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## Component Maintenance Manual with Illustrated Parts List

### **Seat Power Module (SPM)**

### PART NUMBER EQUIVALENCY STATEMENT FOR INFORMATIONAL PURPOSES ONLY

The attached technical publication is a product of a 3rd-party supplier. This manual has been reviewed and accepted by Panasonic Avionics Corporation.

The Panasonic Avionics Corporation part number(s) listed below is/are identical in all respects to the corresponding Astronics part number(s).

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1360-1	RD-FA3622-02		





### TO: HOLDERS OF COMPONENT MAINTENANCE MANUAL NO. 25-21-15 FOR SEAT POWER MODULE P/N 1360-1

#### REVISION NO. 2 DATED APRIL 1, 2014

#### **HIGHLIGHTS**

Revision 2 revises the manual to update the manual to comply with Panasonic Service Bulletins RDFA3622-02-25-01, RDFA3622-02-25-02, and RDFA3622-02-25-03. Please replace your present copy of manual number 25-21-15 with Revision Number 2 dated April 1, 2014. Note the entry on Record of Revisions sheet. Changes are highlighted below.

CHAPTER/SECTION		
OR PAGE NUMBER	DESCRIPTION OF CHANGE	<b>EFFECTIVITY</b>
Front Matter	Revised all front matter. List of Effective Pages changed to reflect new revision dates.	all 1360-1
Introduction	Table Intro-1, updated Service Bulletin History and Description.	all 1360-1
Test And Fault Isolation	Updated original ATP Procedure and added Test Procedure Part 2.	all 1360-1
Schematics and Wiring Diagrams	Deleted reference to number of CCAs in LRU Deleted table of CCAs	all 1360-1
Cleaning	Replaced references to alcohol cleaner with references to mild glass cleaner.	all 1360-1
Repair	Replaced references to alcohol cleaner with references to mild glass cleaner.	all 1360-1
Tools, Fixtures, and Equipment	Added new proprietary equipment to list.	all 1360-1
Illustrated Parts List	Revised IPL and Numerical Index to update part numbers per Service Bulletins.	all 1360-1



#### **COMPONENT MAINTENANCE MANUAL**

**WITH** 

#### **ILLUSTRATED PARTS LIST**

# SEAT POWER MODULE (SPM)

PART NUMBER 1360-1





	RECORD OF TEMPORARY REVISIONS					
TEMPORARY REV NO	PAGE NUMBER	ISSUE DATE	BY	DATE REMOVED	BY	
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SERVICE BULLETIN LIST				
SERVICE BULLETIN	REVISION NUMBER	DATE BULLETIN		
NUMBER	NUMBER	INCORPORATED INTO MANUAL		
RDFA3622-02-25-01	Mod B	4/1/2014		
RDFA3622-02-25-02	Mod C	4/1/2014		
RDFA3622-02-25-03	Mod D	4/1/2014		



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#### INTRODUCTION

#### 1. General

#### A. Contents

This manual contains information on the configuration and operation of the Seat Power Module (SPM), part number 1360-1, manufactured by Astronics Advanced Electronic Systems. This manual covers Description and Operation, Testing and Fault Isolation, Disassembly, Cleaning, Check, Repair, Assembly, and Illustrated Parts List information.

#### B. Purpose

This manual was designed to provide the user with the information necessary for the operation, maintenance, and repair of the Seat Power Module (SPM) to ensure that the maximum efficiency and service life of the unit will be realized.

#### C. Scope

The scope of this manual is to provide verified information and procedures that will enable a trained technician to troubleshoot, locate problems, repair, test, calibrate, and return the unit to service as quickly and economically as possible. The text is written in a format that is easy to read and to understand.

#### D. Terms Used

The standard terms used throughout the electronics industry have been incorporated into this manual. Certain terms that are not standard and that relate to the availability and replacement of parts will be stated in the front matter of the Illustrated Parts List to avoid confusion about the status of usage and replacement of electrically related components.

#### 2. Electrostatic Discharge Sensitive Parts

CAUTION: ALL PROCEDURES AND/OR STEPS IDENTIFIED AS ELECTROSTATIC DISCHARGE SENSITIVE (ESDS) MUST BE FOLLOWED EXACTLY AS WRITTEN. FAILURE TO COMPLY WITH THIS REQUIREMENT WILL JEOPARDIZE THE ESDS DEVICES.

#### A. ESDS Symbol

Equipment documented in this manual contains some ESDS parts. Therefore, certain procedures/ steps contained herein are ESDS device handling procedures. These procedures/steps are identified by use of the symbol (). This symbol is used in two ways.



When the ESDS symbol  $\bigcirc$  is placed after a paragraph number and title, all of that paragraph and all subparagraphs are considered an ESDS device handling procedure.

When the ESDS symbol  $\bigcirc$  is placed between a procedure/step number and the text, all of that procedure/step is considered an ESDS device handling procedure.

#### 3. Abbreviations and Acronyms

AC Alternating Current

ARINC Aeronautical Radio Incorporated

Astronics AES Astronics Advanced Electronic Systems

BIT Built-In Test

CEI Cabin Equipment Interfaces
CFR Code of Federal Regulations

DC Direct Current
DMM Digital Multimeter
DSUB D-subminiature

EMI Electromagnetic Interference
ESDS Electro Static Discharge Sensitive
FAA Federal Aviation Administration
FAR Federal Airworthiness Requirement

Hz Hertz

IFE In-Flight Entertainment LRU Line Replaceable Unit

MTBF Mean Time Between Failures

MTBUR Mean Time Between Unscheduled Removals

RMS Root Mean Square

RTCA Radio Technical Commission for Aeronautics

SPM Seat Power Module

VA Volts-Amps

VAC Volts Alternating Current
VDC Volts Direct Current
UUT Unit Under Test



#### 4. Component Reference Designators

Components are described using their reference designators. For example: C1 for capacitor 1, R1 for resistor 1, U1 for IC1, Q1 for transistor 1, D1 for diode 1, J1 for jack 1, and L1 for inductor 1. Where appropriate, pin numbers are indicated by a hyphen and the pin number after the reference designator. For example: R1-1 for resistor 1 pin 1.

#### 5. Service Bulletin History

A. Table Intro-1 gives a history of service bulletins that affect the 1360-1 Seat Power Module.

Table Intro-1: Service Bulletin History and Description

Service Bulletin	Date of Issue	Description
RDFA3622-02-25-01	Feb 21/2012	Modify Control Circuit and Power Circuit Card PCBs and Update Firmware
RDFA3622-02-25-02	Dec 18/2013	Replace Control Circuit Card and Power Circuit Card Assemblies
RDFA3622-02-25-03	Jan 23/2014	SPM Control and Power Circuit Card Modification



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#### **DESCRIPTION AND OPERATION**

#### 1. Description

#### A. General

This section defines the features and performance of the 1360-1 Seat Power Module (SPM) intended for installation in the pressurized passenger cabin of transport category airplanes.

The SPM provides the following primary features:

- 115VAC, 360-800Hz, single-phase airplane input power.
- 110VAC, 60Hz, single-phase outputs for Portable Electronic Devices (PEDs) totaling 250VA.
- 28VDC, 150W output to an IFE Seat Electronic Box (SEB) and/or IFE peripheral equipment.
- Hold up of the 28VDC output through power interruption.
- Pass through power for the Seat Actuator Controller (SAC).
- Remote off interface that removes power to the SEB, SAC, and PED outputs
- Fan ON/OFF control
- Output load, overcurrent fault, overvoltage/undervoltage fault, and Ground Fault Interruption (GFI) fault monitoring as well as automatic shutoff.
- Input line voltage is isolated/insulated from the chassis of the SPM and from the output of the SPM (galvanic isolation).
- Built-In-Test (BIT) functionality power-on and continuous
- Fault and BIT indications using the In-Use Light (IUL), Outlet Unit (OU) Indicator Light and RS-485 messaging.
- Electro-Magnetic Interference (EMI) filtering.

The SPM is considered a Line Replaceable Unit (LRU). Any field failure will require replacement of the complete unit.



#### B. System Overview

The Seat Power Module, as shown in block diagram Figure 1, is an LRU that meets the performance and feature requirements of the customer In-Flight Entertainment System. In addition to providing In-Seat Power Supply features for PED connectivity, the SPM provides DC power to the IFE SEB and/or peripheral IFE in-seat equipment as well as pass thru power for the SAC.

The SPM is a power supply – converting single phase, 360-800 Hz, 115VAC input power to four (4) single phase, 110VAC, 60 Hz outputs for passenger PEDs and a single 28VDC output to the IFE SEB. An additional RS-485 interface provides communications with seat subsystems for local control and reporting.

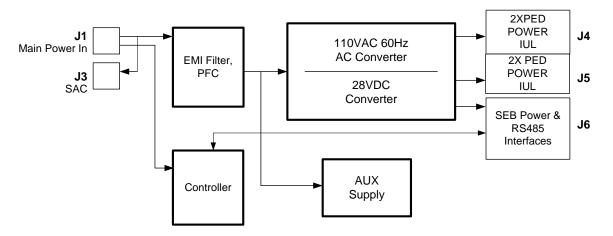


Figure 1: 1360-1 Seat Power Module Block Diagram

#### C. SPM Configuration

The 1360-1 SPM is available in the following configuration:

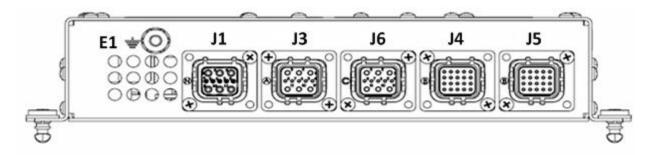
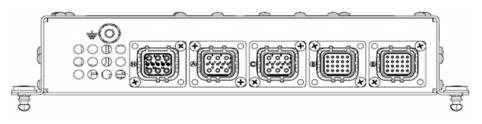
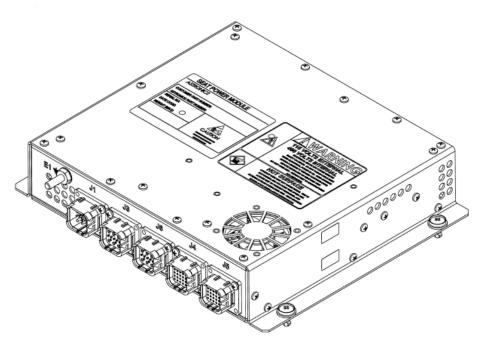


Figure 2: 1360-1 SPM Configuration





**End View** 



1360-1 Seat Power Module

Figure 3: 1360-1 Seat Power Module Configuration Identification



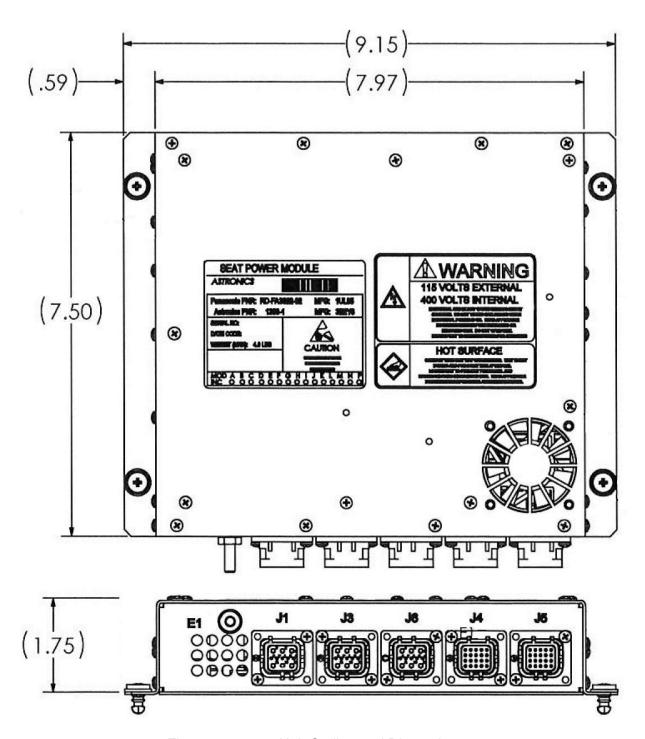


Figure 4: 1360-1 Unit Outline and Dimensions



#### 2. Functional Description

#### A. AC/DC Power

- (1) The SPM provides up to four (4) outputs of 110VACrms power to the AC Outlet Units with output characteristics described in 3.5.2. NOTE: AC OU interfaces are compatible with Astronics AES 1292-x-x series components. All four (4) OUs need not be present for unit operation.
- (2) The AC output is galvanically isolated from DC output power and either galvanically isolated from input AC power OR provide redundant GFI circuits. Circuit protection must be maintained over the entire operating temperature and voltage rating of the SPM.

**NOTE:** The SPM is capable of sustaining 250 VA continuous apportioned over its AC outputs and can internally manage these outputs according to power and temperature set points. Current limits and protection mechanisms are also described in detail in section 3.B.

**NOTE:** In-Use lights are provided to indicate status of the AC output usage. See section 3.E for a summary of indications.

- (3) The SPM provides a single 28VDC output to power seat electronics hardware with output characteristics described in section 3.C.
- (4) The DC output is galvanically isolated from the input power and the AC output power with the isolation maintained over the operating temperature and voltage rating of the SPM.

**NOTE:** Under both DC and AC loads, the DC load takes priority (i.e. remains ON) if thermal and/or power management features are invoked.

NOTE: During power fail/brown out conditions, 28VDC will remain within tolerance for up to 50 mSec and reduce to 24 VDC for up to 150 mSec after power fail. AC output power, Outlet Unit indications, and indications may be (and likely will be) removed during power fail in support of these requirements.

**NOTE:** The above specifications apply over complete input power operating ranges including 96VAC as described in section 3.



#### B. Serial Communications

An RS-485 interface is available for seat systems communication and control to perform power management in the seat and status reporting.

#### C. Physical Layer Interface

The SPM features an RS-485 interface complying with ARINC SPECIFICATION 485, Cabin Equipment Interfaces, Part 1, Head End Equipment Protocol as follows:

Specification: EIA-485 Electrical Characteristics

Signal States: HI: +5 VDC, LO: 0 VDC Bus Type: ARINC-485 multi-drop

Data Rate: 9600 bps (bit rate = baud rate) +1% -1.5%

(low speed bus)

Common Mode Range: -7 VDC to +12VDC Signaling type: Non return to zero

Bus Loading: <1U Address Range 1 – 15

#### D. RS-485 Protocol

- (1) The RS-485 interface protocols comply with ARINC SPECIFICATION 485, Cabin Equipment Interfaces, Part 1, Head End Equipment Protocol and Part 2, Physical Layer In-Seat Protocol with the following general guidelines:
  - Unused fields of *Power Outlet State, LRU Status Request, and New Status Change* messages may be used to accommodate quad outputs.
  - Power Control State message under the Op Transparent Data (244) command is not supported. The Power Outlet State and Power Management State messages are used by the IFE for power control.
  - Additional SPM exchanges under Op Load Transparent Data (243) may be added to facilitate program download to the SPM
- (2) Response time of the SPM from receipt of data request until ready to transmit response does not exceed 10 milliseconds:
- (3) The RS485 interface of the SPM is active during both ON and OFF states as defined in section 3.
- (4) All AC outputs of the SPM is disabled if RS-485 communication is halted for more than 60 seconds.



#### 3. Operation

#### A. Power-On Reset/Initialization States

Initialization begins when power is applied to the SPM, the input stage energizes, and any processing functions begin. Subsequently, the following operations are performed:

- (1) The SPM performs BIT functions following initialization to detect faults that would prevent it from operating.
- (2) When initialization is complete, the SPM enters the ON state as described below, unless a condition exists that would preclude the supplying of AC output voltage.
- (3) If a fault condition is present the SPM enters the OFF state.
- (4) During all subsequent states of operation, except for BIT test failure indicating an 28V DC power supply out-of- tolerance condition, the 28VDC power is available.
- (5) Monitor cooling fan continuously when active for presence of fan or locked rotor. Flag as a failure via the RS-485 interface if either condition (missing fan, locked rotor) exist.

#### B. ON State

- (1) In the ON State, the SPM is capable of supplying AC output to the Outlet Units in accordance with the Operating Modes described in section E.
- (2) The SPM transitions to the OFF state if any of the following conditions occurs:
  - GFI is present on any AC outputs.
  - The maximum over temperature limit is reached.
  - A watchdog expiry has occurred.
  - Internal power supply outputs, other than the 28V DC, are outside specified limits (BIT failure).
- (3) Upon entry into the ON State, the SPM activates the In-Use indicators for 1 minute to provide visual/manual maintenance method for checking indicator LED operation.



#### C. OFF State

- (1) The OFF state is entered only as the result of the occurrence of a fault condition on startup or during the ON state.
- (2) After entering the OFF state, removal and reapplication of AC input power is required (after removal of the fault condition) for the unit to reenter the ON state.
- (3) In the OFF state, the SPM disables AC outputs (i.e. AC PED power is removed).
- (4) In the OFF state, the SPM illuminates the OU status indicators with RED within 5 seconds of detection.
- (5) The SPM blinks the In-Use indicators at a 1 Hz rate for approximately 5 minutes upon entry into the OFF state and then turn the indicators OFF.

#### D. Reprogram State

- (1) The Reprogram State is entered as a result of program load initiation by the 485 master through the 485 interface.
- (2) During Reprogram State, the SPM disables all AC outputs, setting all OU status indicators and In-Use indictors to OFF.
- (3) During program transfer SPM blinks the In-Use indicators at an approximate 2Hz rate.
- (4) Successful program transfer completion is indicated by OU status indicators and In-Use indicators OFF.
- (5) Unsuccessful program transfer completion is indicated by OU status indicators RED and In-Use indicators blinking at an approximate 1 Hz rate for 5-minutes before turning OFF.
- (6) The SPM remains in Reprogram state until a power cycle occurs continued 485 operation including program reload is allowed, but switch to ON state is not possible without a power cycle.



#### 4. Operating Modes in the ON State

The SPM will operate in one of the following modes whenever the SPM is in the ON State:

#### A. Normal Mode

(1) The SPM enters the Normal mode upon command from an SEB via the RS 485 interface.

While in Normal mode, the SPM:

- (2) Applies AC power until successful plug insertion.
- (3) Illuminates the inactive AC OU status indicators appropriately based on remaining PED power availability.
- (4) Performs plug insertion detection and removal algorithms and supply PED power appropriately.
- (5) Performs power management and thermal management of the unit and disconnect/reconnect users when required.
- (6) Reconnects users as appropriate if returning from disabled or restricted modes of operation.

#### B. Restricted Mode

(1) The SPM enters the Restricted Mode upon command from an SEB via the RS 485 interface.

While in Restricted mode, the SPM:

- (2) Continues to supply power to any connected users.
- (3) Refuses new AC power requests from users.
- (4) Removes the power available AC OU status indication on inactive outlets.
- (5) Performs plug removal algorithms and disable PED power appropriately.
- (6) Performs power management and thermal management of the unit and disconnects currently active users when required.
- (7) Does not reconnect users at any time once disconnected due to disabled mode, thermal management, or power management.



#### C. Flight Deck Mode

(1) The SPM enters the Flight Deck Mode upon the completion of power on self-test if the unit RS-485 address is set to 0 (all J1 address lines OPEN).

While in Flight Deck Mode, the SPM:

- (2) Allows operation of the AC output power without regard to the RS-485 input command for operation state change.
- (3) Does not apply AC power until successful plug insertion.
- (4) Does not illuminate the Outlet Unit LED GREEN or RED during operation.
- (5) Performs plug insertion detection and removal algorithms and supply PED power appropriately.
- (6) Performs power management and thermal management of the unit and disconnect/reconnect users when required.
- (7) Auto-connect users as appropriate after power on self-test. Any user plugged in prior to application of power to the SPM will be automatically connected and powered after successful completion of power on self-test.

**NOTE:** This operating mode is intended for SPM installation in locations near the flight deck for flight crew use. This mode allows for un-restricted access to PED power for the flight crew.

#### D. Disabled Mode

(1) The SPM enters the Disabled Mode upon command from an SEB via the RS 485 interface.

While in Disabled Mode, the SPM:

- (2) Removes power to any connected users.
- (3) Refuses new AC power requests from users.
- (4) Removes the power available AC OU status indication on all outlets.

#### E. Power Up Timing Requirements

- (1) The 28VDC power output is available within 400 mSec of input power application.
- (2) The SPM completes Power-On Reset/Initialization and enters Normal mode (assuming proper enable inputs) within 10 seconds after Power-On Reset begins.



#### F. Hold Up Requirements

- (1) The SPM operates without need for re-initialization for a loss of AC Input Power of 200 mSec or less.
- (2) A power interrupt of 200 mSec or less does not require the AC PED user to reconnect their power cord to the OU in order to regain AC power.
- (3) The 28VDC output drops from 28 to 24VDC +/- 5% approximately 50 mSec after input AC FAIL is detected.
- (4) The 28 VDC remains above 22.8VDC for greater than 200mSec following a power interruption.
- (5) AC output power, Outlet Unit indications, and In-Use indications may be removed to support the above requirements. If so, AC outlet power and In-Use/OU indications return to their previous state in less than 3 seconds.

NOTE: See Figure 5.

#### G. Detection of Connected/Disconnected Loads

- (1) The SPM activates the appropriate In-Use Light output and connect AC power to an outlet when a proper connection is detected. A proper connection occurs when all of the following are true.
  - Both pins of the PED plug are detected in the outlet unit within 50 milliseconds maximum of each other,
  - The output load is not above the maximum limits,
  - A ground fault is not detected,
  - Both contacts remain active
  - The plug was not inserted during power-up (unless in the Flight Deck Mode)
- (2) When an invalid plug insertion is detected, based on any of the conditions in (1) being untrue, the SPM denies power to the OU, set the OU status indicator to OFF, and require both pins to be completely removed before again attempting a connect.
- (3) After a valid plug insertion is detected, as described above, the SPM delays application of power for a minimum of 1 second.
- (4) Load disconnect is assumed whenever either or both pins of the plug are removed.
- (5) Sense of a load disconnect prevents power application to the OU if power has not yet been applied and shall result in removal of power to the OU within approximately 100 mSec if power has been applied.



(6) The SPM activates the appropriate In-Use Light output when AC is connected to the OU and deactivate the In-Use Light when AC is removed from the OU.

#### H. Reconnect Criteria

(1) The SPM reconnects previously active AC outputs automatically after the RS-485 mode control changes from DISABLED or RESTRICTED to the NORMAL mode unless the user disconnects during the DISABLED or RESTRICTED period. Previously active AC outputs are reconnected individually at an approximately 10 second interval.

#### I. BIT Requirements

- (1) BIT operation includes the following functions:
  - Power Up tests.
  - · Continuous monitoring.
  - Device identification on the RS-485 bus.

#### J. Continuous Monitoring

During the ON state, the SPM performs Continuous Monitoring.

- (1) Continuously monitors its internal components for faults.
- (2) Continuously monitors its external interfaces, where possible, for faults.
- (3) Does not disrupt the normal operation of the system.
- (4) Communicates any fault information via RS-485.

**NOTE**: The OFF state and the corresponding indications are assumed should a failure occur as described in section 3.B.

#### 5. Electrical Specifications

No termination is required for unused In-Use Light output, Outlet Units outputs, RS-485 interface, or DC output.

#### A. AC Input Power

The following input power specifications apply:

Voltage Range: 115VAC Input, Single Phase

Normal 100 – 122 VAC Single Phase A

Abnormal 80 – 134 VAC Single Phase A

Frequency Range: 360 – 800 Hz



Efficiency: 80% minimum at full load (82% Target)

Power Factor: 0.98 minimum at full load

Current:

Steady state 4.43Amps @ 115Vrms outputs at full load (based

max: on minimum efficiency and minimum power factor

Inrush maximum: 4 times steady state for less than 10 cycles (active

in-rush limit at start up and during power drop

out/re-start

Current limit: 7 A fused, F1, P/N 1025 FA7-R, Bussman

#### B. AC Output Power

The following AC output power requirements apply:

Voltage 110VAC +/- 10% at full load over complete input

range: voltage & frequency range

Frequency range: 57-63 Hz Voltage waveform: Sine wave

Power limits - Individual Loads

\_

Max Load: 200VA maximum

Current Limit: 185 +/-15VA sustained current limit cutoff

Peak Limit: Peak cutoff at 7 Amps (after 3 full cycles @ 60 Hz

Total Unit Loads Managed by user connect/disconnect and available

- for up to 25C ambient:

250VA available

Over voltage limit: 121 – 130 VAC Under voltage limit: 87 – 99 VAC

Over/Under voltage Less than one second

limit response time:

Over/Under voltage All outputs latch OFF when detected at Power On

reset: Self Test. All outputs are disabled in the ON

STATE; each user must replug to regain power

Over/Under voltage OU status LED color changes to RED when

indication: detected at power up (BIT fail). LED turned OFF

when detected after power up.

GFI Detection Per UL 943 for Class A GFI (6ma, 30msec max



GFI Detection reset Unit assumes the OFF state until power is cycled

& indications

Power Up Time: The 28VDC power output is available within 400

mSec of input power application. The SPM completes Power-On Reset / Initialization and enter Normal mode (assuming proper enable inputs) within 10 seconds after Power-On Reset

begins.

#### C. DC Output Power

The following DC Output power requirements apply:

Output voltage: 28 VDC +/- 5% (no load to full load

Output ripple: 3% maximum (0-20 MHz; no load to full load)

Output current: 5.4 Amps continuous

Isolation: The 28VDC shall be galvanically isolated from

input power, AC output power and Chassis

Power limits:

Full load: 150W continuous

Overload: 175W maximum for up to 50mSec

Short circuit: Indefinite short circuit, 7 Amp Fused

Hold up: 200mSec min at full-load w/ output voltage of

Figure 5.

Overvoltage Trip: 30.8VDC overvoltage disable

Level Monitoring: Under/overvoltage monitoring +/- 5%

> Start time: The 28VDC power output is available within 400

> > mSec of input power application. The SPM completes Power-On Reset / Initialization and enter Normal mode (assuming proper enable inputs) within 10 seconds after Power-On Reset

begins.



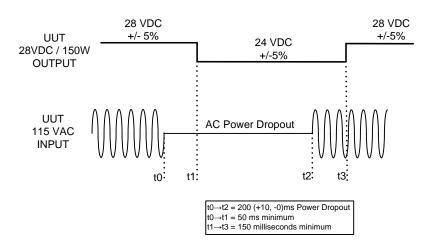


Figure 5: 28VDC Output Voltage

#### D. SAC Interface

The SPM provides pass through AC power output to the SAC port. The power output meets the following requirements:

Output Voltage: 115VAC, 360 – 800 Hz

Output Current 10 Amps

#### E. Remote OFF Interface

The Remote OFF interface provides power control to the SPM and output SAC power connector, removing power from the SPM output and SAC power connector when the Remote OFF pin is connected through a switch to Remote OFF/Fan Off Return.

The power supply for the remote OFF interface is isolated from the input power.

Remote Switch rating: 28VDC, 0.1 Amps minimum.

#### F. Fan OFF Interface

Fan OFF interface provides power control to the SPM fan, turning the fan off when the Fan OFF pin is connected to the Remote Off/Fan OFF Return. In addition, the 28VDC output is disabled when the Fan OFF signal is active.

The power supply for the Fan Off interface is isolated from the input power.

Fan Off Switch rating: 28VDC, 0.1 Amps minimum.



#### G. Status Indicator Operation

A summary of OU Status Indications is listed as follows: (not applicable in Flight Deck Mode)

> **GREEN** Power is available and/or in use at the OU

OFF No power applied to SPM

Individual OU fault (overcurrent, incorrect

connection).

Power is not available to the faulted output.

Other AC outputs are not affected.

Fault is recoverable by removing the plug

from the OU and reconnecting.

All OU fault (over/undervoltage).

No power available to any AC output.

Fault is recoverable by removing all plugs

from the OUs and reconnecting.

RESTRICTED or DISABLED state

RED SPM Fault (BIT failure, GFI, etc.)

No power available to any AC output.

Recovery requires power cycle to the SPM.

A summary of SPM In-Use Light Indications is listed as follows:

**OFF** SPM not powered

SPM powered, but no valid user's connected to AC

OU

ON (steady) At least one valid user is connected to AC OU

NOTE: indicator is ON for 1 minute at power up to

provide visual maintenance check

ON (blinking

1Hz)

SPM Fault (BIT failure, GFI, etc.)

NOTE: Indicator will blink at 1 Hz rate for 5

minutes then turn OFF.

ON (blinking

2Hz)

SPM Op Software Loading



#### H. OU Status Indicator Interface

The OU status indicator bi-polar drive to an LED has the following characteristics (compatible with Astronics AES 1235-1-x and 1292-1-x series outlet units):

- Logic LOW = <0.8VDC
- Logic HIGH = 3.5 to 5.0VDC
- Maximum current = 25mAmp

Table 1: OU Status Indicator Interface

SPM S	LED Color		
LED_X Signal LED_X_RTN		LED COIOI	
LOW	HIGH	RED	
HIGH	LOW	GREEN	

#### I. In-Use Indicator Interface

The SPM provides output power for up to two (2) In-Use Indicator lamps with the following specifications. Note the in-use indicators are not required for proper unit operation:

Table 2: In-Use Indicator Interface

PARAMETER	CONDITION	SPECIFICATION
Output Voltage	Full load, 5.0 VDC	4.0 to 5.0 VDC at 0.135 Amps
Current Limit	Full load, 5.0 VDC	0.300 Amps Maximum
Fold Back Current Limit	Short circuit; < 0.5 Ohms	0.010 Amps Maximum (any output)

- The In-Use Indicator lights default to "all" mode (indicators both provide status of all OUs).
- The individual In-Use outputs from two separate SPM units are capable of cooperatively driving a single In-Use indicator to its proper state based on power usage at both SPMs.



### 6. External Interface Requirements

#### A. Serial Interface

An RS-485 interface is provided as part of the input connectors per ARINC 628, Part 2.

NOTE: The SPM to IFE SEB will deviate from the ARINC specification in that it will be accomplished on the connector also carrying 28VDC power to the IFE SEB. The "daisy-chain" connector to the other in-seat components will comply with the ARINC connector definition.

(2) The SPM provides for external programming of any software via the RS-485 interface from the SEB (field loadable software).

#### B. External Interface Connectors/Pin-outs

(1) The external interface connectors are as specified (or equivalent) in the following tables and figures:

Connector REF	Function	SPM Connector Part Number, or Equivalent	Polari
11	DOWED INDUT	EN_4165_11D	N

Connector REF	Function	SPM Connector Part Number, or Equivalent	Polarization
J1	POWER INPUT	EN-4165-11P	N
J3	AUX POWER OUTPUT	EN-4165-11S	А
J4	PED Power/IUL	EN-4165-20S	В
J5	PED Power/IUL	EN-4165-20S	В
J6	SPM/SEB	EN-4165-11S	С

Table 3: SPM External Interface Connections

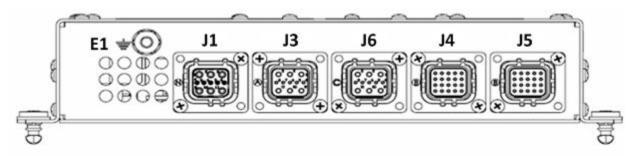


Figure 6: SPM External Interface Connections



(2) The external interface connector pin-outs are as specified in the following tables:

Table 4: SPM Power Input Connector

Connector	Ту	pe	Insert Configuration
J1	Power Input EN-4165-11 BACC65BVMN (Receptacle) BACI10BC1622PN (Insert)		
Contact	Contact Size	Wiring Type	Descriptions
1	16	16 AWG	115VAC
2	16	20 AWG	RS-485 Data Hi
3	16	20 AWG	RS-485 Data Lo
4	22	22 AWG	RS-485 Address 0
5	22	22 AWG	RS-485 Address 1
6	22	22 AWG	RS-485 Address 2
7	22	22 AWG	RS-485 Address 3
8	22	22 AWG	RS-485 Address GND
9	16	16 AWG	Chassis Ground
10	16	20 AWG	RS-485 Data Return
11	16	16 AWG	115VAC Neutral



### Table 5: SPM Aux Power Output Connector

Connector	Ту	pe	Insert Configuration
J3	AUX Power Output EN-4165-11 BACC65BVMA (Receptacle) BACI10BC1622SN (Insert)		(a) (b) (c) (c) (c) (c) (c) (c) (c) (c) (c) (c
Contacts	Contact Size	Wiring Type	Descriptions
1	16	16 AWG	115VAC (SAC)
2	16	20 AWG	Remote Off
3	16	20 AWG	Fan Off
4	22	22 AWG	RS-485 Data HI
5	22	22 AWG	RS-485 Data Lo
6	22	22 AWG	RS-485 Data Return
7	22	-	NC
8	22	-	NC
9	16	16 AWG	Chassis GND (SAC)
10	16	20 AWG	Remote Off/ Fan Off Return
11	16 16 AWG		115VAC Neutral (SAC)
Back-shell	-	-	SAC RS-485 Shield



Table 6: SPM PED Power/IUL Connector

Connector	Ty	/pe	Insert Configuration
J4	PED Power/IUL EN-4165-20 BACC65BVMB (Receptacle) BACI10BC2022SN (Insert)		0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
Contacts	Contact Size	Wiring Type	Descriptions
1	22 AWG	-	Not Connected
2	22 AWG	24 AWG	OU (1) Power
3	22 AWG	24 AWG	OU (1) Control 1
4	22 AWG	24 AWG	OU (1) LED_OUT
5	22 AWG	24 AWG	OU (1) Return
6	22 AWG	24 AWG	OU (1) Neutral
7	22 AWG	24 AWG	OU (1) Safety Ground
8	22 AWG	24 AWG	OU (1) Control 2
9	22 AWG	-	Not Connected
10	22 AWG	24 AWG	IUL (1) Hi
11	22 AWG	24 AWG	OU (2) Power
12	22 AWG	24 AWG	OU (2) Safety Ground
13	22 AWG	24 AWG	OU (2) Control 2
14	22 AWG	-	Not Connected
15	22 AWG	24 AWG	IUL(1) Lo
16	22 AWG	-	Not Connected
17	22 AWG	24 AWG	OU (2) Neutral
18	22 AWG	24 AWG	OU (2) Control 1
19	22 AWG	24 AWG	OU (2) LED_OUT
20	22 AWG	24 AWG	OU (2) Return



Table 7: SPM PED Power/IUL Connector

Table 7: SPM PED Power/IUL Connector				
Connector	Туре		Insert Configuration	
J5	PED Power/IUL EN-4165-20 BACC65BVMB (Receptacle) BACI10BC2022SN (Insert)			
Contacts	Contact Size	Wiring Type	Descriptions	
1	22 AWG	-	Not Connected	
2	22 AWG	24 AWG	OU (3) Power	
3	22 AWG	24 AWG	OU (3) Control 1	
4	22 AWG	24 AWG	OU (3) LED_OUT	
5	22 AWG	24 AWG	OU (3) Return	
6	22 AWG	24 AWG	OU (3) Neutral	
7	22 AWG	24 AWG	OU (3) Safety Ground	
8	22 AWG	24 AWG	OU (3) Control 2	
9	22 AWG	-	Not Connected	
10	22 AWG	24 AWG	IUL (2) Hi	
11	22 AWG	24 AWG	OU (4) Power	
12	22 AWG	24 AWG	OU (4) Safety Ground	
13	22 AWG	24 AWG	OU (4) Control 2	
14	22 AWG	-	Not Connected	
15	22 AWG	24 AWG	IUL(2) Lo	
16	22 AWG	-	Not Connected	
17	22 AWG	24 AWG	OU (4) Neutral	
18	22 AWG	24 AWG	OU (4) Control 1	
19	22 AWG	24 AWG	OU (4) LED_OUT	
20	22 AWG	24 AWG	OU (4) Return	



**Single Power Connector (J1)** Single phase AC power feeds the SPM through a single connector. The in-seat aircraft wiring shall branch out a single phase and ground lines up to the SPM while also rotating the power phases.

Table 8: SPM/SEB Interface Connector

Connector	Ty	уре	Insert Configuration
J6	SPM/SEB Interface EN-4165-11 BACC65BVMC (Receptacle) BACI10BC1622SN (Insert)		(a) 1 (a) 3 (b) 4 (b) 4 (c) 4
Contacts	Contact Size	Wiring Type	Descriptions
1	16	16 AWG	28VDC
2	16	-	NC
3	16	-	NC
4	22	22 AWG	RS485 Data Hi
5	22	22 AWG	RS485 Data Lo
6	22	22 AWG	RS-485 Data Return
7	22	-	NC
8	22	-	NC
9	16	16 AWG	Chassis
10	16 -		NC
11	16	16 AWG	28VDC_Return



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#### TEST AND FAULT ISOLATION

### 1. Introduction

This section contains the necessary test procedures to verify the Seat Power Module (SPM), Astronics Advanced Electronic Systems (Astronics AES) part number 1360-1, meets specified requirements.

### 2. <u>Test Equipment Required – Part 1</u>

NOTE: The following equipment is only for use with TF1301-XXX test fixtures and core software part number SM1307-004.

### A. Proprietary Test Equipment

- (1) TF1248-601, SPM Power and Control Test Fixture
- (2) TF1301-606, Test Fixture, RPO Loads (4 required)
- (3) TF1301-607, Test Fixture, Discrete Control
- (4) TF1301-608, Test Fixture, Aux Outputs
- (5) TF1360-801, Test Cable, 400Hz Input ATP
- (6) TF1360-802, Test Cable, AUX Output ATP
- (7) TF1360-803, Test Cable, RPO Output ATP (Quantity 2)
- (8) TF1360-803, Test Cable, SDB Output ATP
- (9) TF1301-827, Test Cable, Agilent 34980A Relay Control (Quantity: 3)
- (10) TF1301-828, Test Cable, Agilent 34980A MUX Input (Quantity: 1)
- (11) TF1301-829, Test Cable, Agilent 34980A Relay Control (Quantity: 1)
- (12) TF1301-830, Test Cable, Agilent 34980A MUX Input (Quantity: 1)
- (13) TF1360-841, 1301 Instrumentation to Bulkhead cable (optional)
- (14) TF1360-843, 1360 Bulkhead to DUT cable (optional)



### B. Standard Test Equipment

- (1) Oscilloscope, Tektronix TDS1012B, (with USB cable).
- (2) 360 to 800 Hz Power Source, 115 VAC, California Instrument 2001RP.
- (3) Power Meter, 1 Phase, Yokogawa WT200 or equivalent.
- (4) Digital Multimeter/Switch Controller, Agilent 34980, with:
  - Agilent 34921A 40 Channel Multiplexer modules (2 required)
  - Agilent 34938A 20 Channel General Purpose Switch module (4 required)
- (5) Computer with: Windows™ 2000 or higher operating system.
- (6) RS-232 Cable, DB-9M to DB-9F.
- (7) USB to IEEE-488 Converter, National Instrument GPIB-USB-HS.
- (8) IEEE-488 cables (4 required).
- (9) Differential Probe, ProbeMaster 4232 with 6 VDC adapter.

#### C. Software

- (1) Automated Test Software, SM1307-004.
- (2) Automated Test Software Script, 1360, SM1360-008.
- (3) See latest version of VDD1360-000-716 for latest version of SM1360-008.
- (4) Microsoft .NET Framework, v1.1 or higher.



### 3. Test Setup

- A. Initial ATP Test Setup Equipment Interconnections
  - (1) Connect test equipment and cabling between the test equipment as illustrated in Figure 1001 and Figure 1002. Insert the Agilent modules for the DMM/Switch Controller into the slots listed in Table 1001.

Table 1001: DMM / Switch Controller Module Order

Slot	Module	Interconnect	Cable
1	34921A- 40 channel MUX	34921T	TF1301-830
2	34921A- 40 channel MUX	34921T	TF1301-828
3	34938A – 20 channel GP Switch	34938T	TF1301-827
4	34938A – 20 channel GP Switch	34938T	TF1301-827
5	34938A – 20 channel GP Switch	34938T	TF1301-827
6	34938A – 20 channel GP Switch	34938T	TF1301-829
7	None		
8	None		

NOTE: Jumpers between GFI GND jacks of TF1301-606 test fixtures are required to perform the GFI tests.

(2) Connect the UUT when directed in Paragraph 4, Test Procedure.



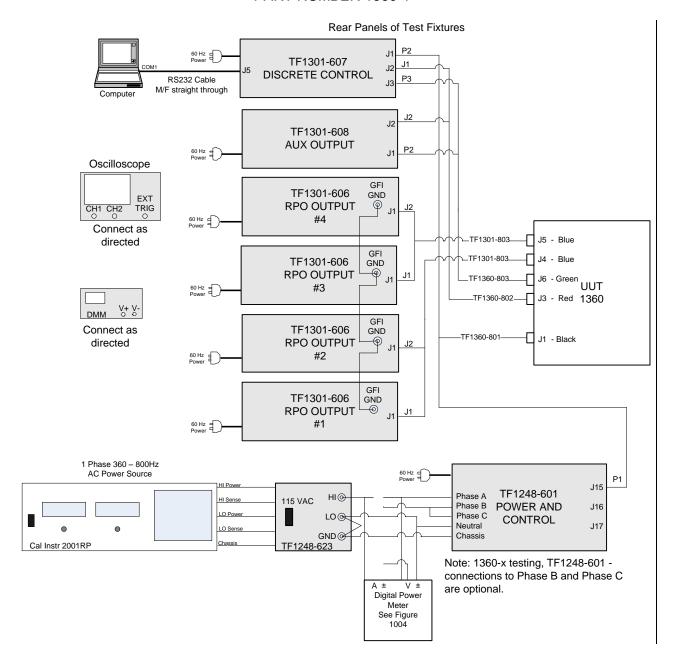


Figure 1001: Test Fixtures/UUT Connections



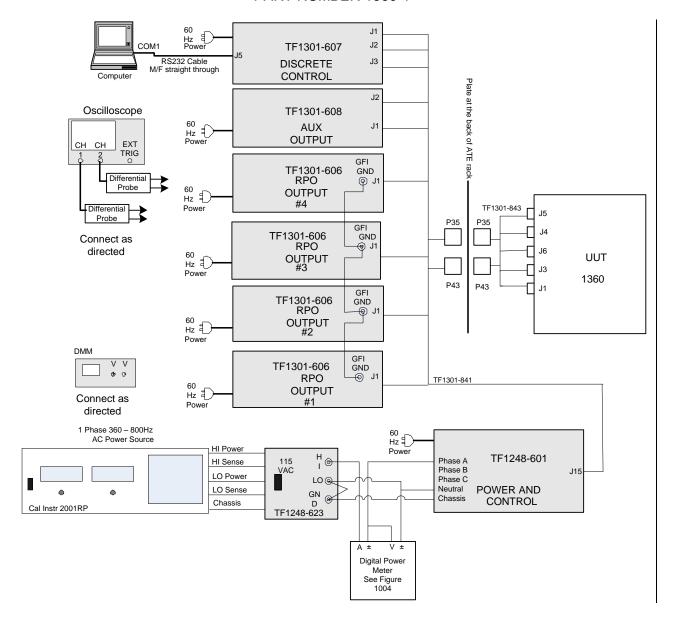


Figure 1002: Test Fixtures/UUT Connections



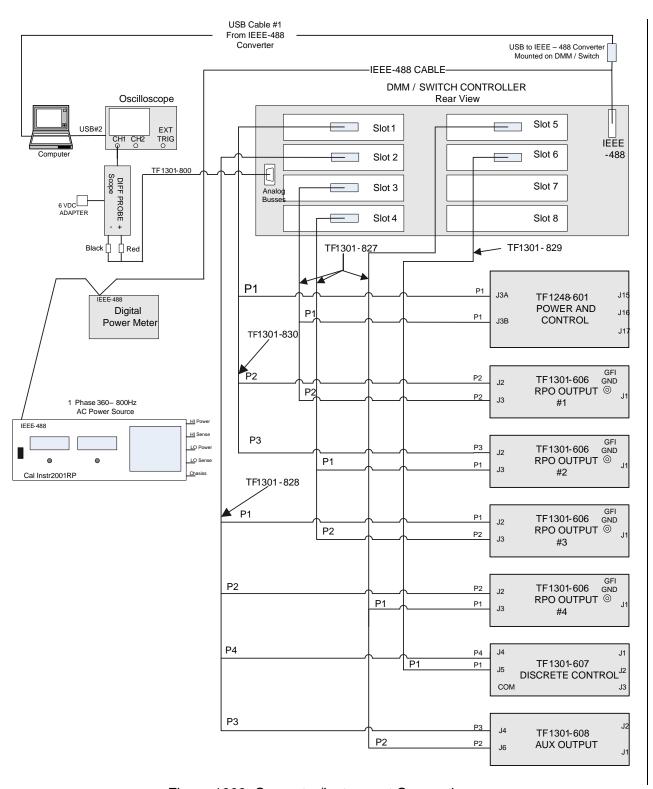


Figure 1003: Computer/Instrument Connections



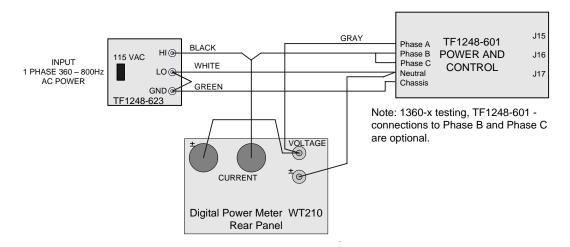


Figure 1004: Digital Power Meter Connections

- (3) Place all toggle switches on the TF1248-601, TF1301-606, TF1301-607, and TF1301 608 Test Fixtures to the down position, except the AUTO/MANUAL switches are set to the Auto position.
- (4) Place the rear panel power switch on each of the TF1248-601, TF1301-606, TF1301 607, and TF1301 608 Test Fixtures to the ON position, if not already on. The 60Hz PWR LED on each test fixture will be illuminated.
- (5) Place the rear panel 1191/1301 1248/1360 switch on each of the TF1301-606 Test Fixtures to the 1248/1360 position.
- (6) Switch on the computer and wait until the operating system completes its startup.
- (7) Verify the Differential Probe is on (verify the power LED is lit) and the gain is set to 1/10.



### B. Test Program Initialization

(1) Start the ATE program by double-clicking the AutomatedTestTool shortcut on the computer desktop. The startup screen is the **Unit Identification** screen shown in Figure 1005.

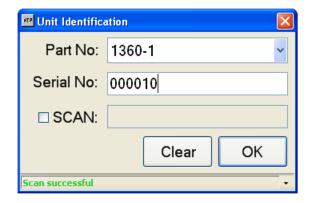


Figure 1005: Unit Identification Screen, Manual Entry

- (2) Select "1360-1" from the **Part No** pull-down menu, then enter the unit serial number in the **Serial No** field.
- (3) The Part and Serial numbers can also be scanned in by checking the box next to the SCAN label (Figure 1006). This makes the scan field active. Scan in the unit barcode and the Part and Serial numbers will be automatically parsed into the correct fields.

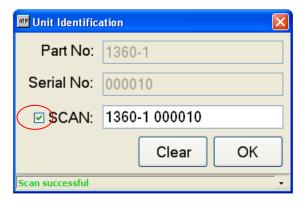


Figure 1006: Unit Identification Screen, Scan Mode

NOTE: The part numbers that appear in the pull-down menu are taken from the test scripts present in the C:\ATP directory.



NOTE:

The software will only accept valid serial numbers and will display an error message if an invalid number is entered. To view the accepted serial number formats click the tab on the right side of the status bar, as shown in Figure 1007.

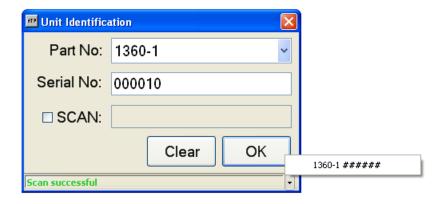


Figure 1007: Unit Identification Screen, Serial Number Formats

NOTE: The "#####" indicates that the serial number must contain six numerical characters.

- (4) Once the Part and Serial numbers are correctly entered and the status bar reads "Scan successful", click the **OK** button.
- (5) The ATP software will automatically select the correct test script and the main Automated Test Tool window (Figure 1009) should appear.
- (6) If there is more than one 1360-1 test script available the software will display the Test Selection Screen (Figure 1008). Select the appropriate test script and click the button at the top of the window.

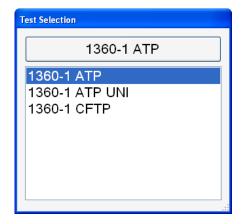


Figure 1008: Test Selection Screen



### 4. Test Procedure

- A. Connect the UUT to the test equipment per Figure 1001.
  - (1) When the main Automated Test Tool window (Figure 1009) appears, verify the Automated Test tab is active. Also verify the software versions of the test script, test library, and ATP software are up to date.

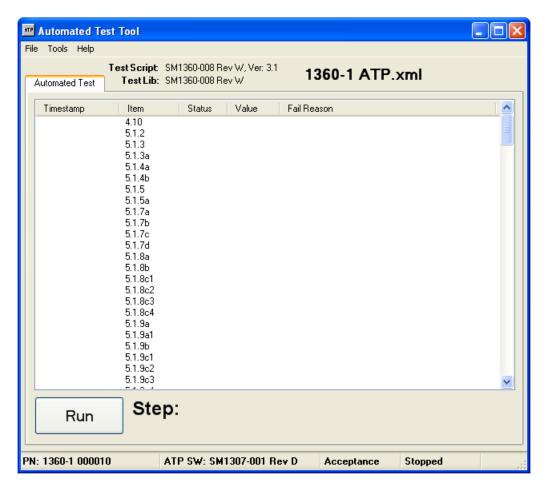


Figure 1009: ATP Main Screen

(2) To start the test, click on the RUN button. The label on the run button will change to "CANCEL". Clicking the cancel button will cause the test to abort.

NOTE: If the Test Program should Abort (ERROR message) then click on the 'Tools' menu button above and select 'Debug'. In the 'Script Debug" screen, open the test step list and scroll to the bottom and select step '6'. Click the 'Run Step' button to completely shut down all power and reset the DMM/Switch.



- (3) Upon completion of the test, disconnect the UUT.
- (4) If the test program shows the UUT failed, print and attach the data sheet and failure report to the failed item.
- (5) To print test results of last UUT tested, select File Print from the main menu.
- (6) To print test results of any UUT tested, open windows explorer. Find the C:\ATP\Reports folder. The file naming convention is:

UNIT <part number><serial number><test#>.htm

example: Unit\_1360-1\_000001\_Test\_1.htm

- (7) Right click on the file and select print. If the computer is not connected to the network, copy the file to a USB Flash drive and print the file from another computer.
- (8) To test another UUT or a different product, select NEW from the File menu, connect the new UUT per Figure 1001 repeat testing procedure.

### 5. Test Equipment Required – Part 2

NOTE: The following equipment is only for use with core software part number SM1307-004 and universal ATE system TF1185-625.

#### A. Proprietary Test Equipment

- (1) TF1185-625, ISPS ATE System
- (2) TF1390-613, Test Fixture, UUT to ATE Adapter
- (3) TF1390-823, Test Fixture, 1390, 1360, 1301 Easy Connect
- (4) TF1390-817, Test Cable, J1 (Black)
- (5) TF1390-818, Test Cable, P2 (Black)
- (6) TF1390-819, Test Cable, P3 (Red)
- (7) TF1390-820, Test Cable, P4, P5 (Blue) (2 required)
- (8) TF1390-821, Test Cable, P6 (Green 20 Pin)



B. Standard Test Equipment

None.

- C. Software
  - (1) SM1307-004, Automated Test Core Software.
  - (2) SM1360-000-008, Automated Test Software Script.

### 6. Test Setup

A. Hardware Setup

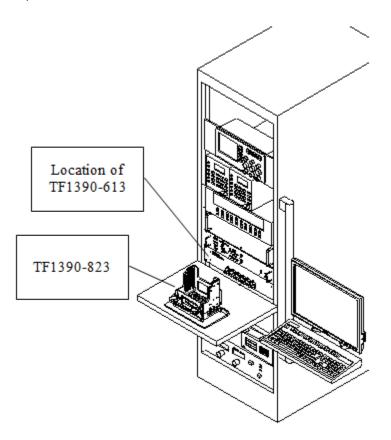


Figure 1010: ISPS ATE System

(1) Connect cables from TF1390-823 Test Fixture to the TF1390-613 of the ATE system per Table 1002.



Table 1002: Test Cable Connections

TF1390-823	TF1390-607
Cable	Connector
TF1390-817	1360-J1
TF1390-819	1360-J3
TF1390-821	1360-J6
TF1390-820	1360-J4
TF1390-820	1360-J5

### B. Software Setup

(1) Start the ATE program by double-clicking the AutomatedTestTool shortcut on the computer desktop. The start-up screen is the Unit Identification screen shown in Figure 1011.

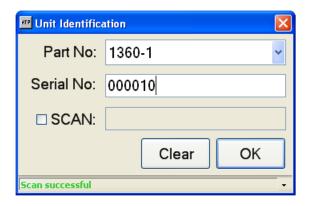


Figure 1011: Unit Identification Screen, Manual Entry

- (2) Select "1360-1" from the Part No pull-down menu, then enter the unit serial number in the Serial No. field.
- (3) The Part and Serial numbers can also be scanned in by checking the box next to the SCAN label (Figure 1012). This makes the scan field active. Scan in the unit barcode and the Part and Serial numbers will be automatically parsed into the correct fields.



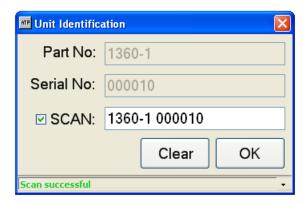


Figure 1012: Unit Identification Screen, Scan Mode

NOTE: The part numbers that appear in the pull-down menu are taken from the test scripts present in the C:\ATP directory.

NOTE: The software will only accept valid serial numbers and will display an error message if an invalid number is entered. To view the accepted serial number formats click the tab on the right side of the status bar, as shown in Figure 1013.

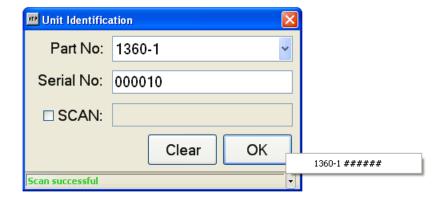


Figure 1013: Unit Identification Screen, Serial Number Formats

<u>NOTE</u>: The "#####" indicates that the serial number must contain six numerical characters.

- (4) Once the Part and Serial numbers are correctly entered and the status bar reads "Scan successful", click the OK button.
- (5) The ATP software will automatically select the correct test script and the main Automated Test Tool window (Figure 1009) should appear.



(6) If there is more than one 1360-1 test script available the software will display the Test Selection Screen (Figure 1014). Select the appropriate test script and click the button at the top of the window.

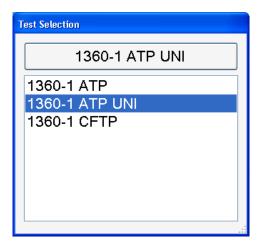


Figure 1014: Test Selection Screen

#### 7. Test Procedure

- A. After completing the Test Setup, do the following:
- B. Insert the UUT into the middle slot of TF1390-823 per Figure 1015. Verify the UUT is firmly seated.



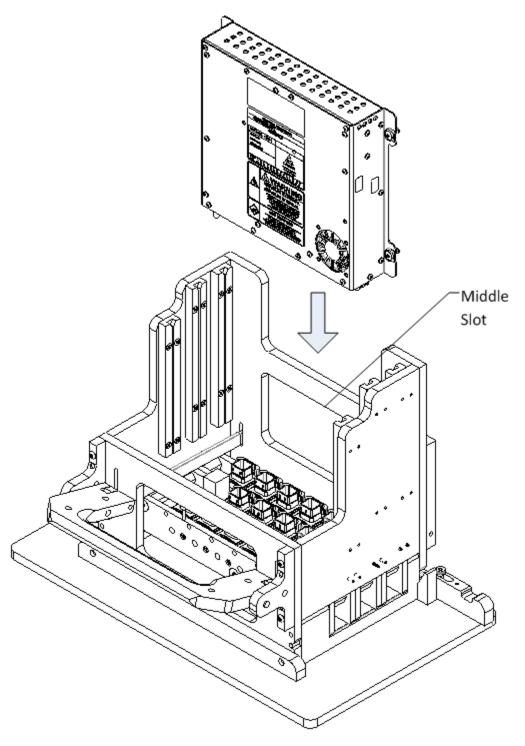


Figure 1015: 1360-1 UUT to ATE Connections



C. Verify the SPM automated test window (shown in Figure 1016) appears.

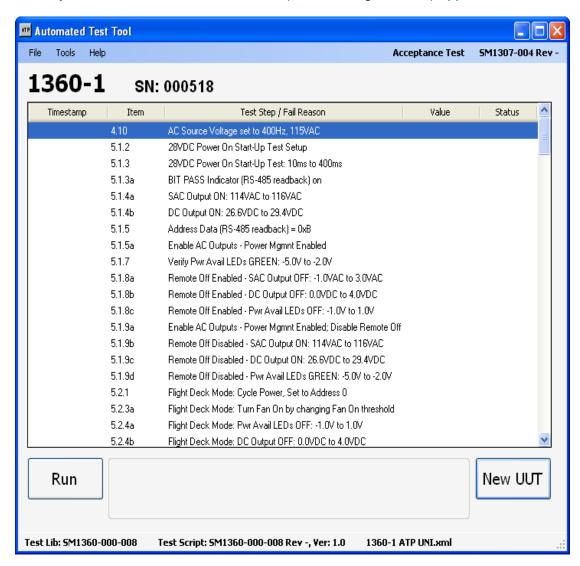


Figure 1016: View of 1360-1 SPM Automated Test Screen

- D. To start the test, click on the run button. The label on the run button will change to "CANCEL". Clicking the cancel button will cause the test to abort.
- E. Upon completion of the test, disconnect the UUT.
- F. If the test program shows the UUT failed, print, and attach the data sheet and failure report to the failed item.
- G. To print test results of last UUT tested, select file print from the main menu.



H. To print test results of any UUT tested, open windows explorer. Find the AutomatedTestTool\bin\reports folder. The file naming convention is:

UNIT <part number><serial number><test#>.csv.htm

Right click on the file and select print. If the computer is not connected to the network, copy the file to a floppy disk and print the file from another computer.

- I. Remove the UUT from TF1390-823 by pushing down on the lever handle of TF1390-823.
- J. To test the next UUT, click on the new UUT button.



### SCHEMATICS AND WIRING DIAGRAMS

### 1. General

A. This section contains top level schematics for the 1360-1 Seat Power Module (SPM).



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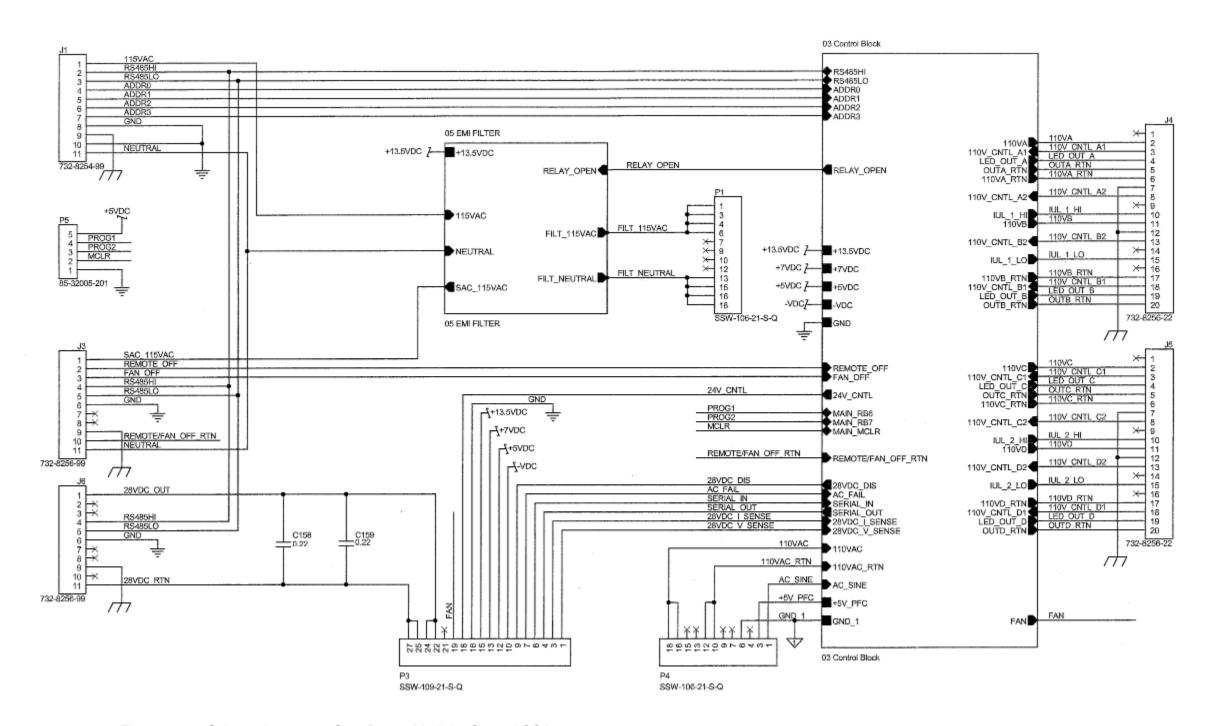


Figure 2001: Schematic 1360-1, Seat Power Module, Control CCA



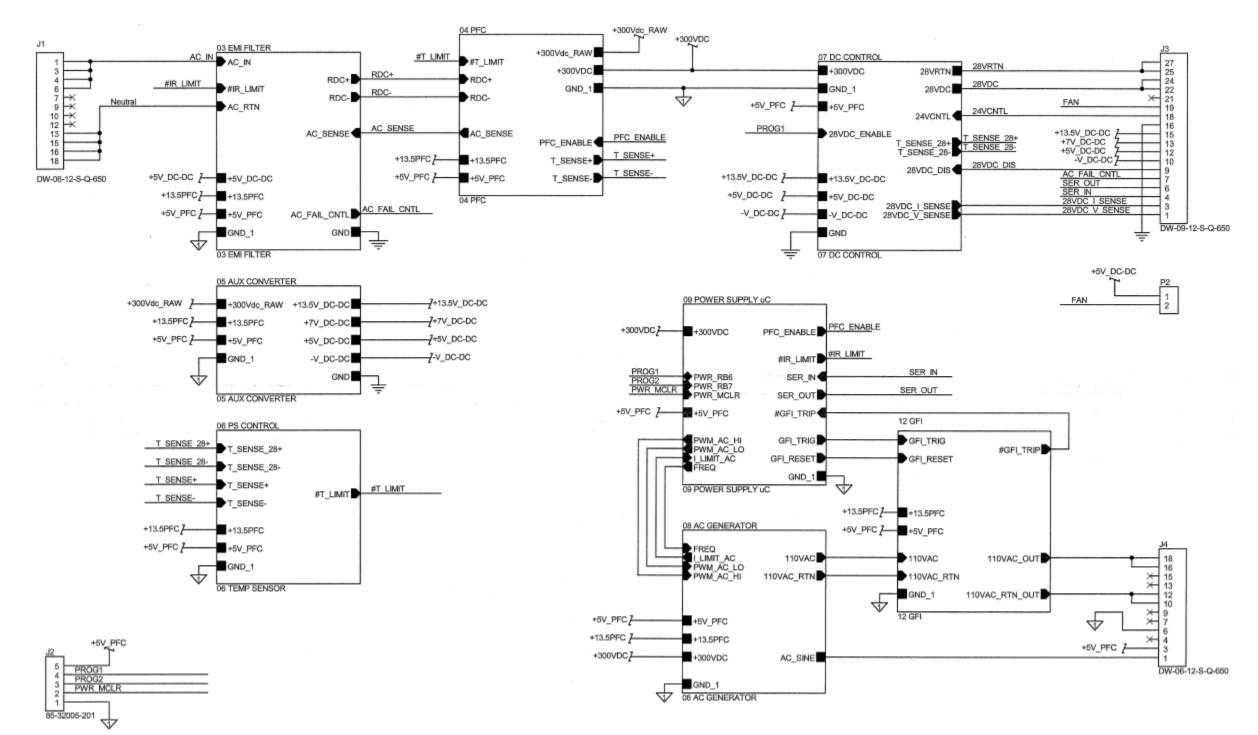


Figure 2002: Schematic 1360-1, Seat Power Module, Power CCA



#### DISASSEMBLY

### 1. General

- A. Before disassembling unit, visually inspect and/or perform the necessary operational tests and fault isolation procedures to determine the cause of a malfunction. Once the cause is isolated, correct the malfunction by replacing components or the complete CCA. After replacing components or circuit cards, test the unit per instruction in the TEST and FAULT ISOLATION section.
- B. Prepare a clean overhaul area equipped with proper tools and containers to store removed parts that are to be reused. Identify all wires to be disconnected by tagging before removal to facilitate reassembly. Disassemble the 1360-1 Seat Power Module (SPM) only to the extent necessary to repair or replace defective components. Refer to the appropriate figure in the Illustrated Parts List (IPL) to locate item numbers referenced in the following disassembly procedures.
- C. Temporarily reinsert attaching hardware (screws, nuts and washers) back into disassembled components. This prevents the mixing of hard-to-identify parts and also helps prevent loss of hardware during repair.

### 2. <u>Disassembly Procedure</u>

**NOTE**: See IPL Figure 1 for disassembly of the 1360-1 SPM.

- A. Remove the cover assembly enclosure (item 70) from the base enclosure (item 5) by removing four stud assemblies (items numbers 75, 80, and 85) from the base.
- B. Continue by removing thirty-three (33) screws (item 25) from the Base Enclosure.
- C. Remove the Fan Assembly (item 60) to the Power Circuit Card Assembly (item 15).
- D. Disconnect the Power Circuit Card Assembly (item 15) from the Base Enclosure Assembly (item 5) and the Control Circuit Card Assembly (item 10).
- E. Remove the Endplate Connector Shell Assembly (item 20) from the Base Enclosure Assembly (item 5) by removing four (4) screws (item 30).
- F. Remove the Control Circuit Card Assembly (item 10) from the Base Enclosure Assembly (item 5) by removing eight (8) screws (item 25).
- G. Disassembly is complete.



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#### **CLEANING**

### 1. General

A. This section contains instructions for cleaning the 1360-1 Seat Power Module (SPM) after disassembly. Parts having identical cleaning procedures are grouped under common headings.

#### 2. Requirements

- A. The following items should be available:
  - Vacuum cleaner
  - Non-metallic soft-bristled brush
  - Clean lint-free cloth
  - Dry, low pressure compressed air; 80 to 100 psi
  - Mild glass cleaner

WARNING: DURING THE FOLLOWING PROCEDURES, MAKE CERTAIN THAT

ALL SOURCES OF FLASH OR FIRE ARE ELIMINATED FROM POSSIBLE CONTACT WITH COMBUSTIBLE MATERIALS AND VAPOR. SHOULD A SPILL OCCUR, FLUSH THE AREA LIBERALLY WITH WATER SPRAY. IN CASE OF FIRE, USE WATER SPRAY, FOAM, DRY CHEMICAL OR CO<sub>2</sub>. KEEP CONTAINERS CLOSED.

WARNING: EXERCISE CARE WHEN WORKING WITH CLEANING SOLVENTS.

USE THEM WITH ADEQUATE VENTILATION AND AVOID PROLONGED BREATHING OF FUMES. DO NOT TAKE THEM INTERNALLY AND AVOID CONTACT WITH EYES AND SKIN.

#### 3. Cleaning

A. Electronic Parts

<u>WARNING</u>: COMPRESSED AIR IS POTENTIALLY DANGEROUS. ALWAYS DIRECT AIR FLOW AWAY FROM PERSONNEL.

- (1) Clean assembled parts with vacuum cleaner or low pressure compressed air.
- (2) Prior to encapsulating, clean surfaces with a non-metallic, soft-bristle brush. Dip brush in cleaning solvent.
- (3) Dry with low pressure compressed air.



### 4. Metal Parts

- A. Brush all surfaces and parts with a non-metallic, soft bristle brush.
- B. Wipe surfaces with a clean, lint-free cloth dampened with a mild glass cleaner.
- C. Dry with a clean cloth.



#### CHECK

### 1. Visual Checks

A. Examine the unit and check the following items:

NOTE: Use a minimum of five-power magnification to check components, wiring, solder and conductor patterns.

- (1) Check the CCA for discoloration of the conformal coating or other evidence of overheating.
- (2) Check components for security of mounting.
- (3) Check components and wires for damage.
- (4) Check wire terminals and connections for proper installation.
- (5) Check wire insulation for charring, cracking, and brittleness.
- (6) Check wire for proper routing
- (7) Check nameplate for proper installation and legibility.
- (8) Check components for legibility of reference designations and terminal identification.
- (9) Check finished surface for damage.
- (10) Check chassis assembly for warping, bending or other damage.
- (11) Check sleeving and tubing, if present, for proper installation and evidence of damage.
- (12) Check hardware for stripping or cross-threaded threads.
- (13) Check CCAs for damage or lifted traces.

### 2. Special Checks

A. Check vendor component per manufacturer's instructions.

Most failure mode indications are electrical and require testing per the TEST AND FAULT ISOLATION section of this manual. Check for the following:

- Gradual performance deterioration.
- Erratic behavior evidenced in output.



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#### REPAIR

Repair of the 1360-1 Seat Power Module (SPM) may be accomplished only at factory-authorized repair stations.

#### 1. General

- A. This section provides the information necessary to return the 1360-1 Seat Power Module (SPM) to serviceable condition.
- B. Factory repairs and modifications performed at Astronics Advanced Electronic Systems by its Customer Returns and Repairs (CRR) Department shall be made in accordance with processes detailed in Astronics procedure ES21600, Service Products.

#### 2. List of Materials

- A. The following is list of recommended materials, chemicals, and tools to have available when doing repairs (equivalent substitutes may be used):
  - Nylon rod with one end flattened.
  - HumiSeal, Type 1A20, MIL-I-46058, Revision C, (protective coating) manufactured by HumiSeal Division of Columbia Technical Corporation, Woodside, New York 11377.
  - Mild glass cleaner, commercially available.
  - Crocus cloth, available from commercial sources.
  - Electrical wire per MIL-W-22759/34.
  - Sleeving, silicone-treated fiberglass, Class HA1 or CH1 per MIL-I-3190 or equivalent.
  - Paint, epoxy, high-solids, black, part number M22750F-004P-37038, CAGE Code 81349, per MIL-C022750.
  - Rubber eraser.

#### 3. Repair

NOTE: The following repair procedures are recommended only as an alternative to complete assembly replacement. Other procedures may be exercised at the option of the repair activity.

- A. Bent Connectors, Pins, or Chassis Frame Members
  - (1) Do not attempt to straighten bent connector pins or chassis frame members unless the bending or warpage is slight. Parts damaged beyond this repair capability should be replaced. Electrical components are normally non-repairable and must be replaced when found faulty. Optionally, the CCA may be replaced and the unit returned to service while conducting lower tier repairs on the CCA.
- B. Repair of Damaged or Defective Trace



(1) A damaged trace may be a complete break or scratches, nicks, or pinholes, which reduce the cross-sectional area of the conductor beyond original design specifications (see Figure 6001).

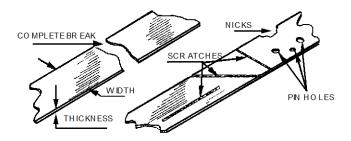


Figure 6001: Typical Printed Wiring Damage

NOTE: Repair should be limited to two repairs per conductor and not more than five repairs per board. The damaged section of the conductor should not exceed five times the conductor width.

- (2) Clean both sides of the break in the conductor, at least 1/4-inch on each side, with a rubber eraser and then isopropyl alcohol.
- (3) Cut a piece of 22 or 24-gauge solid tinned copper wire a minimum of 1/4-inch longer than the break. The wire may be flattened by placing it between smooth metal plates and pressing with a bench vise.
- (4) Hold the flattened wire on centerline of the conductor, across the break, and solder it in place (see Figure 6002).

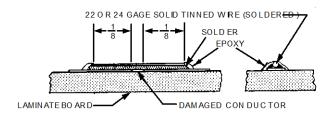


Figure 6002: Repairing Damaged Conductor

(5) Flow a small amount of epoxy cement over the entire repair and allow to dry at room temperature for 12 hours.



### C. Repairing Lifted Conductors

 A lifted conductor is present when a portion of the conductor is lifted from the substrate, but not broken (see Figure 6003).

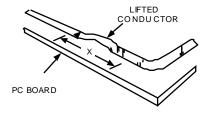


Figure 6003: Typical Lifted Conductor

NOTE: The length of the lifted conductor that is repairable shall not exceed one-half the length of the conductor path between two terminal areas or 1/2-inch, whichever is the smaller.

- (2) Clean the area to be repaired with mild glass cleaner.
- (3) Apply epoxy to the surface of the lifted conductor to a distance of at least 1/8-inch in all directions from the damaged area.
- (4) Cure in air for 12 hours at room temperature.

**NOTE**: Allow the repaired unit to dry thoroughly before handling.

(5) Repairs to the PWB that require straightening warped boards, replacing connector tabs, or installing eyelets are not recommended. If this type of damage is apparent, it is recommended that the entire CCA be replaced.

#### 4. Refinishing

A. If the front panel or assembly cover is nicked, scratched or burred, the damaged area should be worked smooth with crocus cloth, and wiped clean with a mild glass cleaner.

#### Replacement

- A. Replace all electronic components not meeting the requirements outlined in the TEST and FAULT ISOLATION section of this manual. Replace electrical wire, as required, with wire of the same length, color and gauge as that being replaced.
- B. Before removing components or wire, remove the conformal coating by heating it with a soldering iron and pushing the softened coating away with a nylon rod.



- C. Clip leads near the body of the faulty component to be removed.
- D. Grasp the component with pliers and carefully break it free of the conformal coating. Use an 80-watt soldering iron and pliers to remove leads from the PWB.
- E. Take care to avoid lifting solder pads. Heat the solder pads with soldering iron until conformal coating begins to curl and bubble; then remove conformal coating from the area with a cloth soaked in isopropyl alcohol.
- F. Install sleeving on all jumpers and component leads where required.
- G. Bend new component leads to fit matching holes in the PWB and trim the leads to the desired length (leads are not to extend more than 0.040-inch beyond opposite side of PWB).
- H. Be sure the component is oriented in the proper polarity position and install it on the board; then solder it in place.

Perform the applicable steps specified in the TEST FAULT ISOLATION section of this manual prior to application of conformal coating. Brush coat conformal coating on the PWB in the area of all connections around the repaired area, and allow it to dry at room temperature for 12 hours.



#### **ASSEMBLY**

### 1. General

This section contains the steps to reassemble the 1360-1 Seat Power Module (SPM) after doing repair procedures. Observe identification, reference designation, orientation and polarity markings when installing electronic components. If epoxy cement and/or conformal coating was applied during repairs, examine the repair to be sure that curing is complete. Refer to the appropriate figure in the Illustrated Parts List to locate item numbers referenced in the detailed assembly procedures.

## A. Assembly Procedure

For the 1360-1 Seat Power Module (SPM) perform the following steps:

- (1) Attach the Control Circuit Card Assembly (IPL Figure 1, item 10) to the Base Enclosure Assembly (item 5) by inserting eight (8) screws (item 25).
- (2) Attach the Endplate Connector Shell Assembly (item 20) to the Base Enclosure Assembly (item 5) by inserting four (4) screws (item 30).
- (3) Attach five (5) standoff supports to the Base Enclosure Assembly (item 5).
- (4) Attach the left and right Thermal Pads (items 40 and 45) to the Power Circuit Card Assembly (item 15).
- (5) Connect the Power Circuit Card Assembly (item 15) to the Base Enclosure Assembly (item 5) and the Control Circuit Card Assembly (item 10).
- (6) Attach the Fan Assembly (item 60) to the Power Circuit Card Assembly (item 15).
- (7) Attach the Cover Assembly Enclosure (item 70) to the Base Enclosure Assembly (item 5) by inserting thirty-three (33) screws (item 25) into the Base Enclosure.
- (8) Complete attaching the Cover Assembly Enclosure to the Base Enclosure by connecting four stud assemblies (item numbers 75, 80, and 85) to the base.
- (9) This completes the assembly procedure.

### B. Storage

- (1) Preparation for Storage or Shipment
  - Ensure that the 1360-1 SPM is clean before packaging (see CLEANING). Ensure that all necessary hardware is included.



### C. Unit Packaging

- Protect the 1360-1 SPM from dust, moisture and atmospheric conditions by placing it and desiccant in a polyethylene bag and sealing the bag.
- Place the bag in an ATA-300 Category II container with sufficient padding to protect the 1360-1 SPM from damage during storage or shipping.
- Seal container with sufficient marking to ensure easy identification of contents.
- Store at temperatures in the range of -65°F to +165°F.



#### TOOLS, FIXTURES AND EQUIPMENT

### 1. General

A. Table 9001 lists the proprietary test equipment required to perform the Automated Acceptance Test Procedure for the 1360-1 SPM. Table 9002 lists the standard test equipment needed to perform the Automated Acceptance Test Procedure. Equivalent substitutes may be used for standard test equipment.

Table 9001: Proprietary Test Equipment for Automated Acceptance Test

Item	Part or Model No.	Description	Supplier	Qty.
1	TF1248-601	SPM Power and Control Test Fixture	Astronics AES	1
2	TF1301-606	Test Fixture, RPO Loads		4
3	TF1301-607	Test Fixture, Discrete Control		1
4	TF1301-608	Test Fixture, Aux Outputs		1
5	TF1360-801	Test Cable, 400Hz Input - ATP		1
6	TF1360-802	Test Cable, AUX Output - ATP		1
7	TF1360-803	Test Cable, SDB Output - ATP		1
8	TF1301-827	Test Cable, Agilent 34980A – Relay Control		3
9	TF1301-828	Test Cable, Agilent 34980A – MUX Input		1
10	TF1301-829	Test Cable, Agilent 34980A – Relay Control		1
11	TF1301-830	Test Cable, Agilent 34980A – MUX Input		1
12	TF1360-841	1301 Instrumentation To Bulkhead Cable		OPT
13	TF1360-843	1360 Bulkhead To DUT Cable		OPT
14	TF1185-625	ISPS ATE System		1
15	TF1390-613	Test Fixture, UUT to ATE Adapter		1
16	TF1390-823	Test Fixture, 1390, 1360, 1301 Easy Connect		1
17	TF1390-817	Test Cable, J1 (Black)		1
18	TF1390-818	Test Cable, P2 (Black)		1
19	TF1390-819	Test Cable, P3 (Red)		1
20	TF1390-820	Test Cable, P4, P5 (Blue)		2
21	TF1390-821	Test Cable, P6 (Green 20 Pin)		1



Table 9002: Standard Test Equipment for Automated Acceptance Test (Equivalent Test Equipment May Be Substituted)

Item	Part or Model No.	Description	Supplier	Qty.
1	TDS1012B	Oscilloscope with USB cable	Tektronix	1
2	2001RP	360 to 800 Hz Power Source, 115 VAC	California Instrument	1
3	WT200	Power Meter, 1 Phase	Yokogawa	1
4	34980	Digital Multimeter/Switch Controller	Agilent	1
5	34921A	40 Channel Multiplexer Modules	Agilent	2
6	34938A	20 Channel General Purpose Switch Module	Agilent	4
7	RS-232	Cable, DB-9M to DB-9F	National Instrument	1
8	GPIB-USB-HS	USB to IEEE-488 Converter		
9	4232	Differential Probe with 6 VDC adapter	ProbeMaster	1
10	IEEE-488	Cables		4



#### ILLUSTRATED PARTS LIST

### 1. General

- A. The following pages list and describe the subassemblies that are contained in this manual. The IPL is used for purchasing, storing, issuing, identifying parts and for showing assembly and disassembly relationships. The IPL is divided into four parts:
  - (1) Vendor Code List
  - (2) Equipment Designator Index
  - (3) Numerical Index
  - (4) Illustrated Parts Lists

### 2. Commercial and Government Entity (CAGE) Codes

A. The vendor code lists consists of the Commercial and Government Entity (CAGE) codes, which are published in current issues of *H4/H8, Commercial and Government Entity*, a listing of domestic and foreign firms that provide items-of-supply to the federal government. The appropriate CAGE identification is provided in the Description column of the Illustrated Parts List with each part. CAGE code for standard items are not listed in the Description column. The Vendor Cage Code List itemizes the codes and provides the Name and Address of Manufacturers.

### 3. Equipment Designator Index

A. The Equipment Designator Index contains an alpha/numeric listing of reference designations assigned to subassemblies and components listed in the Illustrated Parts List. The designations correspond to those shown on schematics and wiring diagrams.

### 4. Numerical Index

A. The Numerical Index contains an alpha/numeric listing of all parts listed in the IPL. The figure and item number of the part is included to facilitate locating parts in the illustration and parts list. The quantity shown indicates the total quantity used per item.



#### 5. Illustrated Parts List

A. The illustrated parts list is comprised of illustrated breakdowns that identify assemblies and subassemblies of the unit in a figure and item sequence. Items are numbered in disassembly order.

#### B. Indentation

Parts listed in the parts list are indented to indicate item relationship or Next Higher Assembly (NHA). The nomenclature of each assembly is followed in the list by the nomenclature of its component indented one column to the right. This indentation indicates the relationship of the component to the assembly. To determine the NHA of a part or assembly, note the column in which the first word of the nomenclature appears. The first item directly above, which appears one column to the left, is the Next Higher Assembly.

#### C. Effectivity Code

If a part has a blank in this column, this is an indication that the part is applicable to all configurations. If there is a letter in this column, the part may be used only on the assembly with the same letter. For example, if in one IPL there is circuit card assembly with a CCA-1 with effectivity A and a CCA-2 with effectivity B, a part with an A in the "EFFECT" column of the IPL can be used only on the CCA-1. Note that effectivity letters start again with each parts list.

#### D. Units Per Assembly

The quantity shown in this column represents the units required for one next higher assembly, subassembly, or sub-subassembly. The abbreviation AR (as required) is used when the quantity required must be determined when parts are installed as a result of repair efforts.

#### E. Optional Parts

Optional parts are interchangeable or substitute for the preferred part. They are listed beneath that part and the item number is prefixed with a dash and followed by a letter, i.e.; -135B. The abbreviation (OPT) follows the nomenclature. When selecting optional parts, be sure to also check the effectivity column.



## VENDOR (CAGE) CODES

CODE	NAME AND ADDRESS
24345	DYNAMIC SYSTEMS INC. DBA D S I 323 ROUTE 355 POESTENKILL, NY 12140
39428	MCMASTER-CARR SUPPLY COMPANY 600 COUNTY LINE RD ELMHURST, IL 60126
51506	ACCURATE SCREWMACHINE CORPORATION 10 AUDREY PL FAIRFIELD, NJ 07004
55403	CAIG LABORATORIES INC 12200 THATCHER CT POWAY, CA 92064
55566	R A F ELECTRONIC HARDWARE INC 95 SILVERMINE RD SEYMOUR, CT 06483
59093	NYLOK CORPORATION 45260 Hallmark Drive Macomb, MI 48042-4007
61000	GLOBE FASTENERS INC 34-24 56TH ST WOODSIDE, NY 11377
67041	TYCO ELECTRONICS CORPORATION 76 COMMERCIAL WAY EAST PROVIDENCE, RI 02914



80205 NATIONAL AEROSPACE STANDARDS

COMMITTEE AEROSPACE INDUSTRIES

ASSOCIATION OF AMERICA INC 1000 WILSON BLVD SUITE 1700

ARLINGTON, VA

22209

86928 SEASTROM MANUFACTURING CO. INC.

DBA SEASTROM MANUFACTURING

456 SEASTROM ST TWIN FALLS, ID

83301

91833 KEYSTONE ELECTRONICS CORP

31-07 20TH RD ASTORIA, NY

11105

94222 SOUTHCO INC.

210 N BRINTON LAKE RD CONCORDVILLE, PA

19331

96906 FEDERAL SPECIFICATIONS

PROMULGATED BY GENERAL SERVICES ADMINISTRATION WASHINGTON DC

1Q484 CARDINAL INDUSTRIAL FINISHES

DIV NORTHWEST OFFICE 19230 144TH AVE NE STE A

WOODINVILLE, WA

98072

IW947 ALLKAY ELECTRONICS INC

9732 VARIEL

CHATSWORTH, CA

91313



### **EQUIPMENT DESIGNATOR INDEX**

Equip Desig	Fig-Item No.
A1	1-10
A2	1-15

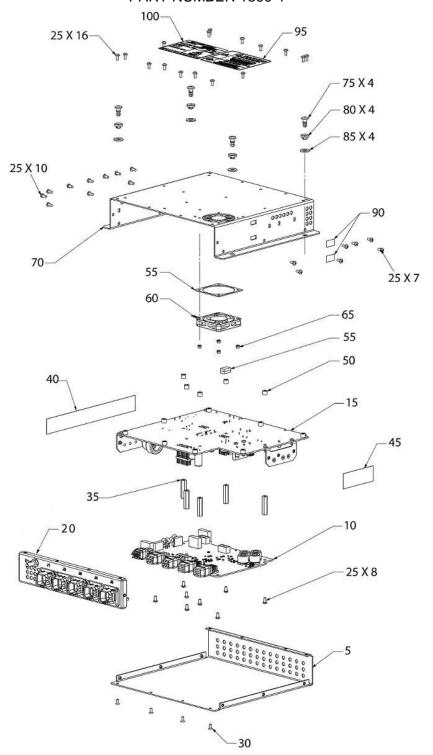


### NUMERICAL INDEX

PART NO.	AIRLINE PART NO.	ITEM	QTY REQ
11236A6		1-50	5
3030R-A.188-23		1-50A	5
A-1201-140-24		1-50B	5
1316401-1		1-95	1
1360101-8		1-15	1
1360101-7		1-15A	1
1360101-6		1-15B	1
1360101-5		1-15C	1
1360101-4		1-15D	1
1360101-3		1-15E	1
1360101-2		1-15F	1
1360102-7		1-10	1
1360102-6		1-10A	1
1360102-5		1-10B	1
1360102-4		1-10C	1
1360102-3		1-10D	1
1360102-2		1-10E	1
1360301-3		70	1
1360301-2		-70A	1
1360302-2		1-5	1
1360307-2		1-20	1
1360307-1		1-20A	1
1360323-2		1-60	1
1360323-1		1-60A	1
1360405-1		1-40	1
1360406-1		1-45	1
1	1	i	

PART NO.	AIRLINE PART NO.	ITEM	QTY REQ
1360518-1		1-55	1
1390403-1		1-105A	
2112440B27 2404-HB-016-ES 2205		1-35 1-35A 1-35B	5 5 5
5710-54-048		1-85	4
82-19-180-20 82-19-180-20-1 82-32-401-41 90101A004 MS21043-04 NAS1291C04M LEB2-0916P-8A NP137CR440R4E NP139CR440R4E STALA410707		1-75 1-75A 1-80 1-65 1-65A 1-65B 1-90 1-25 1-30	4 4 4 4 4 4 4 4 4 4 4 4 1 4 1





IPL Figure 1: 1360-1 Seat Power Module (SPM)



FIG-	PART NUMBER	AIRLINE PART	NOMENCLATURE 1 2 3 4 5 6 7	EFFECT	UNITS PER ASSY
1-1	1360-1	NUMBER		CODE	RF
-1A	1360-1 1360-1 MOD B		<ul><li>SEAT POWER MODULE (SPM)</li><li>SEAT POWER MODULE (SPM)</li></ul>	A B	RF
-1A	1360-1 MOD C		SEAT POWER MODULE (SPM)	С	RF
-1C	1360-1 MOD C		SEAT POWER MODULE (SPM)	D	RF
5			ENCLOSURE ASSEMBLY, BASE	Б	1
10	1360302-2		·	D	1
10	1360102-7		A2, CIRCUIT CARD ASSEMBLY, CONTROL	U	ı
-10A	1360102-6		A2, CIRCUIT CARD ASSEMBLY, CONTROL (OPT TO ITEM 10)	D	1
-10B	1360102-5		A2, CIRCUIT CARD ASSEMBLY, CONTROL	С	1
-10C	1360102-4		A2, CIRCUIT CARD ASSEMBLY, CONTROL (OPT TO -10B)	ВС	1
-10D	1360102-3		A2, CIRCUIT CARD ASSEMBLY, CONTROL	А	1
-10E	1360102-2		A2, CIRCUIT CARD ASSEMBLY, CONTROL (OPT TO -10D)	А	1
15	1360101-8		A1, CIRCUIT CARD ASSEMBLY, POWER	D	1
-15A	1360101-7		A1, CIRCUIT CARD ASSEMBLY, POWER (OPT TO ITEM 15)	D	1
-15B	1360101-6		A1, CIRCUIT CARD ASSEMBLY, POWER	С	1
-15C	1360101-5		• A1, CIRCUIT CARD ASSEMBLY, POWER (OPT TO -15B)	ВС	1
-15D	1360101-4		A1, CIRCUIT CARD ASSEMBLY, POWER	Α	1
-15E	1360101-3		• A1, CIRCUIT CARD ASSEMBLY, POWER (OPT TO -15D)	А	1
-15F	1360101-2		• A1, CIRCUIT CARD ASSEMBLY, POWER (OPT TO -15D)	А	1
20	1360307-2		ENDPLATE CONNECTOR SHELL ASSEMBLY		1
-20A	1360307-1		ENDPLATE CONNECTOR SHELL ASSEMBLY		1
			Attaching Parts		
25	41-00406-003		SCREW,PNH,CRES,SLFLKG,4-40X     0.250L w/MICROSPHERES PATCH,     8SEC VISCOSITY		8



FIG-		AIRLINE PART	NOMENCLATURE	EFFECT	UNITS PER
ITEM	PART NUMBER	NUMBER	1234567	CODE	ASSY
30	41-00406-006		SCREW,PNH,CRES,SLFLKG,4-40X     0.250L w/MICROSPHERES PATCH,     8SEC VISCOSITY		4
35	2112440B27		• STANDOFF, BRS, ¼ HEX, TIN-LEAD PL, 4-40X1.000L		5
-35A	2404-HB-016-ES		• STANDOFF, BRS, ¼ HEX, TIN-LEAD PL, 4-40X1.000L		5
-35B	2205		• STANDOFF, AL, 1/4 HEX, 4-40X1.000L		5
40	1360405-1		THERMAL PAD, OUTSIDE, RIGHT		1
45	1360406-1		THERMAL PAD, OUTSIDE, LEFT		1
			***		
50	11236A6		SPACER, A1, GOLD IRIDITE, ¼ RND, 0.140ID 0.188L		5
-50A	3030R-A.188-23		SPACER, A1, GOLD IRIDITE, ¼ RND, 0.140ID 0.188L		5
-50B	A-1201-140-24		SPACER, A1, GOLD IRIDITE, ¼ RND, 0.140ID 0.188L		5
55	1360518-1		SPACER, FAN		1
60	1360323-3		FAN ASSEMBLY		1
-60A	1360323-1		FAN ASSEMBLY		1
65	90101A004		• NUT, HEX, LOCK, CRES 18-8, 4-40X0.11L		4
-65A	MS21043-04		NUT, SELF LOCKING		4
-65B	NAS1291C04M		NUT, SELF LOCKING, HEX, CRES, DRY FILM LUBE, 4-40THD		4
			***		
70	1360301-3		ENCLOSURE ASSEMBLY, COVER		1
-70A	1360301-2		ENCLOSURE ASSEMBLY, COVER		1
			Attaching Parts		
75	82-19-180-20-1		STUD, OVAL HD, ¼ TURN, STAINLESS STL, PHILLIPS RECESS	D	4
-75A	82-19-180-20		STUD, OVAL HD, ¼ TURN, STAINLESS STL, PHILLIPS RECESS	A,B,C	4
80	82-32-401-41		RETAINER, ¼ TURN STUD, SNAP-IN	A,B,C	4
85	5710-54-048		WASHER, FLAT, STAINLESS STL, .500OD .252ID .048THL		4



FIG- ITEM	PART NUMBER	AIRLINE PART NUMBER	NOMENCLATURE 1234567	EFFECT CODE	UNITS PER ASSY
25	41-00406-003		SCREW,PNH,CRES,SLFLKG,4-40X     0.250L w/MICROSPHERES PATCH,     8SEC VISCOSITY		33
			***		
90	LEB2-0916P-8A		LABEL, POLYESTER, SILVER METALLIZED, 0.63X0.354		2
95	1316401-1		LABEL, WARNING		1
100	STALA410707		• LABEL, POLYESTER, MTLZ, 3.0X2.375		1
-105A	1390403-1		THERMAL PAD	D	2

-Item Not Illustrated