

FLIGHT PAYLOAD STANDARDIZED HAZARD CONTROL REPORT		A. NUMBER	B. PHASE	C. DATE
		STD- AMS-02-F02	Phase II	May 22, 2006
D. PAYLOAD, DTO, DSO or RME (Include Part Number(s), if applicable)		HAZARD TITLE		E. VEHICLE
Alpha Magnetic Spectrometer (AMS-02) Orbiter Interior Elements—See Attached List		STANDARD HAZARDS		Shuttle
F. DESCRIPTION OF HAZARD:	G. HAZARD CONTROLS: (complies with)	H. APP.	I. VERIFICATION METHOD, REFERENCE, AND STATUS:	
1. Structural Failure (payloads must comply with the listed requirements for all phases of flight) <i>Note: Locker and Soft Stowage items only.</i>	Designed to meet the standard modular locker stowage requirements of NSTS 21000-IDD-MDK or equivalent IDD _____.	<input checked="" type="checkbox"/>	1.1.1. SVM: Review of Installation drawings for Middeck Stowage. 1.1.2. SVM: Weight/CG Analysis for Stowage for Middeck Stowage 1.1.1 STATUS: Open 1.1.2 STATUS: Open	
2. Structural Failure of Sealed Containers  <b>Note 1: Only sealed containers made of conventional metal (metal alloy) can use the 1230 form. Sealed containers made of unconventional metals or non-metallic materials shall be documented on Unique Hazard Reports.</b>  <b>Note 2: The 1230 form is not applicable for “sealed container”(s) employed in levels of containment control of hazardous fluid.</b>	Sealed containers must meet the criteria of NASA-STD-5003, Para. 4.2.2.4.2.3a, contain a substance which is not a hazard if released, be made of conventional metals (e.g. Al, inconel, monel, steel or titanium), contain less than 14,240 foot-pounds (19,130 Joules) of stored energy due to pressure, and have a maximum delta pressure of 1.5 atm.	<input type="checkbox"/>	N/A. – No Sealed Containers used as structure (No Sealed Containers for any purpose)	
APPROVAL	PAYLOAD ORGANIZATION		SSP/ISS	
PHASE I				
PHASE II				
PHASE III				

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3. Structural Failure of Vented Containers	<p>For intentionally vented containers, vents are sized to maintain a 1.4 factor of safety for Shuttle or a 1.5 factor of safety for Station with respect to pressure loads. Meets all of the applicable pressure rates defined for one or more of the following.</p> <p>a) Shuttle payload bay – ICD 2-19001, Para. 10.6.1</p> <p>b) Station environment – SSP 52005, paragraph 4.3 or equivalent payload specific ICD _____.</p> <p>c) Station PFE discharge – SSP 57000, Para. 3.1.1.4K, or equivalent payload specific ICD _____.</p> <p>d) Shuttle Middeck – NSTS 21000-IDD-MDK, Section 6.1.</p>	<input type="checkbox"/>     <input type="checkbox"/>	N/A. – No confined volumes in hardware design.	
4. Sharp Edges, Corners, and/or Protrusions.	<p>Meets the <b>intent</b> of one or more of the following:</p> <p>a) NASA-STD-3000 / SSP 50005</p> <p>b) SLP 2104</p> <p>c) NSTS 07700 Vol. XIV App. 7 (EVA hardware)</p> <p>d) NSTS 07700 Vol. XIV App. 9 (IVA hardware) / SSP 57000</p> <p>e) SSP 41163, Para. 3.3.6.12.3 (EVA), Para. 3.3.6.12.4 (IVA).</p>	<input checked="" type="checkbox"/>     <input type="checkbox"/>	<p>AMS-02 provided I/F card will reside within PGSC, cables and connectors.</p> <p>4.a.1 SVM: Inspection of flight hardware for sharp edges, corners and protrusions.</p> <p>4.a.1 STATUS: Open</p>	

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F. DESCRIPTION OF HAZARD:	G. HAZARD CONTROLS: (complies with)	H. APP.	I. VERIFICATION METHOD, REFERENCE, AND STATUS:	
5. Shatterable Material Release	a) All materials are contained. b) Optical glass (i.e. lenses, filters, etc.) components of crew cabin experiment hardware that are non-stressed (no delta pressure) and have passed both a vibration test at flight levels and a post-test visual inspection. c) Payload bay hardware shatterable material components that weigh less than 0.25 lb and are non-stressed (no delta pressure) or non-structural.	<input type="checkbox"/>   <input type="checkbox"/>  <input type="checkbox"/>	N/A. No Identified Shatterable Materials	
6. Flammable Materials	a) A-rated materials selected from MAPTIS, or b) Flammability assessment per NSTS 22648	<input type="checkbox"/> <input checked="" type="checkbox"/>	6.b.1 SVM: Review of design for appropriate use of non-flammable materials. 6.b.2 SVM: Review and approval of flammability assessment by JSC/ES4. 6.b.1 STATUS: Open 6.b.2 STATUS: Open	
7. Materials Offgassing	Offgassing tests of assembled article per NASA-STD-6001 (previously published as NHB 8060.1C).	<input type="checkbox"/>	Reference Hazard Report AMS-02-F02	
8. Nonionizing Radiation	Meets all that apply:			
8.1 Non-transmitters	a) Pass ICD-2-19001, 10.7.3.2.2 / SSP 30238 EMI compatibility testing, or b) NSTS/USA approved analysis ICD Section 20, or c) ISS/EMEP approved TIA d) Meets SSP 41163, Para. 3.3.6.6 and SSP 50094, Para. 3.4.	<input checked="" type="checkbox"/>  <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	8.1.a.1 SVM: EMI testing results reviewed and approved by JSC/EV4 8.1.a.1 STATUS: Open	
8.2 Lasers	Meet ANSI Z136.1-2000 for class 1, 2, or 3a Lasers (as measured at the source).	<input type="checkbox"/>	N/A. Internal elements of AMS-02 do not generate coherent light.	
<b>NOTE: Lasers operating at class levels 3b and 4, meeting ANSI Z136.1, shall be documented on Unique Hazard Reports.</b>				

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F. DESCRIPTION OF HAZARD:	G. HAZARD CONTROLS: (complies with)	H. APP.	I. VERIFICATION METHOD, REFERENCE, AND STATUS:	
9.1 Alkaline cells and batteries made of alkaline cells, connected in series or in parallel, up to 12 V and with up to 60 Watt-hours capacity, no potential charging source and cells are not in a gas-tight compartment.	Cells and batteries pass acceptance tests that include loaded and open circuit voltage measurements, visual examination, and leakage check under vacuum (e.g. 6 hours at 0.1 psia).	<input type="checkbox"/>	<p>N/A. AMS-02 Interior elements utilize no batteries.</p> <p>Submission of EP-Form-03(including the form's approved reference number) for EP5 approval</p> <p>Information to be included on the EP5 reviewed/approved Form-03: application and protective circuit schematics</p>	
9.2 Primary button cells such as Li-(CF)x, Li-iodine, LiV <sub>2</sub> O <sub>5</sub> , LiMnO <sub>2</sub> , Ag-Zn and rechargeable button cells such as LiV <sub>2</sub> O <sub>5</sub> , Li-ion, Ni-Cd, Ni-MH, Ag-Zn cells or batteries, which have a capacity of 300 mAh or less and no more than 3 cells per common circuit, and cells are not in a gas-tight compartment.	<p>Cells and batteries pass acceptance tests that include loaded and open circuit voltage measurements, visual examination, and leakage check under vacuum (e.g. 6 hours at 0.1 psia).</p> <p>Note: Above acceptance testing for button cells in Section 9.2 which are soldered to a circuit board in commercial equipment (not applicable to those button cells in a spring-loaded clip) is limited to a functional check of the equipment utilizing the subject battery.</p>	<input type="checkbox"/>   <input type="checkbox"/>  <input type="checkbox"/>	<p>N/A. AMS-02 Interior elements utilize no batteries.</p> <p>Submission of EP-Form-03(including the form's approved reference number) for EP5 approval</p> <p>Information to be included on the EP5 reviewed/approved Form-03:: application and protective circuitry.</p>	
9.3 COTS NiMH, NiCd and Ag/Zn cells and batteries for IVA use up to 20 V and 60 Wh	Cells and batteries purchased in one lot; pass acceptance tests that include loaded and open circuit voltage measurements, visual examination, leakage check under vacuum (e.g 6 hours at 0.1psia) and vibration to workmanship levels with functional checks which include charge/discharge cycles for rechargeable batteries.	<input type="checkbox"/>	<p>N/A. AMS-02 Interior elements utilize no batteries.</p> <p>Submission of EP5 Form-03(including the form's approved reference number) for approval</p> <p>Information to be included on the EP5 reviewed/approved Form-03: manufacturer's specification, battery protective features and charger schematics</p>	

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9.4 COTS Li-ion batteries up to 10 V and 60 Wh for IVA use	Batteries and charger shall be from a single lot; shall show one-fault tolerance at battery level and shall pass acceptance tests that include loaded and open circuit voltage measurements, visual examination, leakage check under vacuum (e.g 6 hours at 0.1 psia) and vibration to environment or double the workmanship level, whichever is higher; and functional checks which include charge/discharge cycles.	<input type="checkbox"/>	<p>N/A. AMS-02 Interior elements utilize no batteries.</p> <p>Submission of EP-Form-03(including the form's approved reference number) for EP5 approval.</p> <p>Information to be included on the EP5 reviewed/approved Form-03: battery protective features and charger features</p> <p>Note: For hardware using batteries, and/or chargers additional levels of control shall be provided by the hardware</p>	
10. Touch Temperature	<p>a) Within IVA touch temperature range of -18 Degrees C. (0 Degrees F.) and 49 Degrees C. (120 Degrees F.) and satisfies the intentional contact constraints of letter MA2-95-048 (if applicable).</p> <p>b) Meets EVA touch temperature criteria of NSTS 07700 Vol. XIV App. 7.</p>	<p><input checked="" type="checkbox"/></p> <p><input type="checkbox"/></p>	<p>10.a.1 SVM: Review of design to confirm power consuming elements inaccessible to the crew.</p> <p>10.a.2 SVM: Analysis to confirm that interface card will not induce excessive thermal load on PGSC.</p> <p>10.a.1 STATUS: Open</p> <p>10.a.2 STATUS: Open</p>	
11. Electrical Power Distribution	<p>a) Shuttle-powered payloads – Meets all circuit protection requirements of Letter TA-92-038.</p> <p>b) Station-powered payloads – Meets station interface circuit protection requirements of SSP 57000 and payload circuit protection requirements of Letter TA-92-038.</p>	<p><input checked="" type="checkbox"/></p> <p><input type="checkbox"/></p>	<p>11.a.1 SVM: Review of Design</p> <p>11.a.1 STATUS: Open</p> <p>Note: The interface of the interface card is with the PGSC and is not directly interfaced with the Shuttle power systems.</p>	
12. Ignition of Flammable Atmospheres in Payload Bay	All ignition sources in the Payload bay, for launch and landing, are controlled as required in Letter NS2/81-MO82, and MLI grounded per ICD 2-19001.	<input type="checkbox"/>	N/A. Hardware addressed in this hazard report is within the crew habitable environment and not exposed to a flammable atmosphere in the Shuttle Payload Bay	
13. Rotating Equipment	Rotating equipment meets criteria of NASA-STD-5003 for obvious containment.	<input type="checkbox"/>	N/A. AMS-02 Internal hardware does not utilize any rotating equipment.	
14. Mating/demating powered connectors	<p>a) Meets the low power criteria of letter MA2-99-170 or,</p> <p>b) Meets the paragraph 1 criteria of letter MA2-99-170 (e.g., IVA and open circuit voltage no greater than 32 volts).</p>	<p><input checked="" type="checkbox"/></p> <p><input type="checkbox"/></p>	<p>14.a.1 SVM: Review of Design. The Interface Card will be installed prior to flight and the data interface cable meets low power criteria.</p> <p>14.a.1 STATUS: Open</p>	

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15. Contingency Return and Rapid Safing	Shuttle Environment: a) If middeck payload – can be stowed within 50 min. (see paragraph 3 of letter MA2-96-190).  b) If SPACEHAB transfer item – can establish a safe for return configuration within 3 min. (see paragraph 5 of letter MA2-96-190).  Station Environment: c) Payload design does not impede emergency IVA egress to the remaining adjacent pressurized volumes.	<input checked="" type="checkbox"/>  <input type="checkbox"/>  <input type="checkbox"/>	15a.1 SVM: Rapid Safing Assessment to establish that the PGSC and data cables can be stowed within 50 minutes. 15.a.1 STATUS: Open	
16. Release of Mercury from bulbs into crew habitable environment.	a) Mercury vapor bulbs contain less than 30 mg of Mercury per bulb, and  b) No more than one bulb could break due to a single failure.	<input type="checkbox"/>  <input type="checkbox"/>	N/A. AMS-02 internal hardware elements do not utilize mercury containing bulbs.	

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## Alpha Magnetic Spectrometer –02 (AMS-02) Orbiter Interior Hardware Elements:

- PGSC installed Digi International DataFire Sync 570I PCI, two port, Universal Interface Bus Card
- DataFire Sync 570I to PDIP Cables (2 data cables)

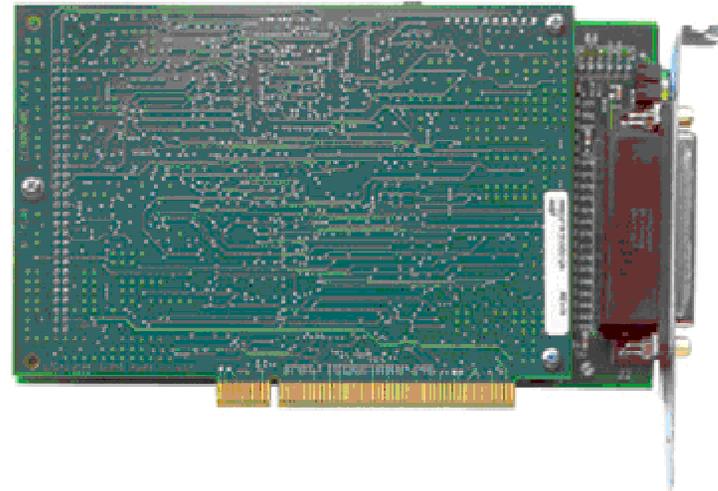
### NOTE:

- *Payload General Support Equipment (GFE), not considered in STD-AMS-02-02, GFE is being used in accordance with its GFE certification.*
- *Spare Hard Disk (GFE) for PGSC, not considered in STD-AMS-02-02, GFE is being used in accordance with its GFE certification.*

## About DataFire SYNC/570

The DataFire SYNC/570 family of adapters provides high performance synchronous communications in two-port and four-port models for ISA or PCI bus compatible systems. SYNC/570 adapters provide integrated remote LAN connectivity for major operating systems including Novell NetWare and Windows NT.

The PCI models offer a Universal Interface Bus (UIB) capable of supporting a different interface on each port. The UIB automatically configures the electrical interface of a port based on the type of Digi cable connected to the port. That is, you can select an interface type for a port just by connecting the appropriate cable between the adapter and the peripheral device. You can use any combination of interface types to connect up to two peripherals to the two-port version, or up to four peripherals to the four-port version.



**Graphic is representation of hardware**

**AMS-02 Utilizes the Digi International DataFire Sync 570I PCI two port Universal Interface Bus Card**

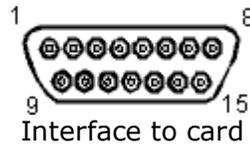
**This card will be hand conformally coated with Dow Corning 3140 or equivalent.**

The DDRS/2 cable has two parts:

- **AMS-02 Sync Cable**

The altered item COTS X.21 cable assembly P/N SED39136115-801 provided by Jacobs Sverdrup (JS) attached directly to the Sync 570I board is an active adapter providing X.21 signaling.

**DB-15 Male Connector**

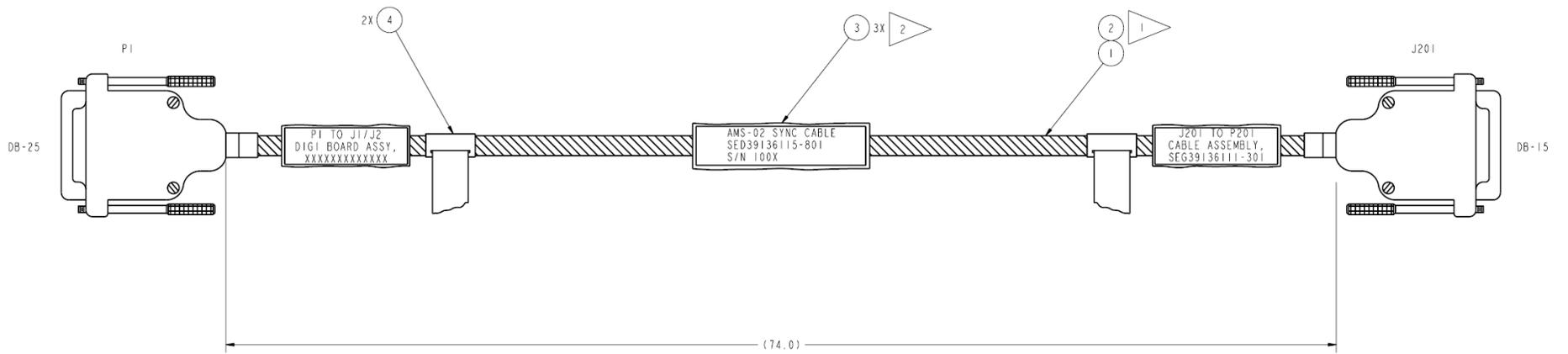


- **AMS-02 RS422 DDRS-02/PDIP Cable**

The STS adapter assembly P/N SED39136111-301 provided by JS attaches to the X.21 interface and provides a circular connector interface to STS PDIP.

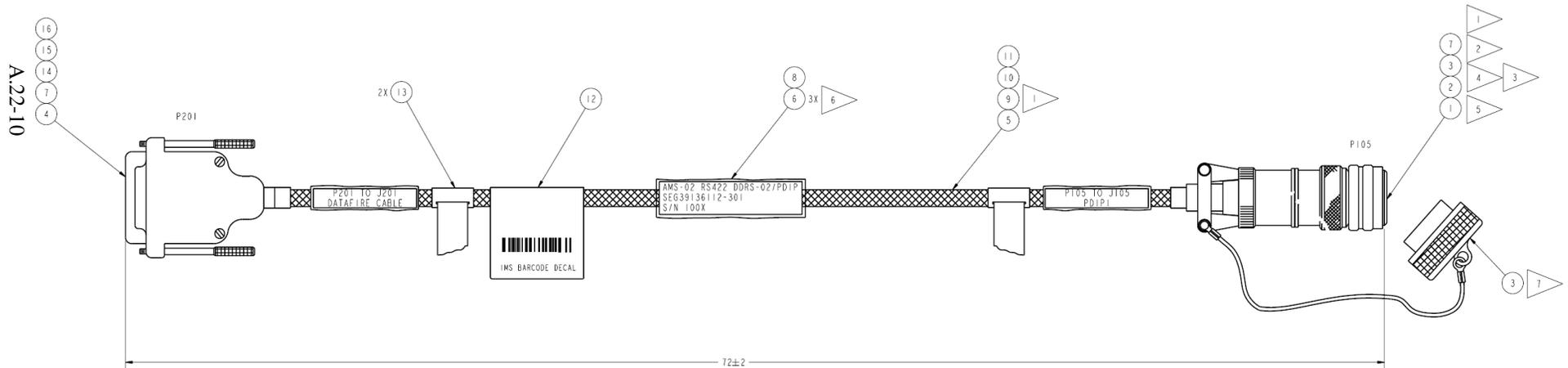
<b>DB-15 Pin Number</b>	<b>Signal</b>
2	TxD (A)
9	TxD (B)
3	Control (A)
10	Control (B)
4	RxD (A)
11	RxD (B) (B)
5	Indicator (A)
12	Indicator (B)
6	Signal Element Timing In (A)
7	Signal Element Timing Out (A)
13	Signal Element Timing In (B)
14	Signal Element Timing Out (B)
8	Signal Ground
1 and shell	CGND

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**AMS-02 Sync Cable interfaces with DataFire Card and AMS-02 RS422 DDRS-02/PDIP Cable**



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**AMS-02 RS422 DDRS-02/PDIP Cable interfaces with Sync Cable and Orbiter PDIP**