the battery every 180 days. If the storage temperature exceeds 30° C, recharge the 2705 Battery Pack every 90 days.

Installation

General Instructions

Two mounting straps, with slots at each end, are welded on the bottom of the 271X-Series instruments. These mounting straps provide the means to attach the 2704 Inverter and 2705 Battery Pack to the instrument. Figure 4–1 and the following procedure describes the installation.

1. Lay the instrument to be powered 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 stud plates (supplied with the mounting kit) into the slots on the mounting strip.
3. Place the adapter plate on the mounting studs with the oval carrying hole facing the front of the instrument. Attach it to the studs using the plain washers and the 8-32 nuts supplied with the mounting kit. Use a 5/16 inch wrench to tighten the nuts.
4. The 2704 Inverter is equipped with guides on its top that fit over the sides of the adapter plate. Slide the 2704 Inverter on to the adapter plate from the front of the instrument with the front panel of the 2704 Inverter facing forward. Slide the 2704 Inverter on until the adapter plate hits the stops on the guides.
5. Plug the AC output cord at the rear of the 2704 Inverter into the AC input receptacle at the rear of the test instrument. Arrange the cord so that it runs straight back down the middle of the adapter plate. Ensure the battery power switch on the 2704 Inverter is turned off.
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 Battery Pack about 3 inches on to the adapter plate from the rear of the instrument, with the feet of the 2705 Battery Pack facing backwards. Be careful not to crimp the 2704 Inverter AC output cord.
7. Connect the DC output cord from the 2705 Battery Pack to the Battery Input receptacle on the rear of the 2704 Inverter.
8. Slide the 2705 on to the adapter plate until it mates with the rear of the inverter.
9. Using the latches on the sides of the 2704 Inverter, attach the 2705 Battery Pack to the 2704 Inverter.
10. The test instrument is now ready for battery power operation.

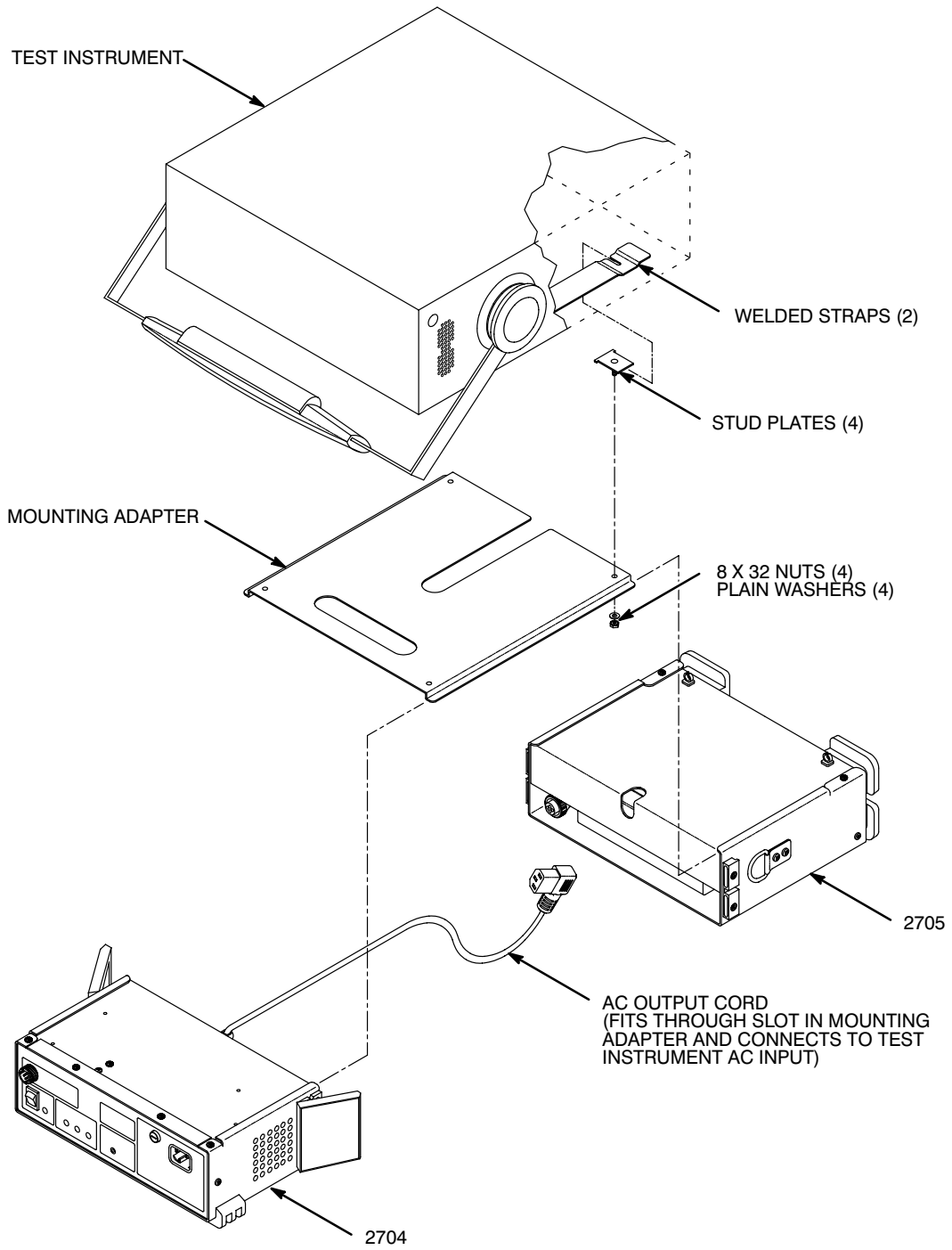


Figure 4-1: Installation of the 2704/2705

Controls and Connectors

The functions of the 2704 Inverter and 2705 Battery Pack controls and connectors are explained in this section.

2704 Inverter Front Panel

Figure 5-1 shows the front panel of the 2704 Inverter. The references in the Figure are described below.

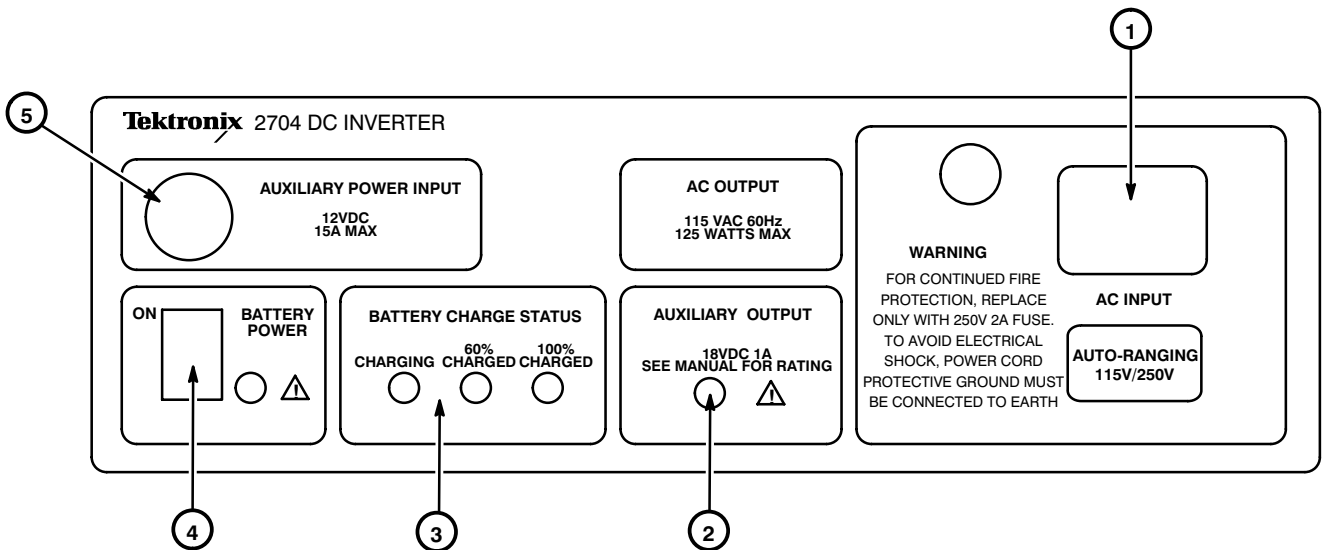


Figure 5-1: The 2704 Inverter Front Panel

- 1 — AC INPUT Receptacle** This three-prong receptacle accepts any of the AC input power cord options. It is used to supply AC power to the internal battery charger.
- 2 — AUXILIARY OUTPUT** This jack accepts a standard (3.5 mm diameter) miniature phone plug. It supplies +18 VDC at not more than 1 ampere to power auxiliary devices such as the LNBS used in satellite downlink applications. Polarity of the miniature phone plug is:

Tip	+18 VDC
Barrel	0 VDC

3 — BATTERY CHARGE STATUS Indicators

One or more of these LED indicators is active whenever AC power is applied to the AC input receptacle of the inverter.

- CHARGING — lights when AC power is applied to the AC input receptacle indicating the battery charger circuit is active.
- 60% CHARGED — lights when the 2705 Battery Pack has been charged to approximately 60% of its capacity.
- 100% CHARGED — lights when the 2705 Battery Pack is completely charged.

4 — BATTERY POWER Switch and Indicator

When the BATTERY POWER switch is in the ON position, it connects DC power from the 2705 Battery Pack or an auxiliary DC input source to the 2704 Inverter and auxiliary DC output supply. The AUXILIARY INPUT is preferentially selected when both DC sources are present. When power is not required, the switch should be left in the off position to conserve battery power

The BATTERY POWER indicator glows steadily when the battery power switch is turned on and the battery is sufficiently charged. The indicator will blink following an audible low-battery alarm after the switch is turned off as a reminder that the battery requires recharging. When the 2704 Inverter is plugged into AC power, the indicator will stop blinking.

5 — AUXILIARY POWER INPUT

This 4-pin receptacle accepts power from auxiliary external DC sources, including an additional 2705 Battery Pack. When sources are connected to both the 2704 Inverter BATTERY INPUT and AUXILIARY POWER INPUT, power is drawn only from the AUXILIARY POWER INPUT.

The AUXILIARY POWER INPUT is also connected to the 2704 Inverter's internal battery charger, enabling the internal charger to recharge a second 2705 Battery Pack. The second pack can be recharged separately, or concurrently with a rear-mounted battery pack (charging time increases when two batteries are charged simultaneously).

AUXILIARY POWER INPUT Source. The auxiliary source must supply power at 11.25 to 15 VDC at a minimum of 15 amperes. The battery protection circuit will shut the inverter down if the source voltage is outside of this range. The output resistance of the DC source must be less than 0.05 Ω .

AUXILIARY POWER INPUT Cord. The 2704 Inverter is intended to operate from a 2705 Battery Pack. However, to extend operating times, the Inverter can be powered from an auxiliary, external 12 VDC (nominal) source such as an extra 2705 Battery Pack or a motor vehicle's electrical system.

The 2704 Inverter is supplied with a 4-pin connector that plugs into the AUXILIARY POWER INPUT connector on the front panel of the 2704 Inverter. Qualified service personnel should refer to the *Maintenance* section for instructions to construct a power cable using this connector. Preassembled auxiliary power input cables are also available. See *Optional Accessories* in the *Product Description* section for part numbers.

2704 Inverter Rear Panel

The AC output cable and battery input connector are located on the rear panel of the 2704 as illustrated in Figure 5–2. The references in the Figure are described below.

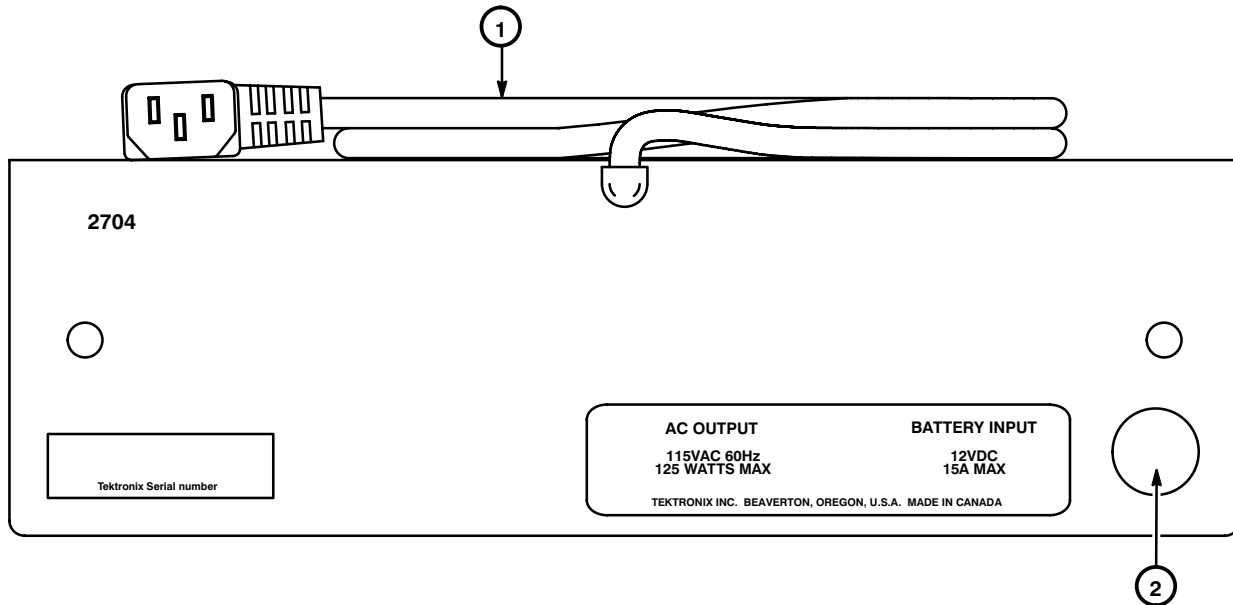


Figure 5–2: Rear Panel of the 2704 Inverter

- 1 — AC OUTPUT Cable** A permanently attached 3-wire cable connects the AC output of the 2704 Inverter to the instrument being powered. The end of the AC output cable is terminated in a 3-contact, polarized AC plug for connection to the instrument.
- 2 — BATTERY INPUT Connector** This receptacle accepts the connector on the 2705 Battery Pack and provides DC input power to the 2704 Inverter. It is the same type connector as the auxiliary power input.

2705 Battery Pack

The 2705 Battery Pack contains a short cable in the recess beside the carrying handle. This cable is used to connect DC power from the battery pack to the inverter. The cable terminates in a 4-pin connector that is usually connected to the BATTERY INPUT connector (see Figure 5–2) on the rear of the 2704 Inverter. This cable can also be used to supply power to the 2704 Inverter through the front-panel AUXILIARY POWER INPUT connector.

Operation

Before applying AC or DC power to the 2704 Inverter, read the *Safety Summary* at the front of this manual. The summary describes power source, grounding, and other safety considerations pertaining to the use of the 2704 Inverter and 2705 Battery Pack. If you are using an auxiliary DC source, read *Auxiliary Power Input* information in the *Controls and Connectors* section before connecting the source or operating the 2704 Inverter.

The 2704 Inverter may be operated with a 2705 Battery Pack or an 11.25 to 15 VDC external source. Its output is a 115 VAC_{RMS} quasi-sinusoidal voltage continuously delivering up to 115 watts. The inverter and a single 2705 Battery Pack can be attached to the instrument being powered, or they can be carried and used separately. A single 2705 Battery Pack provides 50 minutes of operation, and external DC sources can be used to extend the operating time.

Instrument Cooling

The 2704 Inverter is fan cooled. At least 2 inches clearance must be provided at the sides of the 2704 Inverter to enable the fan to draw adequate air into the intake side and expel the exhaust on the opposite side.

Using the 2704 Inverter

Use the following procedure to start and run the 2704 Inverter:

1. Ensure that the DC source you plan to use is appropriate and that it is adequately charged. See the section on *Charging the 2705 Battery Pack* later in this section.
2. Turn off the battery power switch on the 2704 Inverter, and connect the DC source to the inverter.
 - a. Connect a 2705 Battery Pack to the rear of the 2704. Both the 2704 Inverter and 2705 Battery Pack may be attached to the instrument being powered. See the *Installation* section earlier in this manual.
 - b. Alternately or additionally, connect an external DC source to the AUXILIARY POWER INPUT receptacle on the front of the 2704 Inverter using a properly constructed auxiliary power input cord or one of the *DC Power Cord Options* described earlier in this manual. See *AUXILIARY POWER INPUT* information in the *Controls and Connectors* section earlier in this manual. The inverter will draw current from

the auxiliary supply (rather than the rear-mounted 2705 Inverter BATTERY INPUT connector) whenever it is connected.



CAUTION. *To prevent inverter damage, do not use a vehicle with positive ground electrical system to supply power to the AUXILIARY POWER INPUT.*

3. Place the power switch on the instrument to be powered in the off position, and connect the AC power output cord from the 2704 Inverter to the instrument.
4. Place the battery power switch on the 2704 Inverter in the ON position. The LED adjacent to the switch should glow. If it does not, check that the DC source is properly charged and connected.
5. Activate the power switch on the instrument being powered. The instrument should turn on normally.
6. Proceed with your measurements.

Operating Time

A new, fully charged 2705 Battery Pack will power a recommended instrument for a minimum of 50 minutes 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 is not fully charged, or if the temperature is below 10° C.

Operating time can be extended to one hour and 40 minutes by connecting a second fully charged 2705 Battery Pack to the auxiliary DC input on the 2704 Inverter. This can be done in two ways:

- The preferred method is to begin operations with the second 2705 Battery Pack already connected to the auxiliary power input. When the low-battery warning sounds, disconnect the auxiliary 2705. The 2704 Inverter then draws power from the rear-mounted 2705 Battery Pack until it is depleted or another auxiliary source is connected to the front panel; you have 50 minutes in which to complete your measurements or provide an alternate power source.
- You can also begin operations with a single rear-mounted 2705. When the low-battery warning sounds, connect a second 2705 Battery Pack to the auxiliary power input. This method allows only about five minutes to obtain an auxiliary power source once the alarm sounds.

In either case, the 2704 Inverter is designed to draw current from the auxiliary supply whenever it is connected and to switch to the alternate source without interrupting AC power to the instrument.

Even longer operating times can be achieved if the 2704 Inverter is connected to a 12 VDC vehicle electrical system (or other 12 VDC system). A typical 60 amp-hour 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 Inverter Shutdown

The 2704 Inverter sounds an audible alarm when DC input voltage approaches lower operating limit. If input voltage drops below the lower operating limit, the inverter will shut down. When a 2705 Battery Pack is the DC power source, the audible alarm indicates there is about five minutes of operating time left. This gives the user time to shut down the instrument being powered in an orderly fashion, or to connect an external DC source to extend the operating time.

The 2704 Inverter shuts down the inverter to prevent damage to battery sources from over discharge. The audible alarm continues to sound. The alarm can be silenced by turning off the instrument being powered and placing the inverter's battery power switch in the off position. The battery power indicator then begins to flash as a reminder that the battery must be recharged. The indicator continues to flash until the 2704 Inverter is plugged into AC power (thus turning on the charger), or until the battery is completely exhausted (several days) or is disconnected.

NOTE. *If a completely discharged battery is connected to the 2704, you will receive no warning that the battery is dead.*

Under the following conditions, the protective circuit may shut the inverter down even though the DC input appears to be above 11.25 volts:

- DC source has poor voltage regulation
- DC input cable resistance, too high causing a large voltage drop (see The *AUXILIARY POWER INPUT* description earlier in this manual).
- Batteries are weak or discharged
- DC power supply has inadequate current rating

Overload and Thermal Protection

To protect the 2704 Inverter from damage, the AC output shuts down if the output AC power demand becomes excessive, or if the 2704 Inverter overheats for any reason including improper ventilation. The low-battery audible alarm sounds during the shut-down period. To turn the alarm off and return the 2704 Inverter to normal operation, follow this procedure:

1. Turn off the instrument being powered, and disconnect it from the 2704 Inverter AC output cord.
2. Ensure that all the 2704 Inverter ventilation openings are unobstructed.
3. Turn off the 2704 Inverter battery power switch.
4. Wait 5 minutes.
5. Set the 2704 Inverter power switch to ON.
6. If the audible low-battery alarm recurs (even though the DC source is charged), refer the 2704 Inverter to a qualified service technician.
7. If the 2704 Inverter returns to normal operation, reconnect the AC output cord to the instrument to be powered, and turn it on.
8. If the output shuts down again, check that the instrument being powered (271X-Series Spectrum Analyzer) is functioning properly.

Charging the 2705 Battery Pack

The 2704 Inverter can charge a single 2705 Battery Pack or two 2705's simultaneously. The inverter cannot be operated while charging is in progress. Charging starts when the 2704 Inverter is plugged into AC power and halts when the 2704 Inverter is unplugged.

Charging a fully discharged 2705 Battery Pack requires less than 8 hours. When two fully discharged 2705's are being charged simultaneously, less than 12 hours are required. Because the battery charger switches to a float mode after the battery is fully charged, it can be left on indefinitely.

Three battery charge status indicators are provided on the front of the 2704. The indicators are controlled by the charging circuit and are active only when the charger is on. In general, 2705 Battery Packs should be charged until the 100% Charged indicator is illuminated, but a 2705 Battery Pack may be used before it is fully recharged, if necessary. However, if the 2705 Battery Pack has been partially recharged more than 10 times in succession, it should be completely recharged (as indicated by the 100% Charged indicator) to equalize the cells in the battery.

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 a current and voltage control sequence to maximize battery capacity and life. The charger requires several minutes to cycle to the 100% charged step, even when the battery is fully charged.



CAUTION. *The 2705 Battery Pack must be recharged as soon as possible after a complete discharge to avoid damage due to sulfation.*

Warning

The following servicing instructions are for use only by qualified personnel. To avoid personal injury, do not perform any servicing other than that contained in the operating instructions unless you are qualified to do so. Refer to the General Safety Summary and Service Safety Summary prior to performing any service.



Service Information

Theory of Operation

This section describes the operation of the 2704 Inverter at the block diagram level as shown in Figure 7-1.

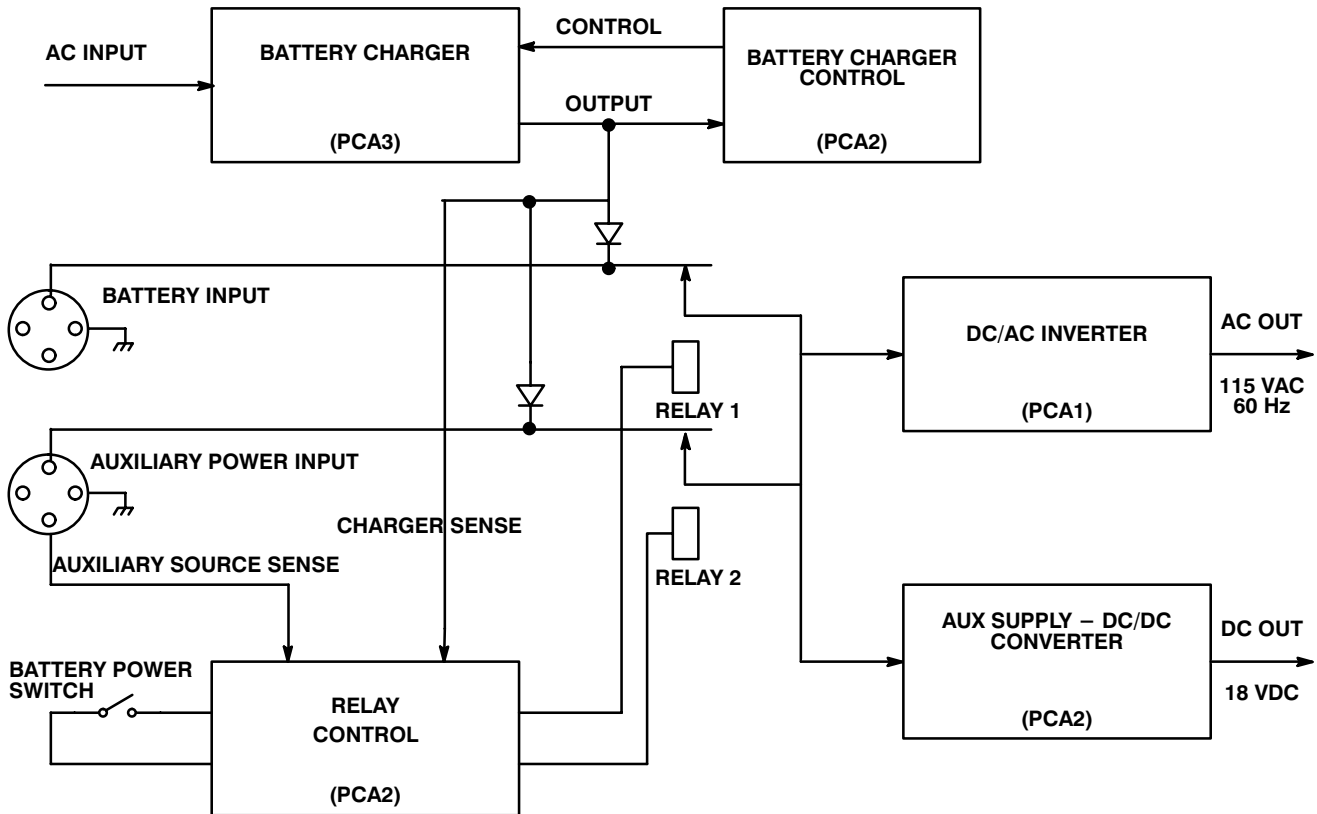


Figure 7-1: 2704 Inverter Block Diagram

DC Input Selection

DC power is supplied to the inverter and the auxiliary DC output supply through either the battery input connector on the 2704 Inverter rear panel or the DC auxiliary power input connector on the front panel. A pair of relays (RELAY 1 and RELAY 2) and a relay control circuit on circuit board PCA2 selects which connector is active. The control circuit performs the following functions:

1. Opens both relays if the battery power switch is in the off position. This disconnects power from the inverter and auxiliary DC Output.
2. Opens both relays if the battery charger is connected to AC power.

3. Connects the DC auxiliary power input and disconnects the battery input when a DC source of correct polarity is connected to the auxiliary input, and conditions in steps 1 and 2 are not true.
4. Connects the battery input and disconnects the auxiliary power input when a DC source of proper polarity is connected to the battery input, and conditions in steps 1, 2, and 3 are not true.

Battery Charger

The battery charger consists of a switching power supply that converts 90 VAC or 250 VAC power to low-voltage DC, and a charge control circuit that adjusts the output of the power supply to meet the charge profile of the battery. The charge control circuit (Unitrode 3906) is designed specifically for charging sealed lead-acid batteries. Using a combination of voltage and current sensing, the charger determines the present battery condition and then applies a sequence of charge currents and voltages that maximize battery capacity and life. Charger voltage thresholds are temperature compensated to match the temperature coefficient of lead-acid batteries. The battery charger has three operating states:

1. Bulk Charge

A charge cycle begins with the charger in the bulk charge state. In this state, the charger is a constant current source delivering the maximum current available from the charger power supply (approximately 3.5 A). The Charging indicator is illuminated.

2. Over charge

The charger senses the battery voltage during the bulk charge state. As the voltage reaches the transition threshold (13.4V to 13.5V), the charger begins its overcharge cycle. At this point the battery is at least 60% recharged, and the 60% Charged indicator is illuminated. During over charge, the battery voltage is set to its maximum value (approximately 14.4 V temperature compensated) until the charging current drops below 0.25 A.

3. Float charge

When the charge current drops below 0.25 A, the charger enters the float charge state. The 60% Charged indicator is switched off and the 100% Charged indicator is switched on. The charger maintains a float voltage (13.8 V at 25° C) across the battery.

The battery charger output is connected to both the rear-mounted battery connector and the auxiliary power input connector through isolation diodes. This enables the charger to simultaneously charge two 2705 Battery Packs.

Inverter

The inverter has two power conversion stages. A DC converter stage raises the input voltage to 145 volts DC. The DC-to-DC converter stage is followed by a full-wave bridge inverter that converts the DC voltage to a quasi-sinusoidal output of 115 VAC_{RMS}. The output waveform is shown in Figure 2–1.

A voltage monitoring circuit in the inverter sounds an audible alarm when the input voltage approaches its lower limit, and shuts off the inverter and auxiliary output before the battery reaches 100% depth of discharge. The inverter is also shut off in case of input over voltage, the inverter overheats, or the inverter's load increases to more than 150 watts.

Auxiliary Output

The auxiliary output is a flyback type power converter that steps the 12 VDC input voltage up to 18 VDC. A current limit circuit restricts the converter output to a maximum of approximately one ampere.

Cooling

The 2704 Inverter is supplied with a fan to cool its internal components. The fan runs whenever AC or DC power is applied, but the speed may vary during battery charging.

Maintenance

This section contains maintenance information for the 2704 Inverter and 2705 Battery Pack.

Preventive Maintenance

Preventive maintenance is limited to visual inspection, cleaning, and checking instrument performance. Preventive maintenance should be carried out every 2000 hours, or at one year intervals if the inverter/battery pack is used infrequently. In particularly harsh environments, more frequent maintenance may be required.

Inspection

Instruments that appear to have been dropped or otherwise abused should be checked thoroughly to verify correct operation and performance. Deficiencies that could cause personal injury or lead to further damage to the instrument should be repaired immediately.

Dirt, grease, or other foreign materials—either external or internal—should be removed. Dirt on components may act as an insulating blanket both electrically and thermally, preventing proper electrical operation or efficient cooling.

Dust and debris should be removed from the vent holes on the sides of the 2704 Inverter as it accumulates. Failure to do so may result in overheating the 2704 Inverter, and cause the protective circuit to shut down inverter operation.

Electrical terminations in the 2704 Inverter and 2705 Battery Pack should be inspected, and all screws and mounting hardware in both instruments should be checked for tightness.

The battery in the 2705 Battery Pack should be examined for signs of leakage, bulging or deformation, venting, or loose terminations. Leaking or deformed batteries should be replaced.



WARNING. To prevent injury do not allow electrolyte to contact skin or clothing. In the event that electrolyte contacts skin or clothing, immediately wash it away with water. If electrolyte gets in your eyes, immediately flush with water and consult a doctor.

Cleaning

Clean the outside of the inverter or battery pack with a soft cloth or soft-bristled brush. Remaining dirt should be removed with a soft cloth dampened with a mild detergent and water solution. Abrasive cleaners may erode the painted surface and labels.



CAUTION. Avoid the use of chemical or abrasive cleaning agents which may damage the plastics or paint used in the 2704/2705. Use a nonresidue cleaner, preferably isopropyl alcohol, denatured ethyl alcohol, or a solution of 5% mild detergent and 95% water.

To clean the interior of the instrument:

1. Remove the eight machine screws (four 6-32 panhead screws through the cover and four 6-32 flathead screws through the latches or latch keepers) that hold the inverter or battery pack cover to the chassis.
2. Carefully spread the cover so that the bottom edges clear the chassis, and lift the cover straight off.
3. Blow the dust away using dry, low-pressure air (approximately 9 psi). Remove additional dust with a soft-bristled brush.
4. Remaining dust, dirt, grease, etc. should be removed with alcohol or a mild detergent solution. Small brushes and cotton swabs are good applicators, and are particularly useful for cleaning narrow spaces on the circuit boards.
5. In the case of the 2705 Battery Pack, you may wish to also remove the battery to clean it and the chassis beneath it. If the battery has leaked electrolyte, wipe it up with a cloth and neutralize the acid with baking soda.
6. Ensure that all components are thoroughly dry before reassembling the instrument.

Performance Check

The following procedures verify proper operation of the 2704 Inverter and 2705 Battery Pack.

2704 Inverter Checks

The following procedures check the 2704 Inverter AC OUTPUT and Inverter Output. An Inverter Output alternate procedure using a dual-channel oscilloscope is also provided.

AC OUTPUT. The most convenient and safest method of checking the inverter's AC OUTPUT is simply to see if it successfully powers a recommended test instrument. However, a more complete check can be carried out using a differential true-rms-reading AC voltmeter, or a dual-channel oscilloscope.

Use the following procedure to measure the inverter output supplied to the AC OUTPUT connector:



WARNING. *When a single-ended, common-grounded test instrument is used to measure the inverter AC output, a difference of 70 volts can exist between the inverter and test instrument cases. The equipment operator can be shocked by touching both instruments simultaneously, and the inverter can be damaged if the inverter and test instruments make contact. Use only differential, or double insulated single-ended test instruments to measure the 2704 Inverter AC OUTPUT.*

1. Connect a DC power source (2705 Battery Pack or external DC source) to the 2704 Inverter.
2. Disconnect the 2704 Inverter from any load.
3. Use a differential or double insulated true-rms-reading AC voltmeter to measure the voltage between the flat terminals of the 2704's AC OUTPUT plug. A true-rms-reading voltmeter must be used because of the quasi-sinusoidal shape of the output waveform. The voltage should measure 115 VAC, $\pm 10\%$.
4. Place an approximately 100 watt load on the inverter (a recommended test instrument or 100 watt light bulb will suffice) and again measure the voltage. It should still be 115 VAC, $\pm 10\%$.

Alternate Procedure to check AC OUTPUT. The following alternate procedure uses a dual-channel oscilloscope to measure the output supplied to the AC OUTPUT connector.

1. Set the vertical scales on both channels of the oscilloscope to 50 volts per division and the horizontal scale to 5 msec per division. Use the DC coupled mode.
2. Connect the common ground of an oscilloscope probe to the case ground of the 2704. Attach the two probes to the flat terminals of the 2704 Inverter's AC OUTPUT plug. Place the oscilloscope in A-minus-B inverted mode (this is essentially differential operation).
3. Observe the 2704 Inverter's output waveform (no load and 100 watt load). In both the no load and 100 watt load cases it should agree within 10% with the waveform in Figure 2-1.

AUXILIARY OUTPUT. Use the following procedure to check the performance of the 2704 Inverter's auxiliary 18 VDC output:

1. Connect a DC power source (2705 Battery Pack or auxiliary DC power) to the 2704 Inverter.
2. Disconnect the auxiliary output from any load.
3. Measure the auxiliary output voltage using a DC voltmeter. The voltage should measure 18 VDC, $\pm 10\%$.
4. Connect a 20 Ω , 20 watt load to the auxiliary output and again measure the voltage. It should still be 18 VDC, $\pm 10\%$.

2705 Battery Pack Checks

Battery Capacity Check. A new, fully charged 2705 Battery Pack powers a 271X-Series Spectrum Analyzer, set to draw 100 watts, for one hour when the ambient temperature is approximately 24° C. As the battery ages (or is damaged by over draining or over charging), its capacity diminishes. To determine the present battery condition, proceed as follows:

1. Connect the 2705 Battery Pack to the 2704 Inverter.
2. Run the 2704 Inverter under load until the low-battery alarm sounds. This discharges the 2705 Battery Pack.
3. Charge the battery pack using the 2704 Inverter until the 100% Charged indicator illuminates (this should take less than 8 hours). The battery is now fully charged. If the battery cannot be charged, but the charger satisfactorily charges other batteries, the battery is defective or the wiring of the 2705 Battery Pack is damaged.
4. Wait 20 minutes and measure the open circuit battery voltage. The battery must be at 25° C, $\pm 5\%$. The voltage should be greater than 12.5 VDC. If the voltage is less than 11.5 VDC, it is likely the battery is damaged (i.e., shorted cell or extensive sulfation) and should be replaced. If the voltage is between 11.5 and 12.5 VDC, and it has experienced more than 150 deep discharge cycles (80% or more), it is likely the battery has lost capacity due to age. If the battery has experienced fewer than 150 discharge cycles, check the performance of the battery charger.
5. To check battery capacity, power a recommended test instrument with the 2704 Inverter using the freshly charged 2705 Battery Pack. Time how long the instrument runs before the low-battery alarm sounds. A battery in usable condition should power the instrument for at least 1/2 hour. If it does not, the battery in the 2705 Battery Pack should be replaced (see the *2705 Battery Pack Troubleshooting and Repair* section).
6. Recharge the 2705 Battery Pack.

Battery Charger Check. The best way to check the performance of the 2704 Inverter battery charger is to use it to charge a 2705 Battery Pack. The ambient temperature must be in the range of 10 to 40° C, and the voltages and currents specified are at 25° C. Variations of a few tenths of a volt are acceptable over the operating temperature range.

To check the battery charger, proceed as follows:

1. Connect a 2705 Battery Pack to the 2704 Inverter. The battery pack must be in good condition.
2. Run the 2704 Inverter under load until the low-battery alarm sounds. This discharges the 2705 Battery Pack.
3. Turn off or disconnect the load on the inverter.
4. Plug the 2704 Inverter into AC power.
5. Observe that the Charging indicator illuminates. The battery terminal voltage should rise to 13.4 to 13.5 VDC during this portion of the charge cycle. Battery charge current should be approximately 3.5 ampere.
6. In less than 6 hours, the 60% Charged indicator should light. The battery terminal voltage should rise to 14.4, ± 0.2 VDC over the next half hour.
7. Continue charging. In less than 8 hours the 100% Charged indicator should light. The battery terminal voltage should drop back to 13.8 VDC.

Corrective Maintenance

This section of the manual contains information about corrective maintenance for the 2704 Inverter and 2705 Battery Pack.

2704 Inverter

Maintenance of the 2704 Inverter is performed at the printed circuit board level. With the aid of the troubleshooting charts in Figures 8–7 and 8–8 and the following material, the problem can be isolated to a single board. The faulty board can then be replaced.

Figure 8–1 shows the principal components of the 2704 Inverter. The inverter's electronic circuits are contained on three printed circuit boards. The circuit functions are distributed among these three boards as follows:

PCA1 Inverter. AC input and fuse, DC-to-AC inverter, low-battery alarm and shutdown, over-temperature and overload protection.

PCA2 Control. DC source selection relays, relay control logic, battery charger control, indicator lamps, auxiliary DC supply.

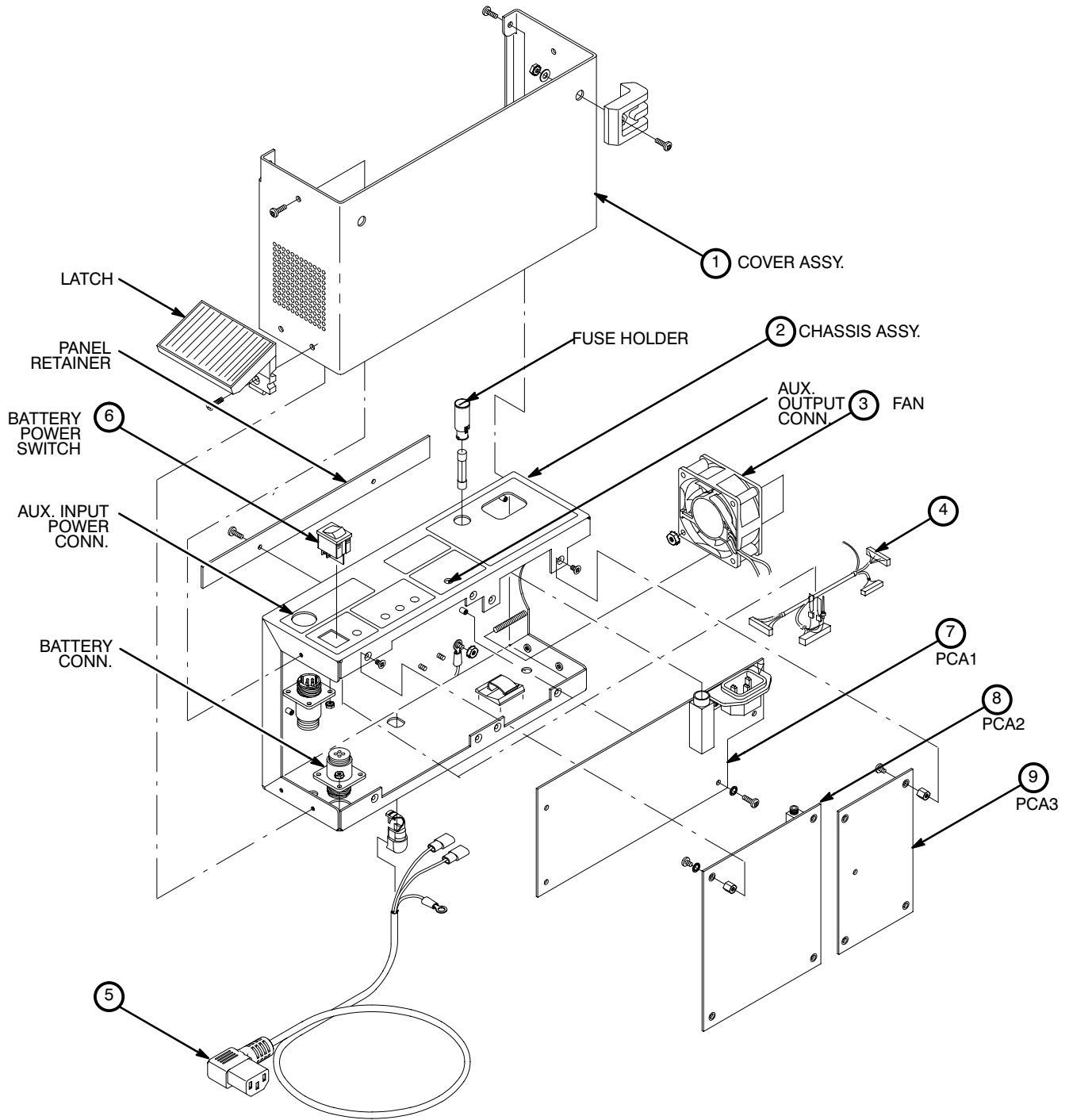


Figure 8-1: 2704 Inverter Components

PCA3 Battery Charger. Battery charger power supply.

The interconnections among the three circuit boards are shown in Figures 8–2 and 8–3. Figures 8–4, 8–5, and 8–6 show the wiring harnesses and cables in more detail.

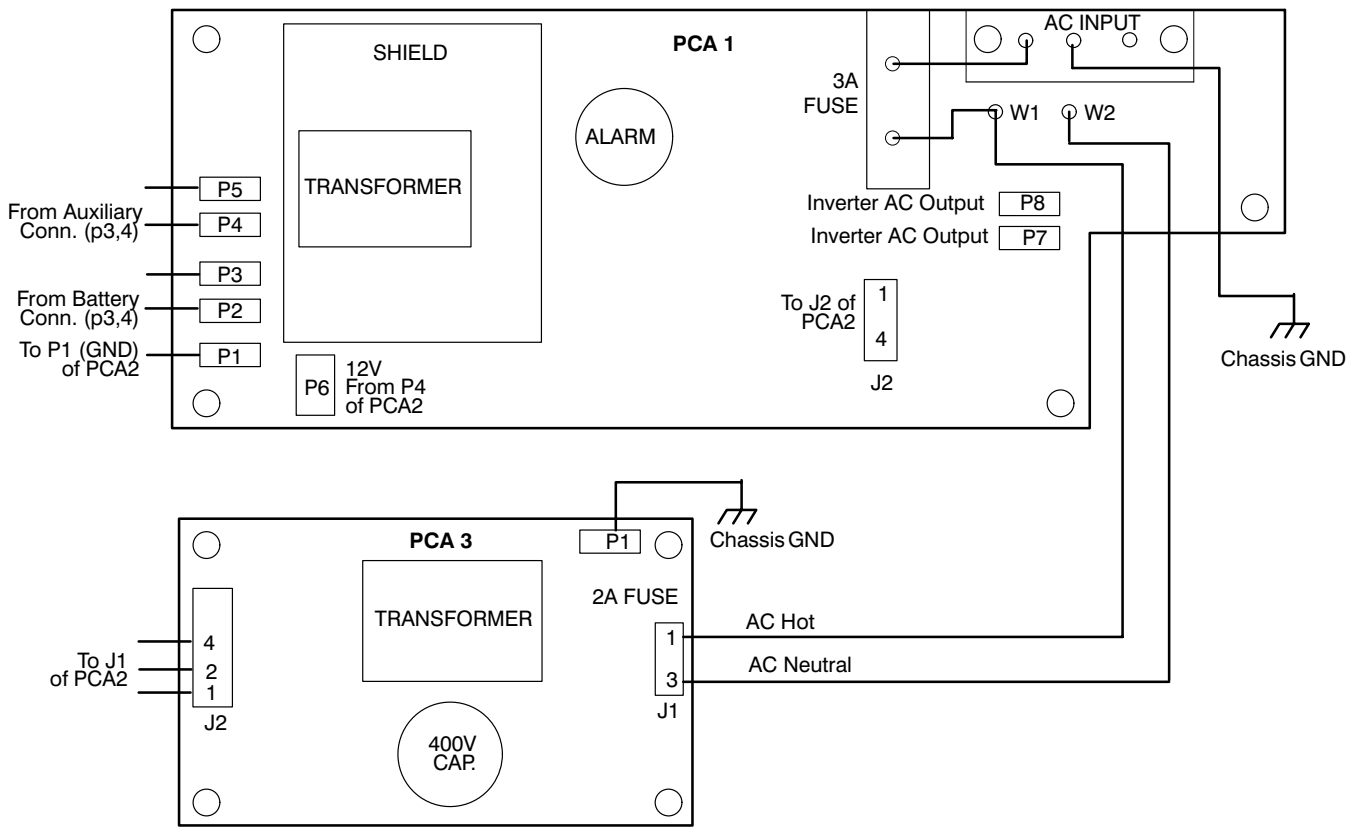


Figure 8–2: Inverter (PCA1) and Battery Charger (PCA3) Connections

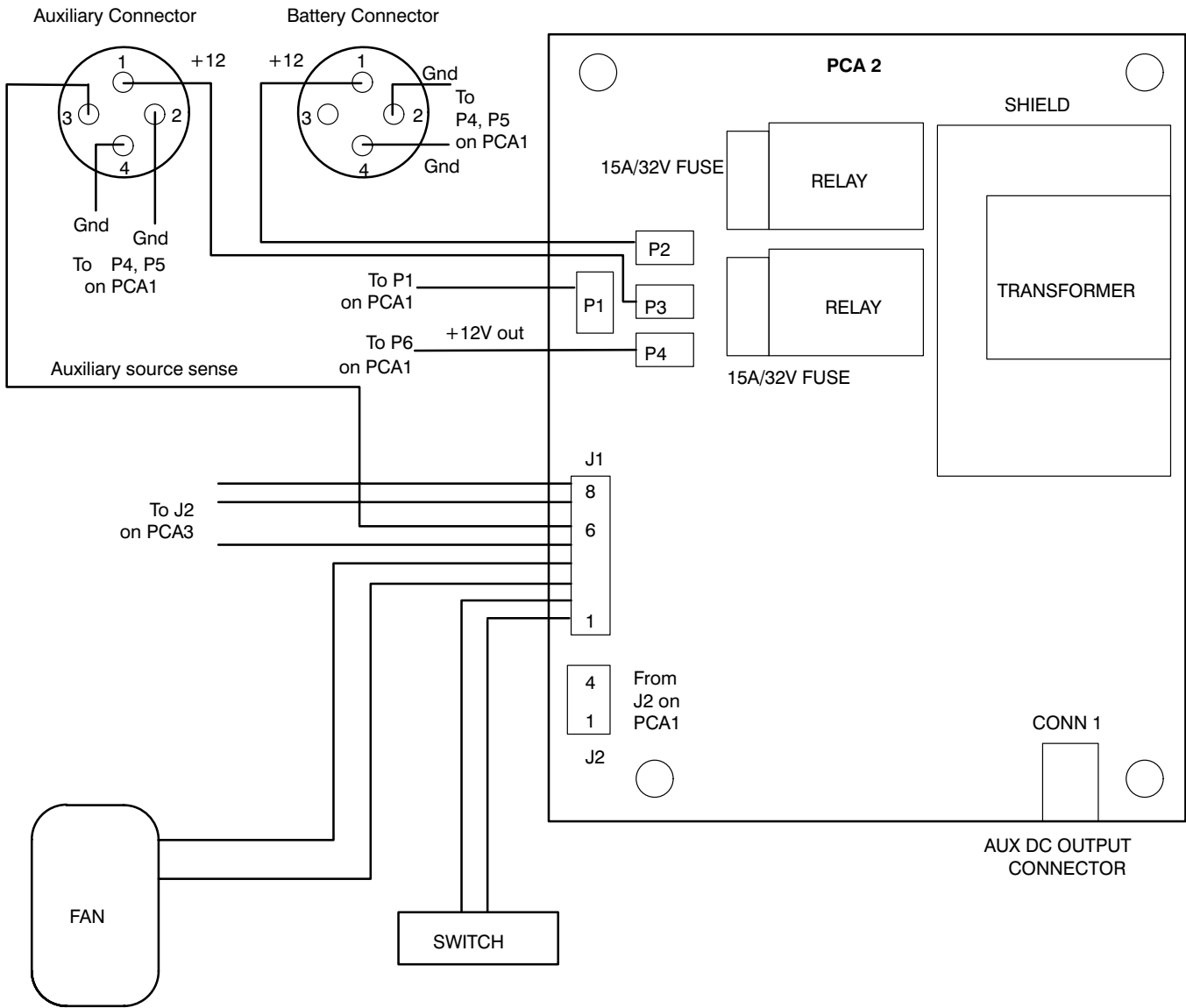


Figure 8-3: Control (PCA2) Connections

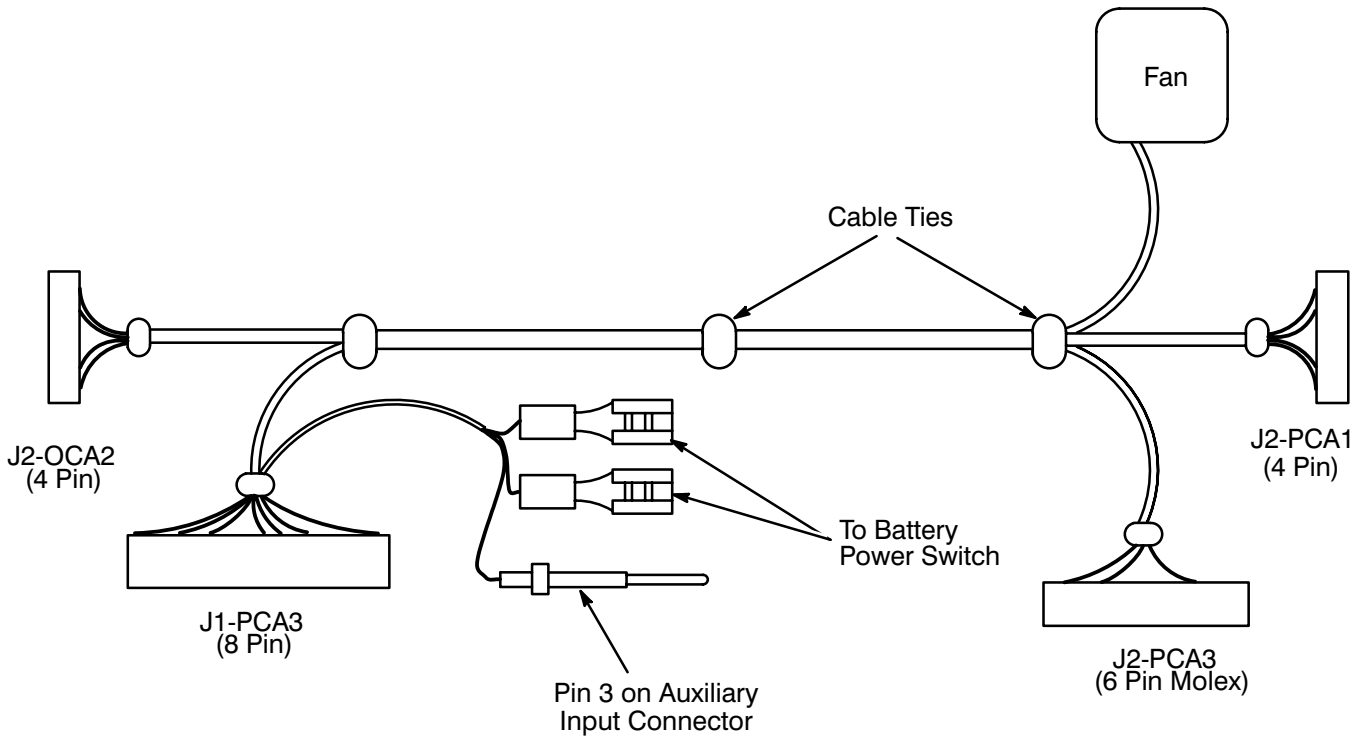


Figure 8-4: 2704 Inverter Wiring Harness

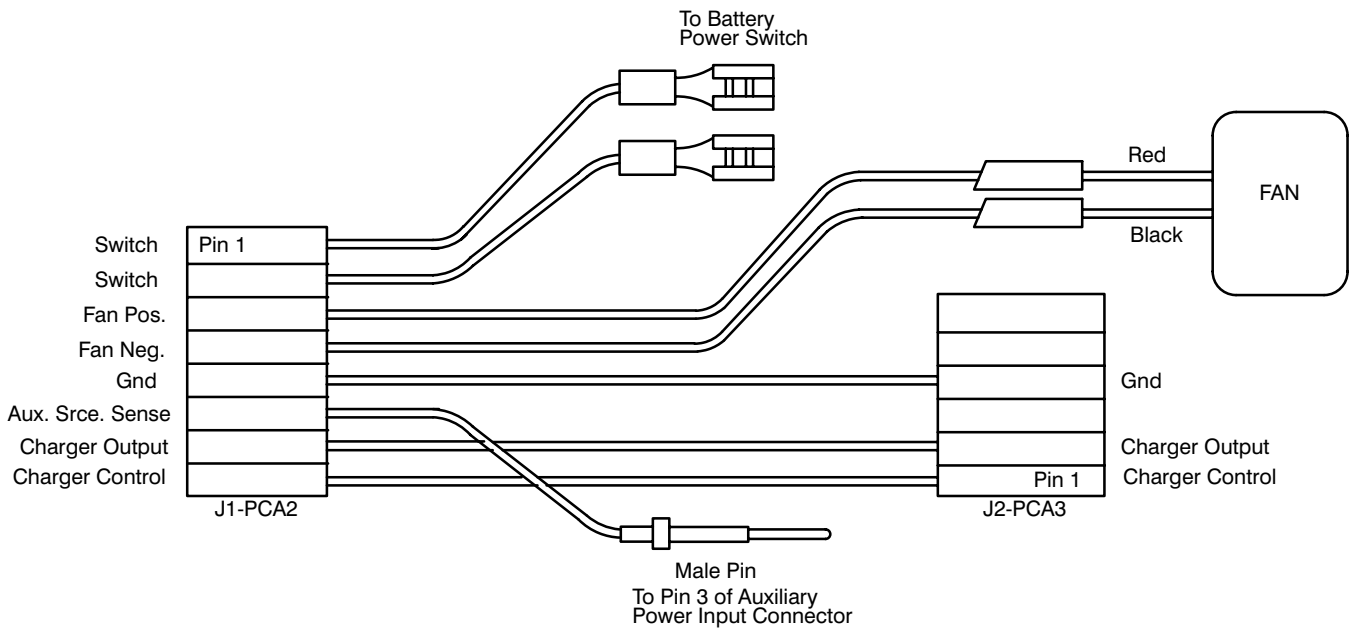


Figure 8-5: J3/J5 Wiring

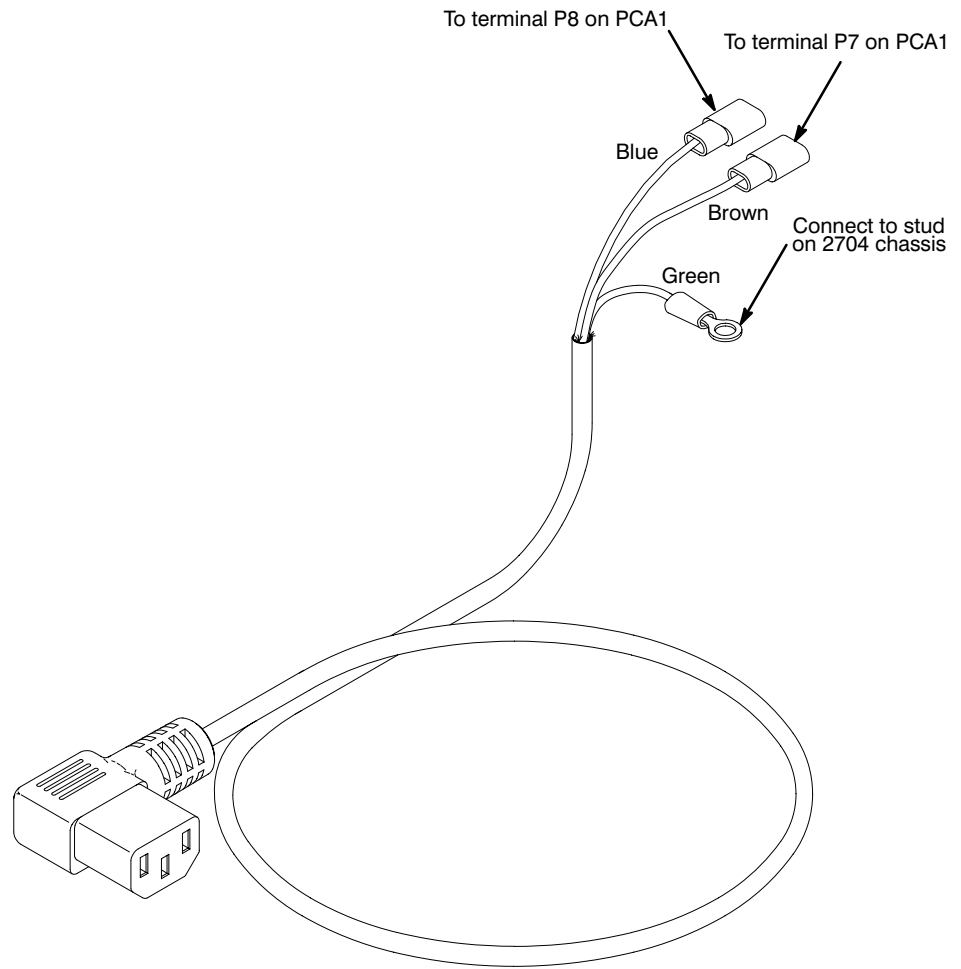


Figure 8-6: 2704 Inverter AC Output Cable

2704 Inverter Troubleshooting. Use the following symptoms to troubleshoot the 2704 Inverter.

- Inverter does not appear to supply power to 271X-Series instrument.

Follow the troubleshooting sequence shown in Figure 8–7.

- Auxiliary power supply does not supply proper voltage.

Check, the following:

- a. Check load on auxiliary output (1 A maximum load).
 - b. Check inverter operation.
 - c. If inverter is not operating properly, follow troubleshooting sequence in Figure 8–7.
 - d. If inverter is operating properly, and within its load limits, problem is probably located on PCA2 (Control). Replace PCA2.
- The battery charger does not appear to charge the 2705 Battery Pack.

Follow the troubleshooting sequence shown in Figure 8–8.

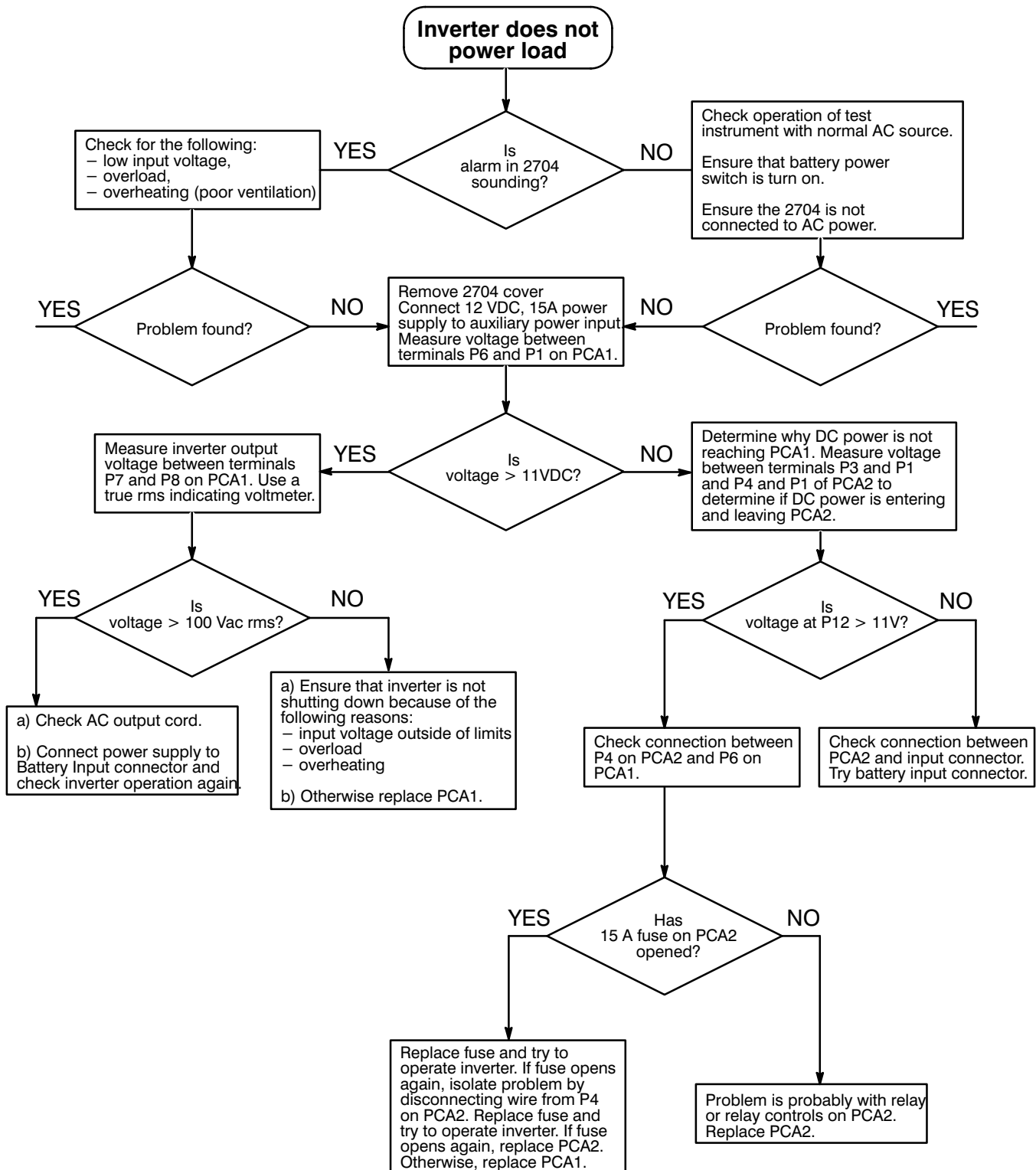


Figure 8-7: Inverter Troubleshooting Chart

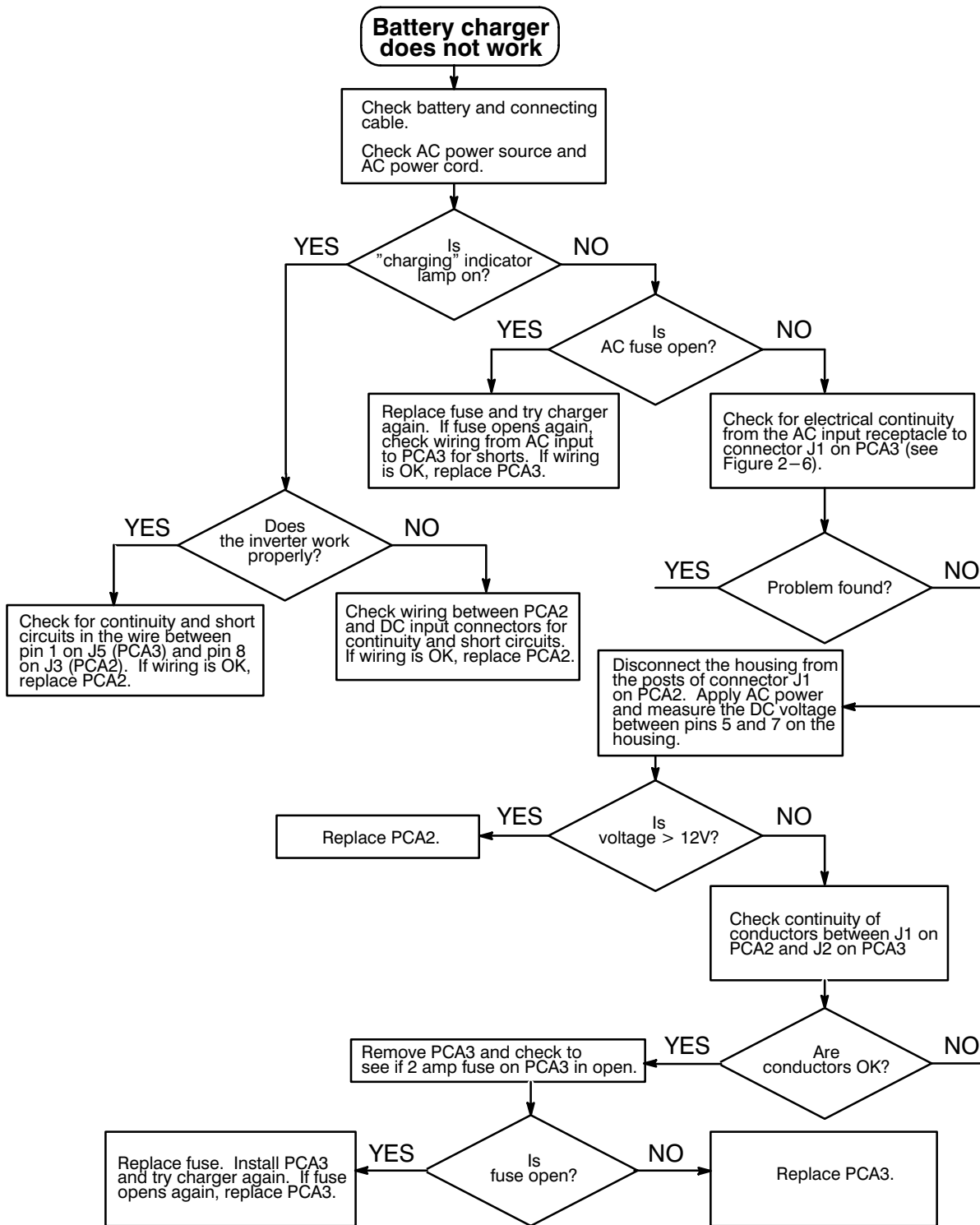


Figure 8-8: Battery Charger Troubleshooting Chart

2705 Battery Pack Troubleshooting and Repair

Outside of obvious physical damage, troubleshooting and repair of the 2705 Battery Pack is limited to diagnosis and replacement of worn-out batteries and defective cables/connectors. When a problem is suspected, the battery cable/connector should be checked first for breaks, short circuits, and intermittent or high resistance conditions. Once the cable/connector is ruled out as the source of the problem, the battery should be checked. To check the condition of the 2705 battery, see the *Preventive Maintenance* earlier in this section.



WARNING. To prevent injury, do not allow electrolyte to contact skin or clothing. In the event that electrolyte contacts skin or clothing, immediately wash it away with water. If electrolyte gets in your eyes, immediately flush with water and consult a doctor.

The mechanical assembly of the battery pack is shown in Figure 8–9. To replace the battery in the 2705, proceed as follows:

1. Remove the six 6-32 panhead machine screws that hold the battery pack cover to the chassis.
2. Slide the cover off, and clean away any dust or dirt.
3. With the 2705 Battery Pack lying flat, remove the battery retainer.
4. Lift the battery free of the chassis, and disconnect the two battery cable leads.
5. If the battery has leaked, clean up the electrolyte with a cloth and neutralize it with baking soda.
6. Install a new battery.
7. Reassemble in reverse order.

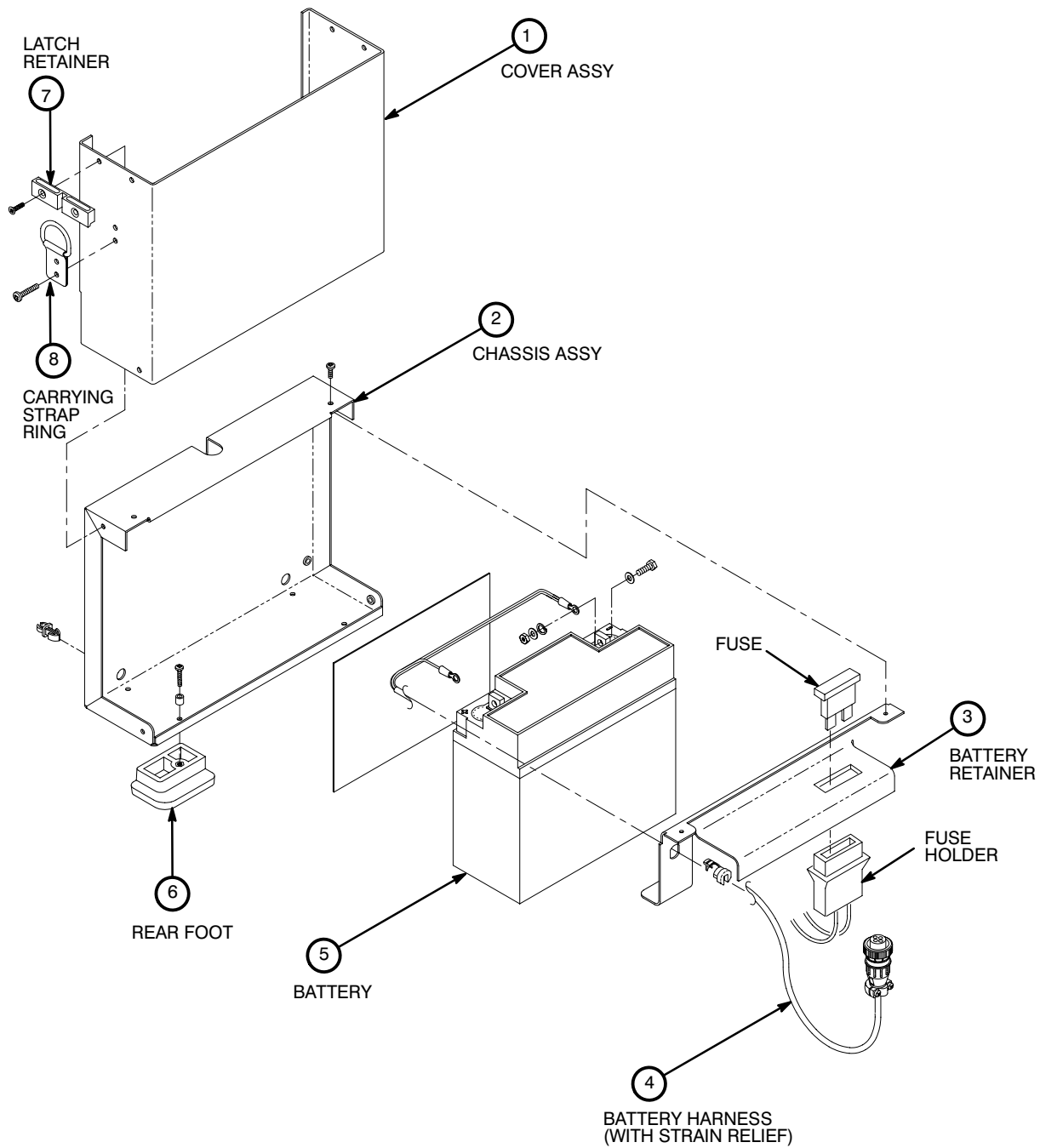


Figure 8-9: 2705 Battery Pack Components

Auxiliary Power Input

The 2704 Inverter is intended to operate from a 2705 Battery Pack. However, to extend operating times, the Inverter can be powered from an auxiliary external 12 VDC (nominal) source such as an extra 2705 Battery Pack or a motor vehicle's electrical system. A power cord must be constructed to connect the auxiliary source.

AUXILIARY POWER INPUT Source

The auxiliary source must supply power at 11.25 –15 VDC. The battery protection circuit will shut the inverter down if the source voltage is outside of this range. The output resistance of the DC source must be less than 0.05 ohm.

AUXILIARY POWER INPUT Cord

The 2704 Inverter is supplied with a 4-pin circular connector (Tektronix part number 118-8551-XX) which plugs into the DC auxiliary power input on the front panel of the 2704 Inverter. A qualified service technician can attach a cable to this connector and provide the required termination on the other end of the cable to produce a DC input power cord for use with a specific auxiliary DC power source. Alternately, alligator clips (or equivalent) can be provided for use with unspecified sources. The pin configuration for the input connector is shown in Figure 9-1. The cable conductors and terminations must be sized to carry up to 12 amperes. The total resistance of the cable and terminations should not exceed 0.1 ohm. Preassembled DC auxiliary power input cords are also available. See the *Product Description* section.

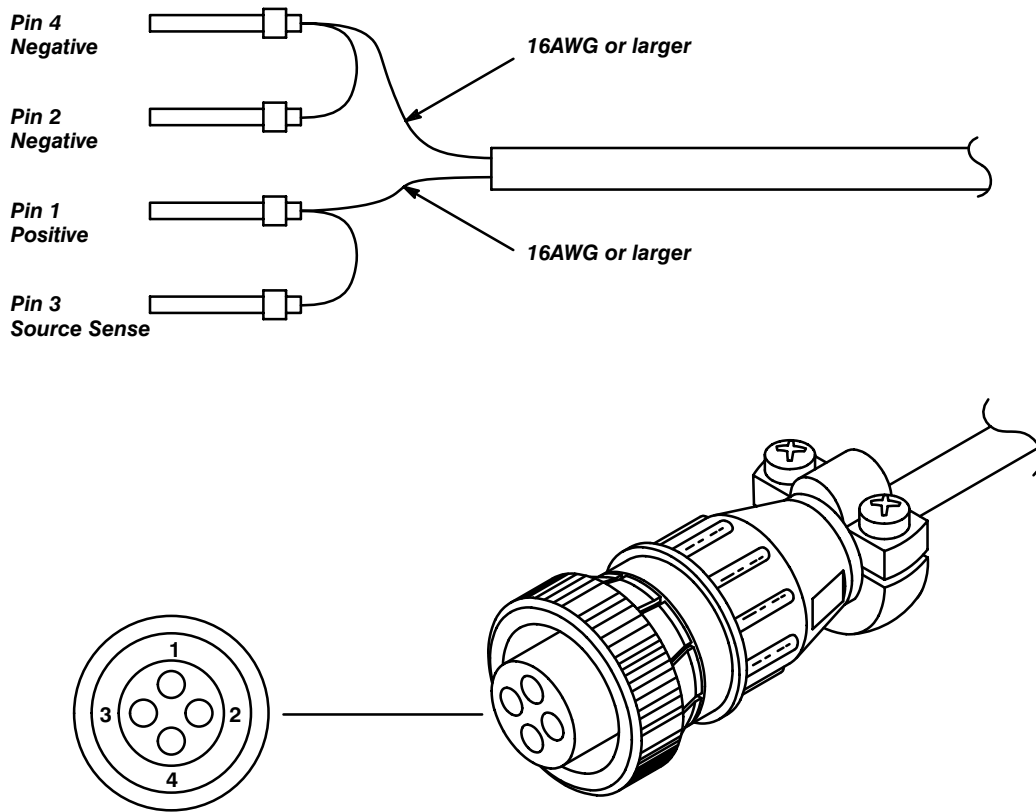


Figure 9-1: Pin Configuration of the Auxiliary Power Input Cord Connector

Parts List

Table 10–1 lists the replaceable and accessory parts for the 2704 Inverter and 2705 Battery Pack. Item numbers are keyed to the indicated drawings located in Section 4, *Installation* and Section 8, *Maintenance*.

Table 10–1: 2704/2705 Replaceable Parts

Illustration Reference Number	Description	Part Number
	Standard Accessories	
	manual, instruction	070-7840-XX
	strap, carrying (2705 Battery Pack only)	118-8745-XX
	power cord, AC, USA	161-0104-00
See Figure 4–1	plate, mounting (including hardware)	118-8545-XX
	connector kit to manufacture a user specific DC power cord	118-8551-XX
	Optional Accessories	
	power cord, aux., 1.5m, cig lighter	118-8549-XX
	power cord, aux., 1.5m, alligator clips	118-8550-XX
	power cord, AC, (A1) European	161-0104-06
	power cord, AC, (A2) United Kingdom,	161-0104-07
	power cord, AC, (A3) Australian,	161-0104-05
	power cord, AC, (A4) North America	161-0134-00
	power cord, AC, (A5) Swiss	161-0167-00
See Figure 8–1	2704 Inverter Parts	
1	cover, assy (including latch and feet)	118-8546-XX
2	chassis, assy (including label and panel retainer)	118-8543-XX
3	fan	118-8536-XX
4	harness, wiring (including connector)	118-8538-XX
5	cord, power (including strain relief)	118-8547-00
6	switch, power	118-8548-XX
7	circuit board, inverter (PCA1)	118-9033-XX
8	circuit board, control (PCA2)	118-9034-XX
9	circuit board, battery charger (PCA3)	118-8541-XX
10	foot (front)	118-9035-XX

Table 10–1: 2704/2705 Replaceable Parts (Cont.)

Illustration Reference Number	Description	Part Number
11	latch	118-9036-XX
—	hardware, not provided	
See Figure 8–9	2705 Battery Pack Parts	
1	cover, assembly (including latch retainer)	118-8544-XX
2	chassis, assembly (including label and feet)	118-8542-XX
3	retainer, battery	118-8553-XX
4	harness, wiring (including connector)	118-8539-XX
5	battery	118-8552-XX
6	foot (rear)	118-9037-XX
7	latch retainer half	118-9038-XX
8	ring, carrying strap	118-9039-XX
—	hardware not provided	

