SAE INTERNATIONAL

AEROSPACE STANDARD

AS5725™ REV. B

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Superseding AS5725A

Interface Standard, Miniature Mission Store Interface

RATIONALE

This standard was developed by SAE International. It defines implementation requirements for the electrical interface between platforms and miniature stores, and/or miniature store launch/carriage systems and miniature stores. This document was revised to incorporate editorial and technical comments received and coordinated by SAE AS-1B2 Aircraft/Store Interface Standards User Group. The changes include items that came out of the validation document development effort and the official release of the connector insert in MIL-STD-1560.

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1. SCOPE

1.1 Scope

This standard defines implementation requirements for the electrical interface between:

a. aircraft carried miniature store carriage systems and miniature stores

b. aircraft parent carriage and miniature stores

c. surface based launch systems and miniature stores

The interface provides a common interfacing capability for the initialization and employment of smart miniature munitions and other miniature stores from the host systems. Physical, electrical, and logical (functional) aspects of the interface are addressed.

1.2 Purpose

The purpose of this standard is to minimize proliferation of electrical interfaces between platforms, miniature stores and associated carriage systems and thereby promote interoperability of miniature stores and carriage systems across different programs and services.

1.3 Application

This standard applies to all platforms, miniature stores and associated carriage systems that electrically interface with each other. The carriage systems include captive and releasable (canister type) aircraft mounted carriage devices, platforms such as unmanned combat air vehicles (parent carriage), dedicated carriage areas on aircraft, and surface based launch systems. For simplicity within this document, all carrying devices are generically referred to as the miniature store carriage system (or simply carriage system) from an interface perspective. Additionally, the term store as used in this document refers to a miniature store unless otherwise indicated.

2. APPLICABLE DOCUMENTS

The following publications form a part of this document to the extent specified herein. The latest issue of SAE publications shall apply. The applicable issue of the other publications shall be the issue in effect on the date of the purchase order. In the event of conflict between the text of this document and references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

2.1 General

The documents listed in this section are specified in Sections 3, 4, and 5 of this standard. This section does not include documents cited in other sections of this standard or recommended for additional information or as examples. While every effort has been made to ensure the completeness of this list, document users are cautioned that they must meet all specified requirements documents cited in Sections 3, 4, and 5 of this standard, whether or not they are listed.

2.2 Non-Government Publications

The following documents form a part of this document to the extent specified herein. Unless otherwise specified, the issues of the documents are those cited in the solicitation or contract.

2.2.1 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or +1 724-776-4970 (outside USA), www.sae.org.

AS5652 10 Megabit/sec Network Configuration Digital Time Division Command/Response Multiplex Data Bus

AS5653 High Speed Network for MIL-STD-1760

AS39029 Contacts, Electrical Connector, General Specification For

AS85049/80 Connector Accessories, Electrical, Dummy Contact, Sizes 16, 12 and 8, Category 7 (For MIL-DTL-38999 Connectors)

2.2.2 ANSI Accredited Publications

Copies of these documents are available online at http://webstore.ansi.org/

FC-PI ANSI INCITS 352-2002 Fibre Channel - Physical interfaces

2.3 U.S. Government Documents

Copies of these documents are available online at http://quicksearch.dla.mil.

2.3.1 Specifications, Standards, and Handbooks

The following specifications, standards, and handbooks form a part of this document to the extent specified herein.

STANAG 4294 (Part 1) Navstar Global Positioning System (GPS) System Characteristics

MIL-DTL-38999 Connectors, Electrical, Circular, Miniature, High Density, Quick Disconnect (Bayonet, Threaded, and Breech Coupling), Environment Resistant, Removable Crimp and Hermetic Solder Contacts, General Specification For

MS27488 Plug, End Seal, Electrical Connector

MIL-STD-704 Aircraft Electric Power Characteristics

MIL-STD-1760 Aircraft/Store Electrical Interconnection System

MIL-STD-1560 Insert Arrangements for MIL-DTL-38999, MIL-DTL-27599, and SAE-as29600 Series A Electrical Circular Connectors

2.4 Order of Precedence

In the event of a conflict between the text of this document and the references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

3. DEFINITIONS

3.1 Definitions

Definitions applicable to this standard are as follows.

3.1.1 AIRCRAFT

Any vehicle designed to be supported by air, being borne up either by the dynamic action of the air upon the surfaces of the vehicle, or by its own buoyancy. The term includes fixed and movable wing airplanes, helicopters, gliders, and airships, but excludes air-launched missiles, target drones, and flying bombs.

3.1.2 ELECTRICAL INTERFACE TYPES

The two electrical interface types for the carriage system/store electrical interconnection system shall be as specified below.

3.1.2.1 MINIATURE STORE CARRIAGE INTERFACE (MSCI)

The electrical interface on the miniature store carriage system structure where the miniature mission store is electrically connected either directly (blind mate) or via an interconnecting umbilical cable.

3.1.2.2 MINIATURE MISSION STORE INTERFACE (MMSI)

The electrical interface on the miniature mission store external structure or interconnecting umbilical cable that mates with an MSCI interface on the carriage system.

3.1.3 MINIATURE STORE CARRIAGE SYSTEM

A system which provides for carriage and release of and electrical interfacing to miniature munitions or other stores that are compliant with the miniature store electrical interface standard defined in this document. The miniature store carriage system may be located external to the aircraft in a separate enclosure (possibly releasable) which is electrically interfaced to the aircraft via a MIL-STD-1760 compatible interface, or may be integrally contained within the structure of an unmanned or manned aircraft platform, or may be included in surface based launch systems. The miniature store carriage system is typically referred to simply as the carriage system in this document.

3.1.4 STORE

Any device intended for internal or external carriage and mounted (either directly or through an intermediary carriage device) on aircraft suspension and release equipment, whether or not the item is intended to be separated in flight from the aircraft. Stores relevant to this standard are miniature stores classified in two categories as specified below. (Note that the generic term store is typically used to refer to miniature stores in this document when the distinction of category is not important.)

3.1.4.1 MINIATURE MISSION STORE

A small munition or other store with an MMSI carried at a station on a miniature store carriage system.

3.1.4.2 SUBPACK

An in-flight separable physical package which contains multiple miniature mission stores intended for release as a single entity (for aerodynamic purposes, etc.) from a carriage system. Subpacks provide individual external MMSIs for each carried miniature mission store. A separate external MMSI may additionally be provided (as required) on each subpack for interfacing to internal subpack electronics.

3.1.5 STORES MANAGEMENT SYSTEM

The avionics subsystem which controls and monitors the operational state of aircraft installed stores and provides and manages the communications between aircraft stores and other aircraft subsystems.

3.1.6 SUSPENSION AND RELEASE EQUIPMENT

All airborne devices used for carriage, suspension, employment, and jettison of stores, such as, but not limited to, racks, adapters, launchers, and pylons.

3.1.7 DELAY

Signal or data delay is the elapsed time between the input stimulus and output response of a particular signal or data path.

3.1.8 POWER INTERRUPTION

An excursion of supplied interface power below the specified normal steady state limits established by this standard.

3.1.9 L1_P(Y) Signal

The L1_P(Y) signal is the GPS $L1_p$ carrier component of L1, bi-phase shift key (BPSK) modulated by the P(Y) code plus data bit stream, as described in STANAG 4294.

3.1.10 L2_P(Y) Signal

The L2_P(Y) signal is the GPS $L2_p$ carrier component of L2, bi-phase shift key (BPSK) modulated by the P(Y) code plus data bit stream, as described in STANAG 4294.

3.1.11 L1_C/A Signal

The L1_C/A signal is the GPS $L1_c$ carrier component of L1, bi-phase shift key (BPSK) modulated by the C/A code plus data bit stream, as described in STANAG 4294.

3.1.12 FIBRE CHANNEL

Fibre Channel is the name for a high-speed network standard. Fibre Channel allows for both copper and fiber optic implementations.

3.1.13 SAFETY CRITICAL

An interface operation (electrical, logical or a combination of both) at the MSCI or MSSI, is deemed safety critical when it causes the store to perform functions that have the potential to generate store behavior that may present a hazard to the platform, crew or ground handling personnel.

3.2 Acronyms and Abbreviations

The following acronyms and abbreviations are applicable.

BC	Bus Controller
dB	Decibel
dBmW	decibels above 1 milliwatt
dBW	decibels above 1 watt
DC	Direct Current

DFC	Down Fibre Channel
FC	Fibre Channel
GHz	Gigahertz
GPS	Global Positioning System
HB	High Bandwidth
HS	High Speed
Hz	Hertz
ICD	Interface Control Document
ISO	International Organization For Standardization
JMMI	Joint Miniature Munitions Interface
kHz	Kilohertz
MHz	megahertz
MMSI	Miniature Mission Store Interface
ms	millisecond
MSI	Mission Store Interface
MSCI	Miniature Store Carriage Interface
MUX	Multiplex (Digital Data Interface)
pp	Peak-to-Peak
RF	Radio Frequency
RMS	Root Mean Square
RT	Remote Terminal
STANAG	North Atlantic Treaty Organization (NATO) Standardization Agreement
UFC	Up Fibre Channel
V	Volt

4. GENERAL REQUIREMENTS

4.1 System Configurations and Interface Nomenclature

In the baseline carriage configuration for miniature stores, a host captive carriage or releasable carriage system interfaces to a host aircraft as a MIL-STD-1760 mission store. The carriage system in turn has internal electronics which service a number of miniature store interfaces, to which miniature munitions/stores electrically connect. The stores connect to the carriage system in either a direct blind mate fashion or via a retained (by the carriage system) umbilical cable. Appendix A of this standard defines additional high bandwidth requirements for carriage systems attached to a host MIL-STD-1760 interface.

The stores may also be carried by autonomous carriage platforms (unmanned combat air vehicles, etc.) which inherently provide all required avionics capabilities necessary to initialize and employ the subject stores. In these instances, the autonomous platform is considered to be the carriage system from an interface requirements standpoint. The requirements of this document apply to mated halves of the miniature store interface, consisting of a miniature store carriage interface (MSCI) on the carriage system structure and a miniature mission store interface (MMSI) on the store structure or the upper (carriage system) end of an umbilical cable attached to the store. The overall system interface arrangement is illustrated in Figure 1.

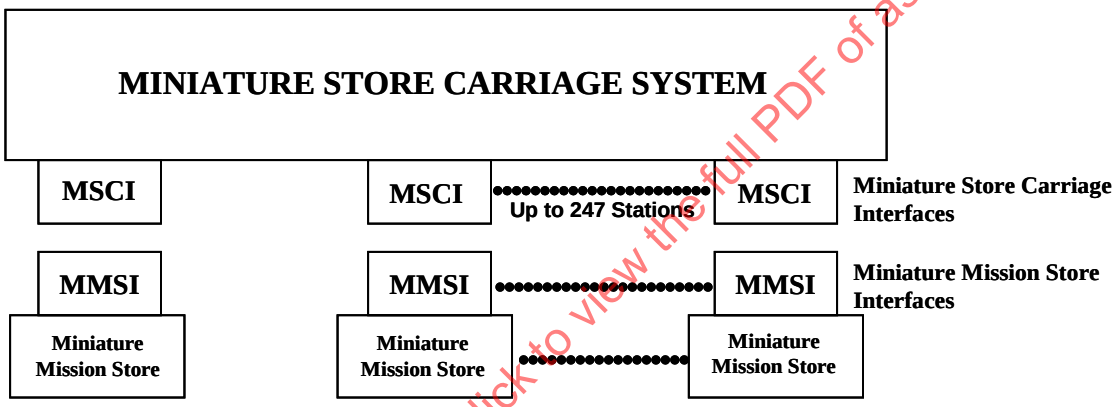


Figure 1 - Overall system interface arrangement

Note that in some physical configurations multiple stores may be carried in subpacks mounted on a carriage system. In these cases, the subpack will be released from the carriage system and the stores will subsequently be released from the subpack once it is in free flight. For these configurations, an individual MMSI (which will mate with an individual MSCI on the carriage system) will be provided on the subpack for each contained store, as illustrated in Figure 2. An additional MSCI/MMSI interconnection may be incorporated if the subpack contains internal electronics (separate from the stores) which must be interfaced to. Interconnection of the MMSIs to the stores is the responsibility of the subpack/store provider in these configurations, and is not addressed in this standard. Subpack/store developers should consider, however, whether the stores will also be carried individually (i.e., without a subpack) on carriage system stations and thus require direct mating compatibility with MSCI interfaces.

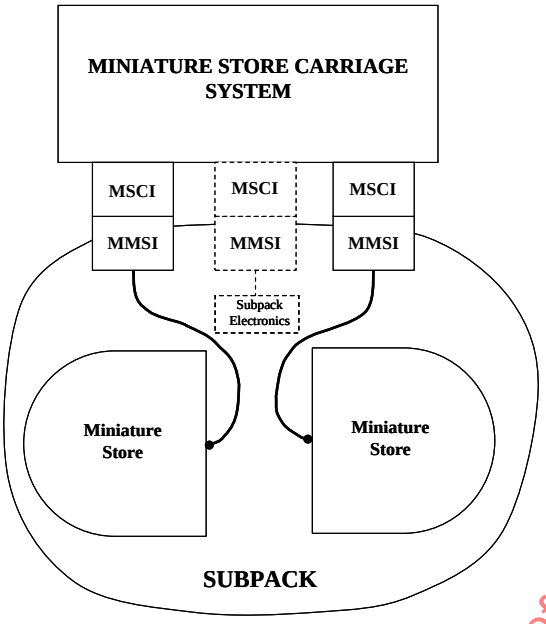


Figure 2 - Subpack carriage arrangement

4.2 Interface Signal Set and Classes

The interface signal set, as shown in Figure 3, shall be comprised of interfaces for high bandwidth, data bus, dedicated discrete, and carriage system power signals. Detailed electrical requirements for each of these functions at the MSCI and MMSI shall comply with the requirements of Section 5 herein. Equipment shall not be functionally damaged by the removal of a termination on any interface.

The MSCI shall implement, and the MMSI shall be compatible with, one of the following interface classes:

a. Class I. Class I shall consist of the full interface without the auxiliary power interface.

b. Class IA. Class IA shall consist of the full interface including the auxiliary power interface.

c. Class II. Class II shall consist of the full signal set without the high bandwidth, Up Fibre Channel, Down Fibre Channel signals and auxiliary power interface.

d. Class IIA. Class IIA shall consist of the Class II signal set plus the auxiliary power interface.

Subsequently stated signal interface requirements apply only to systems which implement an interface class for which the signal is applicable.

4.2.1 High Bandwidth (HB) Interface

The HB interface shall support the non-concurrent transfer of two general signal types (Type A and Type B). Miniature mission stores may be either the source or the sink for these signals. Type A signals shall be compatible with a transmission passband of 20 Hz to 20 MHz. Type B signals shall be compatible with a passband of 20 MHz to 1.6 GHz. The nominal source and sink impedance of the HB interface shall be 50 ohms. The requirements in 4.2.1 and subparagraphs apply with the interfaces terminated by the proper nominal impedance and include the effect of the applicable mating contacts.

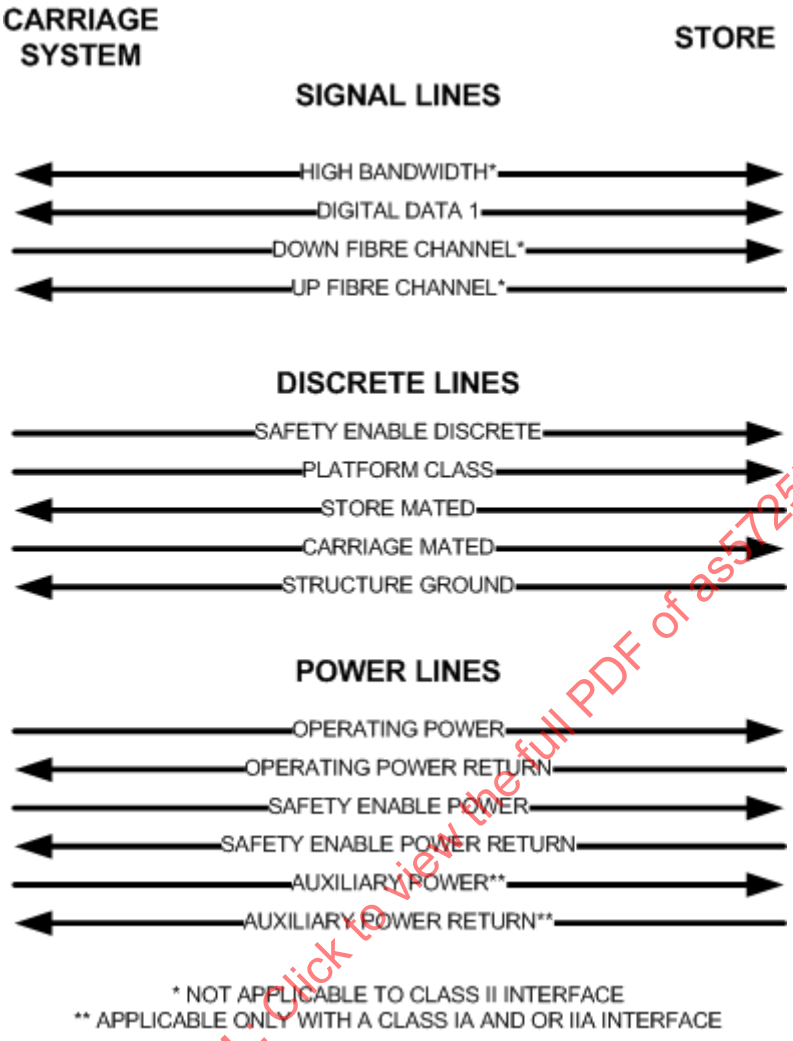


Figure 3 - Interface signal set

4.2.1.1 Type A Signal Requirements

The following type A signal requirements shall apply at the MMSI when the miniature mission store is the source of the signal. When the miniature mission store is the sink of the signal, the type A signal characteristics shall apply at the signal source. The signal path between the source and the MSCI output might affect the signal characteristics as seen at the MSCI. The signal path characteristics are undefined in this standard except for implementations described in Appendix A.

a. Type A signals shall be limited to 1.3 Vpp within the range of ±1.55 V under steady state conditions or within the range of ±2.0 V under transient conditions. The signal peak voltage shall return to within 5% of the steady state voltage limits in less than 250 ms following a transient change in the DC component of the signal.

b. The power spectral components above 20 MHz shall not exceed a limit line which decreases at a rate of 14 dB/octave. At 20 MHz the limit line shall be equal to the largest power spectral component determined over the nominal transmission passband stated in 4.2.1. The requirement shall apply up to 200 MHz.

c. The slew rate shall not exceed 65 volts/microsecond.

4.2.1.2 Type B Signal Requirements

The following Type B signal requirements shall apply at the MMSI when the miniature mission store is the source of the signal. When the miniature mission store is the sink of the signal, the following Type B signal characteristics shall apply at the signal source. The signal path between the source and the MSCI output might affect the signal characteristics as seen at the MSCI. The signal path characteristics are undefined in this standard. More detailed Type B signal characteristics may be included in subsequent issues of this document.

a. Type B signal peak envelope power shall not exceed -20 dBm RMS. This requirement applies to the sum of the individual peak envelope power values if more than one signal is simultaneously present.

4.2.2 Digital Data Interfaces

The digital data interface shall include a digital data 1 time division command/response serial multiplex data channel for transferring digital information, including store control and status data, between carriage systems and stores. The signals crossing the digital data 1 interface shall comply with the requirements of AS5652 as augmented by the requirements of Section 5 herein.

The digital data interface shall also include the high speed 1760 (Down Fibre Channel (DFC) and Up Fibre Channel (UFC)) signal paths, in accordance with AS5653 as augmented by the requirements of Section 5 herein.

4.2.3 Store Mated Interface

The store mated interface shall be a discrete signal path available for the carriage system to monitor the electrically mated status with a store at the associated store station.

4.2.4 Carriage Mated Interface

The carriage mated interface shall be a discrete signal path available for the store to monitor its electrically mated status with a carriage system.

4.2.5 Safety Enable Discrete Interface

The safety enable discrete interface shall be a low power discrete used only to enable and inhibit safety critical store functions which are commanded via the carriage system digital data interface (see 4.2.2).

CAUTION

The Safety Enable Discrete interface is provided to enable a safety or irreversible function within the Store. The discrete shall only be enabled when the Carriage System determines that safety criteria for the Store safety or irreversible function have been met.

4.2.6 Power Interfaces

The carriage system shall supply and control all power to stores through the MSCI. Two 28 VDC power sources and an auxiliary power source shall be supplied through each interface. A dedicated power return shall be provided through the interface for each power source. The activation of power shall not be used for discrete functions.

4.2.6.1 Operating Power

28 VDC operating power shall be supplied to each store by the carriage system for basic operation of store internal electronics and performance of non-safety-critical functions.

4.2.6.2 Safety Enable Power

28 VDC safety enable power shall be supplied by the carriage system to each store as the power source for certain functions designated as safety critical. This power source shall only be activated when the carriage system has determined that it is safe to perform the subject functions.

4.2.6.3 Auxiliary Power

270 VDC auxiliary power shall be supplied by the carriage system to each store as the power source for stores that can make use of the higher DC voltage or that require power in excess of that available through the operating power interface. Stores may use either Operating power or Auxiliary power for basic operation of store internal electronics and performance of non-safety-critical functions.

4.2.7 Structure Ground Interface

A dedicated circuit shall be provided between the carriage system and store structure grounds. It shall provide an electrical connection between the carriage system and store structures to minimize shock hazards to personnel. This circuit shall not be used as a signal return path or power return path.

4.2.8 Platform Class Interface

The platform class interface shall be a discrete signal path available for the weapon to monitor the type of platform that is carrying the weapon.

4.2.9 Physical Interconnection Interface

Physical connector provisions for electrical mating of stores to carriage systems using both blind mate and retained umbilical interconnection techniques shall be incorporated into the interface.

5. DETAILED REQUIREMENTS

5.1 Carriage System Requirements

The carriage system shall meet the following requirements at each MSCI.

5.1.1 Carriage System: High Bandwidth (HB) Interface

The carriage system shall support bi-directional simplex transfer of Type A and Type B signals through the HB interface at each MSCI. The carriage system shall assign, control, and route HB signals associated with the interface via a signal routing network.

Each implemented routing network signal path shall meet the following electrical requirements.

5.1.1.1 Type A Signal Path Requirements

HB Type A signal paths shall be compatible with the transfer of type A signals as defined in 4.2.1.

HB Type A signal paths associated with MIL-STD-1760 compatible miniature store carriage systems shall additionally satisfy the signal path requirements outlined in Appendix A.

5.1.1.2 Type B Signal Paths Requirements

HB Type B signal paths shall be compatible with the transfer of Type B signals as defined in 4.2.1.

The primary envisioned use for the HB Type B signal path is the transfer of RF signals from a GPS antenna to the store. When the path is used for this purpose, the carriage system shall support the transfer of L1_P(Y), LI_C/A, and L2_P(Y) signals as defined herein.

More detailed Type B signal transfer requirements may be included in subsequent issues of this document.

5.1.1.3 Ground Reference (Type A Signals)

When the miniature mission store is the signal source, the MSCI shall present a differential load as shown in Figure 4A. The signal return (shield) shall be electrically isolated from the carriage system structure ground. When the miniature mission store is the signal sink, the MSCI shall present a circuit whose ideal Thevenin equivalent is shown in Figure 4B. The signal return (shield) shall be electrically connected to the carriage system structure ground.

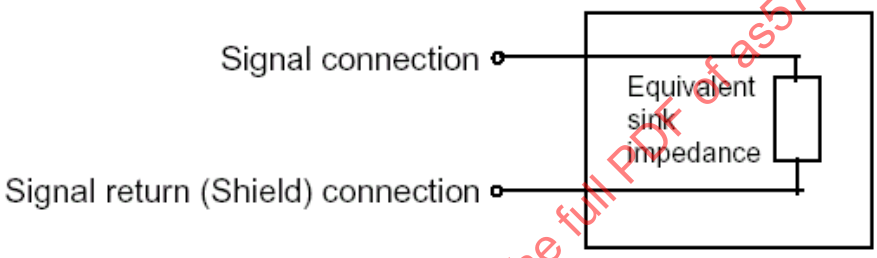


Figure 4A - Equivalent circuit of MSCI Type A interface (MMSI is signal source)

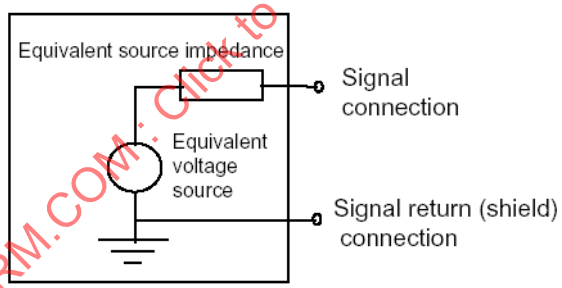


FIgure 4B - Equivalent circuit of MSCI HB Type A interface (host platform is signal source)

Figure 4 - Equivalent circuits of MSCI HB Type A interfaces

5.1.1.4 Ground Reference (Type B Signals)

When the miniature mission store is the signal source, the MSCI shall present a non-differential load as shown in Figure 5A. The signal return (shield) shall be electrically connected to the carriage system structure ground. When the miniature mission store is the signal sink, the MSCI shall present a circuit whose ideal Thevenin equivalent is shown in Figure 5B. The signal return (shield) shall be electrically connected to the carriage system structure ground.

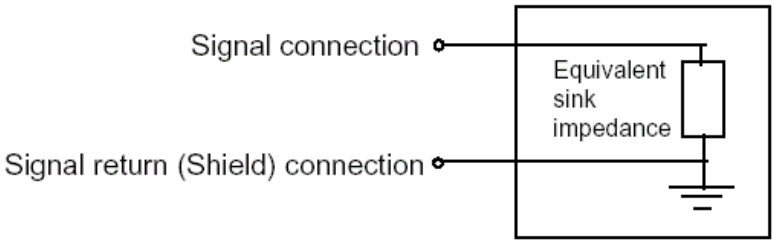


Figure 5A - Equivalent circuit of MSCI HB Type B interface (MMSI is signal source)

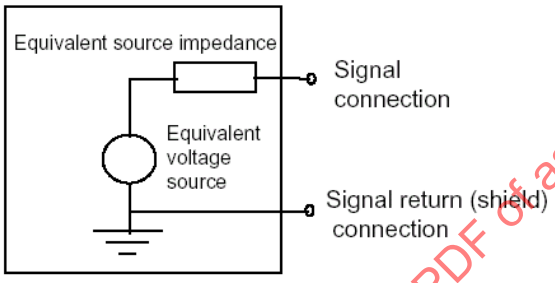


Figure 5B - Equivalent circuit of MSCI HB Type B interface (host platform is signal source)

Figure 5 - Equivalent circuits of MSCI Type B interfaces

5.1.2 Carriage System: Digital Data 1 Interface

The carriage system shall provide a digital data 1 interface at each MSCI for the transfer of digital messages through the MSCI to an AS5652 compliant remote terminal in the connected store. Each digital data 1 interface shall contain a data high connection, a data low connection, and a shield connection.

5.1.2.1 Functional Characteristics

a. The carriage system shall be responsible for the bus controller function as described in AS5652.

b. The carriage system shall provide the Link Mode service as defined in AS5652. Note: The Link Mode communications topology eliminates the need for an external addressing interface.

c. The carriage system shall communicate with stores through the digital data 1 interface in accordance with the applicable logical communications requirements of MIL-STD-1760 Appendix B, with aircraft requirements applicable to the carriage system and mission store requirements applicable to the miniature mission store.

5.1.2.2 Electrical Characteristics

The carriage system shall comply with the electrical characteristics defined herein at the MSCI. The characteristics defined apply when measured on the data high connection referenced to the data low connection. Data high is that connection which is positive referenced to the data low connection in the first part of an AS5652 defined command or status word sync waveform. The detailed electrical characteristics shall be in accordance with AS5652.

5.1.3 Carriage System: Fibre Channel Interface

The carriage system shall provide a Fibre Channel interface at each primary signal set MSCI for full duplex transfer of digital data. Up Fibre Channel (UFC) and Down Fibre Channel (DFC) signals shall be present. The carriage system shall send digital messages through the MSCI to a Fibre Channel terminal (node) in the connected store on the DFC signal. The carriage system shall receive digital messages through the MSCI from a Fibre Channel terminal (node) in the connected store on the UFC. Each implemented Fibre Channel full-duplex link shall meet the following requirements and the requirements specified in AS5653 except as noted below.

The carriage system shall communicate with stores through the Fibre Channel interface in accordance with the applicable logical communications requirements of MIL-STD-1760E Appendix B and Appendix D, with aircraft requirements applicable to the carriage system and mission store requirements applicable to the miniature mission store.

The carriage system shall assign, control, and route Fibre Channel signals to their proper destinations by means of the services provided by the Fibre Channel protocol.

5.1.3.1 Fibre Channel Physical Layer Characteristics

The physical layer of AS5653 when present in the MSCI shall comply with Fibre Channel Physical Interface [FC-PI 100-DF-EL-S] with the following signal assignments.

MSCI signal	FC-PI signal
DFC_H	TD+
DFC_L	TD-
UFC_H	RD+
UFC_L	RD-

5.1.4 Carriage System: Store Mated

The carriage system shall provide a connection for a store mated interface at each MSCI for monitoring the electrically mated status of an associated store. The carriage system shall provide the source for this interface. These requirements apply to the store mated connection referenced to the operating power return connection.

a. Open circuit voltage

    1. Minimum voltage of 4.0 VDC

    2. Maximum voltage, in accordance with MIL-STD-704 for 28 VDC

    3. Voltage transients shall not exceed the upper limit defined in MIL-STD-704 for 28 VDC

b. Excitation current

    1. Minimum current of 5.0 milliamperes

    2. Maximum current of 100 milliamperes

c. Resistance detection threshold. An interface disconnected condition shall be detected for any resistance level of 100 kilohms or greater. An interface connected condition shall be detected for any resistance level of 2.0 ohms or less.

5.1.5 Carriage System: Carriage Mated Interface

The carriage system shall provide a connection for a carriage mated interface at each MSCI. The carriage mated interface shall be connected within the carriage system to the operating power return connection at the associated MSCI. The path between the carriage mated interface and the operating power return connections shall have a resistance of 500 milliohms maximum when measured at the MSCI. This resistance applies for excitation current within the range of 5.0 to 100 milliamperes.

5.1.6 Carriage System: Safety Enable Discrete Interface

The carriage system shall provide a safety enable discrete interface at each MSCI for transferring an enable/inhibit signal to the connected store. Safety enable, when in the enabled state, shall indicate carriage system consent for stores to perform safety-critical functions, such as Commit to Separate Store or Submunition function (bit D8) or the Fire, Launch or Release function (bit D10) of the Critical Control 1 data word in the Mission Store Control message (see Appendix B of MIL-STD-1760), when commanded over the digital data 1 interface (see 4.2.2). When in the inhibited state, the safety enable discrete at a MSCI shall be electrically isolated from the safety enable discrete interface at all other MSCIs. The isolation shall be 100 kilohms minimum at DC.

5.1.6.1 Voltage Level

The voltage level measured between the safety enable discrete connection and safety enable power return connection at the MSCI shall be:

a. Steady state conditions

    1. Enable: Minimum voltage of 19.0 VDC

    2. Maximum voltage, in accordance with MIL-STD-704 for 28 VDC

    3. Inhibit: 1.50 VDC (maximum)

b. Voltage transients shall not exceed the limits defined in MIL-STD-704 limits for 28 VDC applications.

5.1.6.2 Current Level

Stores may require 100 milliamperes steady state through the MSCI during the enable state and the carriage system shall be able to supply that current. The carriage system is not, however, required to supply any current in excess of 100 milliamperes. The carriage system shall comply with the requirements herein for store imposed load currents of 5.0 milliamperes minimum through the MSCI.

5.1.6.3 Stabilization Time

With any resistive load between 320 ohms and 3.8 kilohms between safety enable discrete and safety enable power return, the voltage at the MSCI shall reach steady state levels (see 5.1.6.1.a) within 3 milliseconds during transition between enable and inhibit states.

5.1.6.4 Enable Lead Time

The safety enable discrete signal shall be applied to the MSCI at least 10 milliseconds before transmitting any safety critical command over the digital data 1 interface.

5.1.6.5 Inhibit Delay

If the safety enable discrete at an MSCI has been enabled, the carriage system shall operate under the assumption that the store connected to that MSCI may remain in an enable state for up to 10 milliseconds after the safety enable discrete signal has been returned to the inhibit state.

5.1.6.6 Duration of Application to Store

Once the safety enable discrete signal has been enabled by the carriage system to the store in conjunction with the commanding of either the Commit to Separate Store or Submunition D8 (bit 2) or the Fire, Launch or Release D10 (bit 0) of the Critical Control word in the Mission Store Control message (see Appendix B of MIL-STD-1760), it shall be maintained at that state until one of the following conditions arises:

a. the carriage system receives from the store, a Mission Store Monitor Message with the Fired, Launched or Released (bit 0) or Committed to Store or Submunition Separation (bit 2) set in the Critical Monitor 1 word.

b. the carriage system determines that the store has prematurely terminated its preparations because of store failure;

c. the carriage system terminates the launch sequence prematurely.

5.1.7 Carriage System: Power Interfaces

The carriage system shall provide a set of power interfaces at each MSCI. This shall include connections for 28 VDC operating power and safety enable power, and 270 VDC auxiliary power in each interface signal set along with associated returns.

5.1.7.1 Operating Power

A 28 VDC operating power source (175 W) shall be provided through the MSCI by the carriage system for powering store electronics and performing non-safety critical functions within the store.

5.1.7.1.1 Independent Control

The carriage system shall be capable of sourcing and independently controlling each operating power interface through each individual MSCI.

5.1.7.1.2 Voltage Level

The voltage at the MSCI between the operating power connection and the associated power return connection shall comply with the 28 VDC normal and abnormal operation characteristics for utilization equipment defined in MIL-STD-704 with the following addition: the normal steady state lower voltage limit at the MSCI shall be 22.0 VDC at any current up to the full rated load of 8 amperes. Voltage transients at the MSCI shall not exceed the limits defined in MIL-STD-704.

5.1.7.1.3 Current Capacity

The carriage system shall be capable of sourcing the maximum load current levels of Figure 6 through the operating power interface.

5.1.7.1.4 Overcurrent Protection

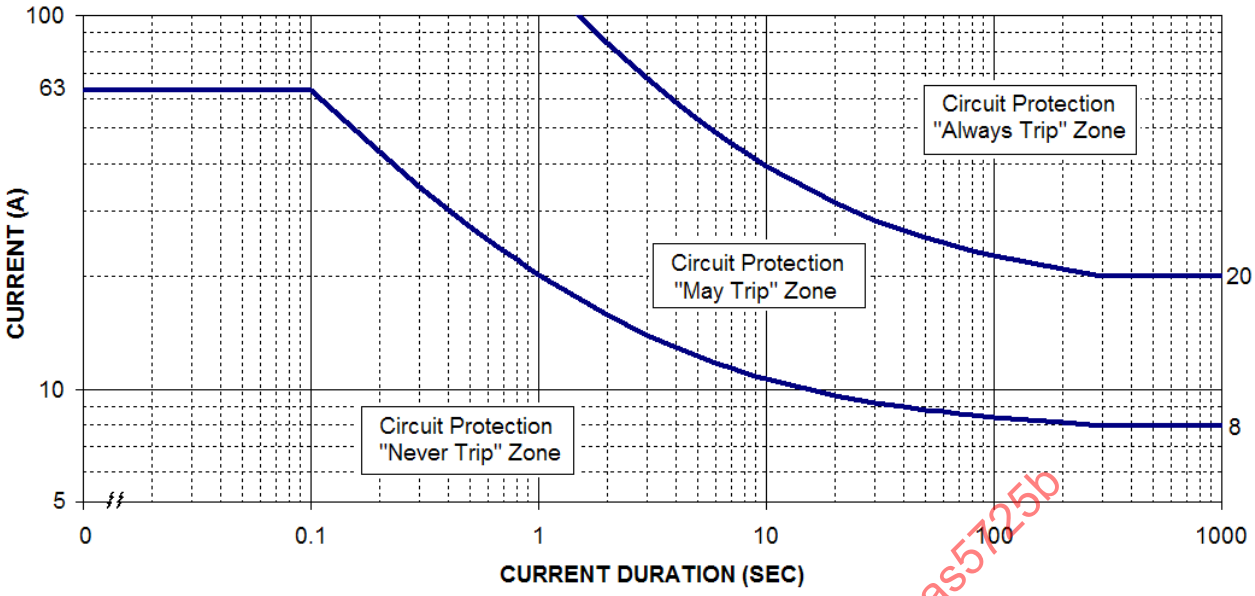
The carriage system shall ensure that the current flow through the operating power connection does not exceed the maximum overcurrent limits of Figure 6. The carriage system may achieve this overcurrent protection by the deactivation of the subject power interface and any other power interface at the associated MSCI.

5.1.7.1.5 Off-state Leakage Current

The off-state leakage current from the operating power MSCI output to its return shall not exceed 1.0 milliampere DC with all load resistances.

5.1.7.1.6 Stabilization Time

When tested with a resistive load connected to the MSCI, the voltage at the MSCI operating power interface shall reach steady state levels (see 5.1.7.1.2) within 3.0 milliseconds of power turn-on and turn-off (see Figure 7) at any current up to the full rated load of 8 amperes.



$$i_{max\_overload} = 4.57 * \left(\frac{75.62}{t} - 0.25\right)^{0.73} + 20.0 \quad for \quad 0.2 < t < 100 \text{ sec}$$

$$i_{\max\_overload} = 20.0 \quad for \quad t > 300 \text{ sec}$$

$$i_{\max\_load} = 63 \quad for \quad t < 0.1 \text{ sec}$$

$$i_{max\_load} = 0.683 * \left(\frac{85.63}{t} - 0.285\right)^{0.65} + 7.95 \quad for \quad 0.1 < t < 300 \text{ sec}$$

$$i_{\max\_load} = 8.0 \quad for \quad t > 300 \text{ sec}$$

Figure 6 - Operating power interface current level

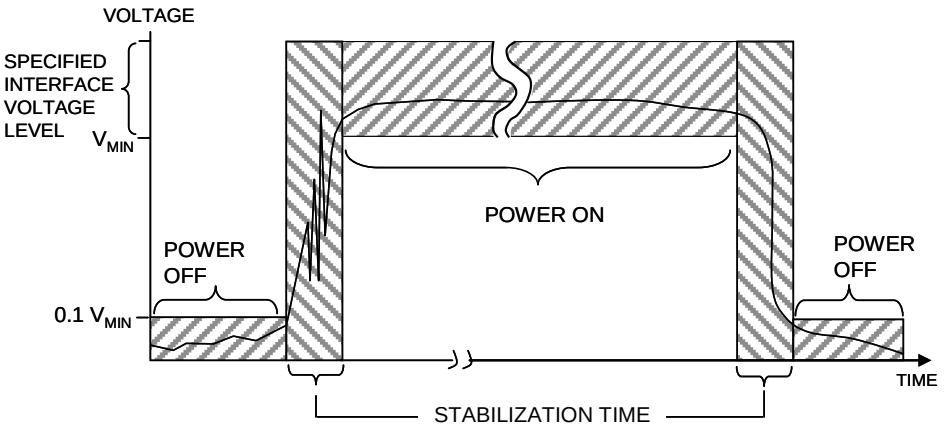


Figure 7 - Stabilization time

5.1.7.1.7 Power Return

The operating power return connection in the MSCI shall be the reference for the associated operating power connection.

5.1.7.1.8 Power Application

The carriage system may energize operating power at any time under the assumption that all store functions so powered are either not safety critical or that multiple safety interlocks exist within the store such that store safety is not significantly degraded by activation of operating power.

5.1.7.2 Safety Enable Power

A short term safety enable power source shall be provided through the MSCI by the carriage system for performing safety critical functions within the store.

5.1.7.2.1 Independent Control

The carriage system shall be capable of sourcing and independently controlling each safety enable power interface through each individual MSCI.

5.1.7.2.2 Voltage Level

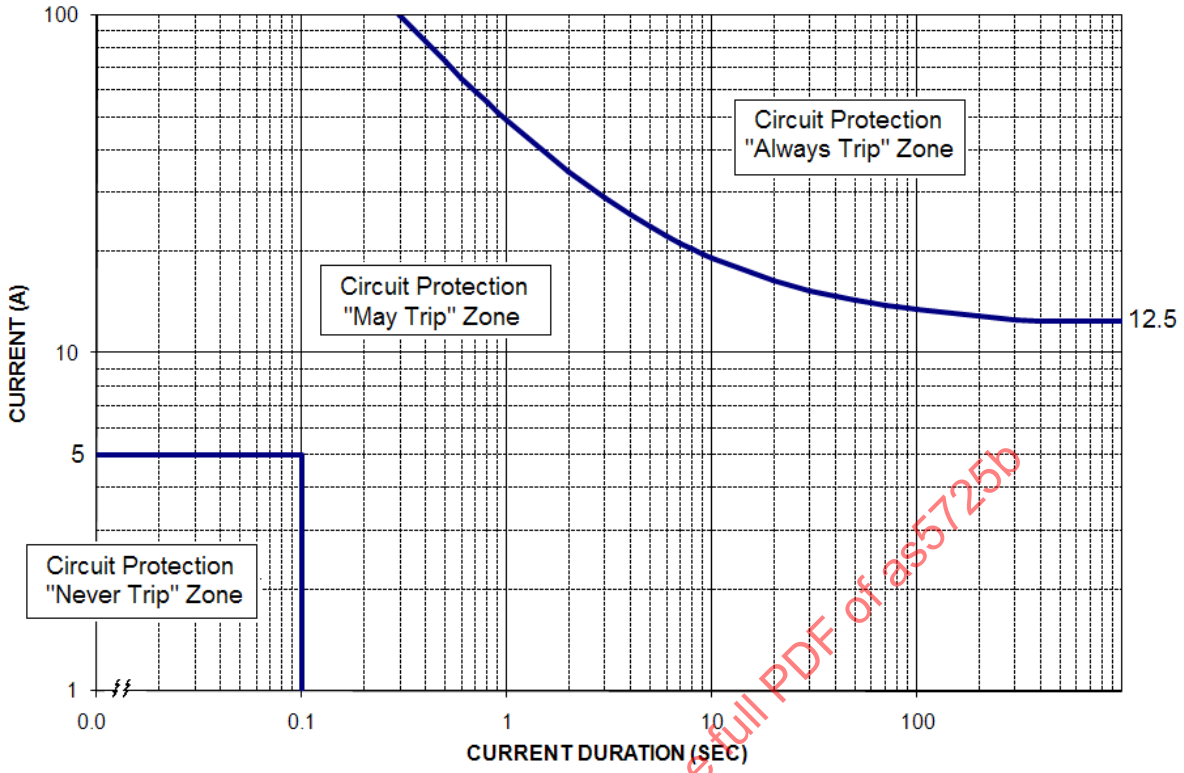
The voltage at the MSCI between the safety enable power connection and the associated power return connection shall comply with the 28 VDC normal and abnormal operation characteristics for utilization equipment defined in MIL-STD-704 with the following addition: the normal steady state lower voltage limit at the MSCI shall be 22.0 VDC at any current up to the full rated load of 5.0 amperes. Voltage transients at the MSCI shall not exceed the limits defined in MIL-STD-704.

5.1.7.2.3 Current Capacity

The carriage system shall be capable of sourcing the maximum load-current levels of Figure 8 through the safety enable power interface while also sourcing the maximum operating power load current levels specified in 5.1.7.1.3.

5.1.7.2.4 Overcurrent Protection

The carriage system shall ensure that current flow through the safety enable power connection does not exceed the maximum overcurrent limits of Figure 8. The carriage system may achieve this current limit operation by the deactivation of the subject power interface and any other power interface at the associated MSCI.



$$i_{max\_overload} = 1.55 * \left(\frac{75.62}{t} - 0.25\right)^{0.73} + 12.5 \quad for \quad 0.3 < t < 300 \text{ sec}$$

$$i_{\max\_overload} = 12.5 \quad for \quad t > 300 \text{ sec}$$

$$i_{\max\_load} = 5.0 \quad for \quad t < 100 \text{ ms}$$

$$i_{\max\_load} = 0.0 \quad for \quad t > 100 \text{ ms}$$

Figure 8 - Safety enable power interface current level

5.1.7.2.5 Off-state Leakage Current

The off-state leakage current from the safety enable power MSCI output to its return shall not exceed 1.0 milliampere DC with all load resistances.

5.1.7.2.6 Stabilization Time

When tested with a resistive load connected to the MSCI, the voltage at the MSCI safety enable power interface shall reach steady state levels (see 5.1.7.2.2) within 3.0 milliseconds of power turn-on and turn-off (see Figure 7) at any current up to the full rated load of 5.0 amperes.

5.1.7.2.7 Power Return

The safety enable power return connection in the MSCI shall be the reference for the associated safety enable power connection.

5.1.7.2.8 Power Application

The carriage system shall only energize safety enable power when a determination has been made that it is safe to do so. This power source shall be activated to the interface by the carriage system at least 10 milliseconds prior to any command to the store to initiate a function which utilizes safety enable power. This power source shall remain activated at least 120 milliseconds after any such command or be removed after an appropriate response (from the store) to the command requiring safety enable power.

5.1.7.3 Auxiliary Power

A 270 VDC auxiliary power source shall be provided through the MSCI by the carriage system for powering store electronics and performing non-critical functions within the store.

5.1.7.3.1 Independent Control

The carriage system shall be capable of sourcing and independently controlling each auxiliary power interface through each individual MSCI.

5.1.7.3.2 Voltage Level

The voltage at the MSCI between the auxiliary power connection and the associated power return connection shall comply with the 270 VDC normal and abnormal operation characteristics for utilization equipment defined in MIL-STD-704 with the following addition: the normal steady state lower voltage limit at the MSCI shall be 245.0 VDC at any current up to the full rated load of 1.5 amperes. Voltage transients at the MSCI shall not exceed the limits defined in MIL-STD-704.

5.1.7.3.3 Current Capacity

The carriage system shall be capable of sourcing the maximum load-current levels of Figure 9 through the auxiliary power interface.

5.1.7.3.4 Overcurrent Protection

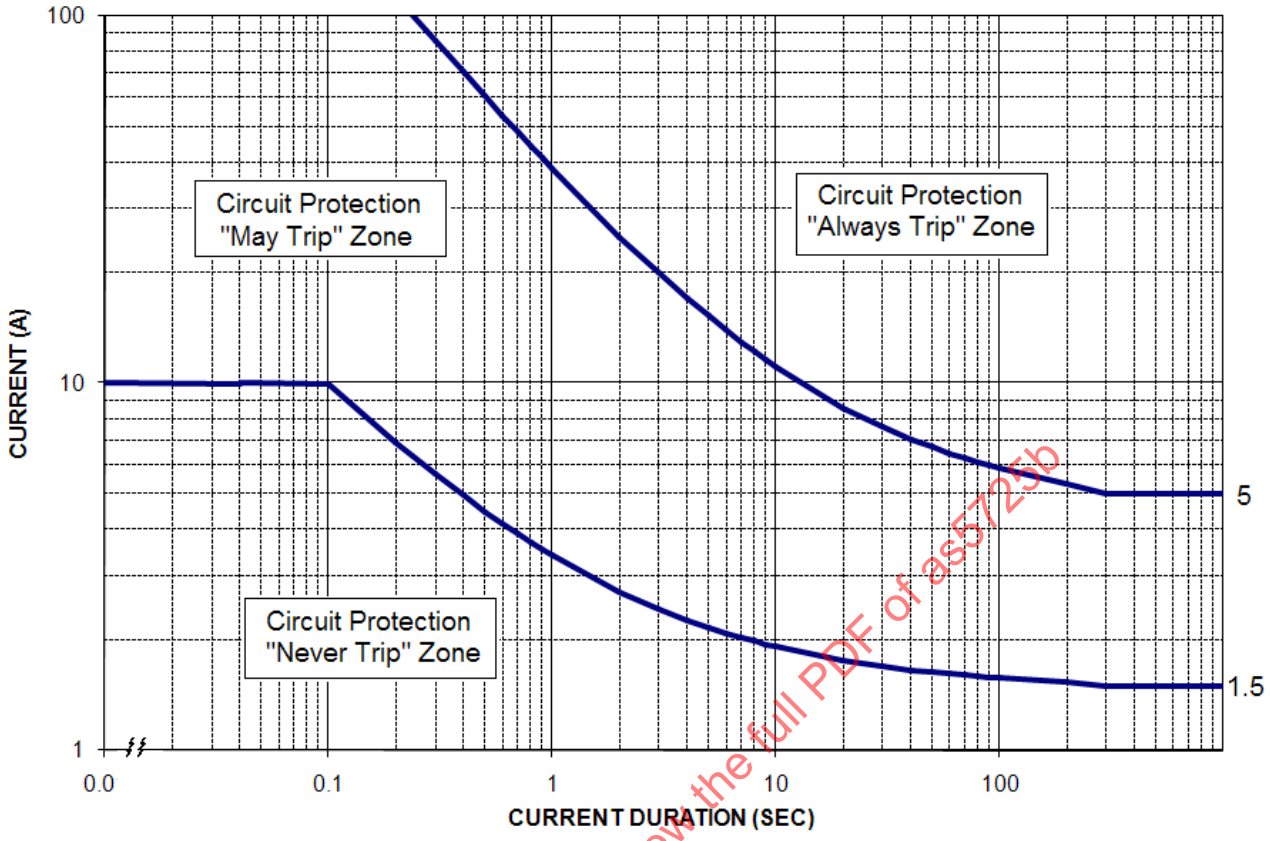
The carriage system shall ensure that current flow through the auxiliary power connection does not exceed the maximum overcurrent limits of Figure 9. The carriage system may achieve this current limit operation by the deactivation of the subject power interface and any other power interface at the associated MSCI.

5.1.7.3.5 Off-State Leakage Current

The off-state leakage current from the auxiliary power MSCI output to its return shall not exceed 1.0 milliampere DC with all load resistances.

5.1.7.3.6 Stabilization Time

When tested with a resistive load connected to the MSCI, the voltage at the MSCI auxiliary power interface shall reach steady state levels (see 5.1.7.2.2) within 3.0 milliseconds of power turn-on and turn-off (see Figure 7) at any current up to the full rated load of 1.5 amperes.



$$i_{max\_overload} = 1.425 * \left(\frac{75.62}{t} - 0.25\right)^{0.73} + 5.0 \quad for \quad 0.2 < t < 100 \text{ sec}$$

$$i_{\max\_overload} = 5.0 \quad for \quad t > 300 \text{ sec}$$

$$i_{\max\_load} = 10 \quad for \quad t < 0.1 \text{ sec}$$

$$i_{max\_load} = 0.105 * \left(\frac{85.63}{t} - 0.285\right)^{0.65} + 1.5 \quad for \quad 0.1 < t < 300 \text{ sec}$$

$$i_{\max\_load} = 1.5 \quad for \quad t > 300 \text{ sec}$$

Figure 9 - Auxiliary power interface current level

5.1.7.3.7 Power Return

The auxiliary power return connection in the MSCI shall be the reference for the associated auxiliary power connection.

5.1.7.3.8 Power Application

The carriage system may energize auxiliary power at any time under the assumption that all store functions so powered are either not safety critical or that multiple safety interlocks exist within the store such that store safety is not significantly degraded by activation of auxiliary power.

5.1.8 Carriage System: Structure Ground Interface

The carriage system shall provide a conductive path from the MSCI structure ground interface to carriage system structure, capable of carrying overcurrents associated with the power limits specified in 5.1.7.1.4. The structure ground interface will not be used as a signal return path or power return path except under fault conditions within the store. The voltage drop between the MSCI structure ground interface and the carriage system ground shall not exceed 0.2 volts when conducting 8.0 amperes (continuous).

5.1.9 Carriage System: Platform Class

The carriage system shall provide a three state discrete signal for identification of the platform that is used to indicate the velocity capability of the platform to the weapon at each MSCI.

5.1.9.1 Platform Class #1: Airborne High Speed Platforms (> 250 knots)

To indicate platform class #1, the platform class interface shall be unconnected (open circuit) within the carriage system. The carriage shall provide a minimum isolation of 100 kilohms (at DC) between the platform class interface and all other signals in the MSCI.

5.1.9.2 Platform Class #2: Airborne Low Speed Platforms (≤ 250 knots)

The carriage system shall indicate Platform Class #2 by providing a source voltage (28 VDC) to the platform class interface. These requirements apply to the Platform Class connection referenced to the operating power return connection:

a. Open circuit voltage

    1. Minimum voltage of 22.0 VDC

    2. Maximum voltage, in accordance with MIL-STD-704 for 28 VDC

    3. Voltage transients shall not exceed the upper limit defined in MIL-STD-704 for 28 VDC

b. Excitation current

    1. Minimum current of 5.0 milliamperes

    2. Maximum current of 100 milliamperes

5.1.9.3 Platform Class #3: Surface Platforms

To indicate platform class #3, the platform class interface shall be connected within the carriage system to the operating power return connection at the associated MSCI. The path between the platform class interface and the operating power return connections shall have a resistance of 500 milliohms maximum when measured at the MSCI. This resistance applies for excitation current within the range of 5.0 to 100 milliamperes.

5.2 Miniature Mission Store Requirements (Measured at the MMSI)

Miniature mission stores shall provide Miniature Mission Store Interfaces (MMSIs) with the following characteristics.

5.2.1 Store: High Bandwidth Interface

The store is not required to use the HB interface. If the HB interface is used, the store shall comply with the requirements below. If the HB interface is not used, the DC resistance between the signal and the signal return connection at the MMSI shall be greater than 45 ohms.

5.2.1.1 Electrical Characteristics (Type A)

The MMSI HB type A interface shall be compatible with the transfer of type A signals as defined in 4.2.1, and shall comply with the following signal transfer requirements.

5.2.1.1.1 Return Loss

The return loss of the store shall not be less than 25 dB over the frequency band 20 Hz to 20 MHz when operating in either source or sink mode.

5.2.1.1.2 Dynamic Range

When acting as a sink, the store shall be compatible with an input voltage within the range of ±3.0 V.

5.2.1.2 Electrical Characteristics (Type B)

The MMSI HB interface shall be compatible with the transfer of Type B signals as defined in 4.2.1. The primary envisioned use for this interface is the transfer of GPS RF signals from the carriage system to the store. Stores that use this capability shall be compatible with carriage systems which output GPS RF signals meeting the requirements specified in 5.1.1.2.

5.2.1.3 Ground Reference (Type A Signals)

When the miniature mission store is the signal sink, the MMSI will present a differential load as shown in Figure 10A. The signal return (shield) shall be electrically isolated from the miniature mission store structure ground. When the miniature mission store is the signal source, the MMSI will present a circuit whose ideal Thevenin equivalent is shown in Figure 10B. The signal return (shield) shall be electrically connected to the miniature store structure ground.

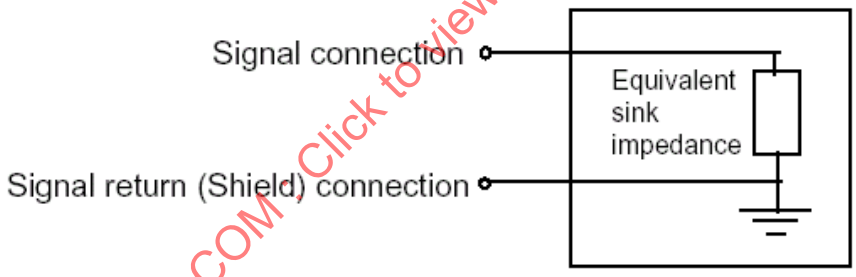


Figure 10A - Equivalent circuit of MMSI HB Type A interface (MMSI is signal sink)

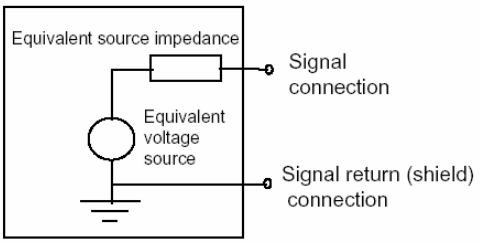


Figure 10B - Equivalent circuit of MMSI HB Type A interface (MMSI is signal source)

Figure 10 - Equivalent circuits of MMSI HB Type A interfaces

5.2.1.4 Ground Reference (Type B Signals)

When the miniature mission store is the signal sink, the MSCI will present a non-differential load as shown in Figure 11A. The signal return (shield) shall be electrically connected to the miniature mission store structure ground. When the miniature mission store is the signal source, the MSCI will present a circuit whose ideal Thevenin equivalent is shown in Figure 11B. The signal return (shield) shall be electrically connected to the miniature store structure ground.

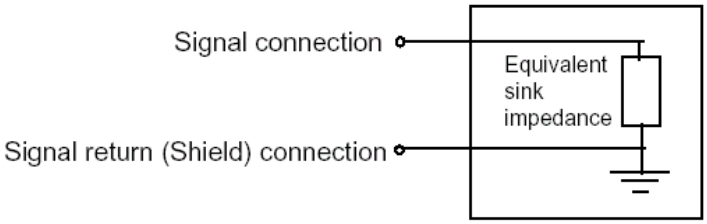


Figure 11A - Equivalent circuit of MMSI HB Type B interface (MMSI is signal sink)

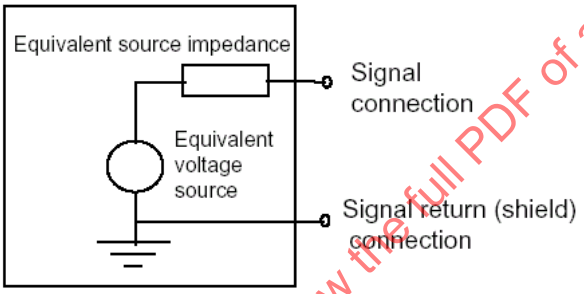


Figure 11B - Equivalent circuit of MMSI HB Type B interface (MMSI is signal source)

Figure 11 - Equivalent circuits of MMSI HB Type B interfaces

5.2.2 Store: Digital Data 1 Interface

The store shall provide connections for the digital data 1 interface in the MMSI signal set. The digital data 1 interface shall include a data high, a data low, and a shield connection. The store is not required to use the interface. However, if the interface is used, the store shall comply with the MMSI requirements below. If the interface is not used, the impedance between the data high and data low connections at the MMSI shall be greater than 12 kilohms from 75 kHz to 10.0 MHz.

5.2.2.1 Functional Characteristics

a. The store shall provide a remote terminal function as defined in AS5652. This remote terminal shall be accessible through the digital data interface at the MMSI for a communication link with the carriage system.

b. The store shall respond in accordance with AS5652 to those messages whose command word terminal address corresponds to:

   1. the store default address (zero), or

   2. the broadcast address.

c. The store shall respond to commands received over the digital data 1 interface in accordance with the applicable logical communications requirements of MIL-STD-1760 Appendix B. Appendix B aircraft requirements shall be applicable to the carriage system. Appendix B mission store requirements shall be applicable to the store.

5.2.2.2 Electrical Characteristics

The store shall comply with the electrical characteristics defined herein at the MMSI. The characteristics defined apply when measured on the data high connection referenced to the data low connection. Data high is that connection that is positive referenced to the data low connection in the first part of an AS5652 defined command or status sync waveform. The detailed electrical characteristics shall be in accordance with AS5652.

5.2.3 Store: Fibre Channel Interface

The store shall provide connections for an Up Fibre Channel (UFC) and Down Fibre Channel (DFC) interface at each primary signal set MMSI. The Fibre Channel interface may be used for full duplex transfer of digital data. The store may send digital messages through the MMSI to a Fibre Channel terminal (node) in the connected carriage system on the UFC signal. The store may receive digital messages through the MMSI from a Fibre Channel terminal (node) in the connected carriage system on the DFC.

The store shall respond to commands received over the Fibre Channel interface in accordance with the applicable logical communications requirements of MIL-STD-1760E Appendix B and Appendix D, with aircraft requirements applicable to the carriage system and mission store requirements applicable to the miniature mission store.

Each implemented Fibre Channel full-duplex link shall meet the requirements specified in AS5653 except as noted below.

The store is not required to use the Fibre Channel interface. If the interface is not present, the impedance shall be greater than 150 ohms in the frequency range of 20 MHz to 3GHz between _H and _L contacts for both the Up Fibre Channel & Down Fibre Channel.

5.2.3.1 Fibre Channel Physical Layer Characteristics

The physical layer of AS5653 when present in the MMMI shall comply with Fibre Channel Physical Interface [FC-PI 100-DF-EL-S] with the following signal assignments.

MMSI signal	FC-PI signal
DFC_H	RD+
DFC_L	RD-
UFC_H	TD+
UFC_L	TD-

5.2.4 Store: Store Mated Interface

The store shall provide a connection for a store mated interface at the MMSI. The store mated interface shall be connected within the store to the operating power return connection at the associated MMSI. The path between the store mated interface and the operating power return connection shall have a resistance of 500 milliohms maximum when measured at the MMSI. This resistance applies for excitation current within the range of 5.0 to 100 milliamperes.

5.2.5 Store: Carriage Mated Interface

The store shall provide a carriage mated interface connection at the MMSI for monitoring the electrically mated status of an associated carriage system. The store shall provide the source for this interface. These requirements apply to the carriage mated connection referenced to the operating power return connection.

a. Open circuit voltage

    1. Minimum voltage of 4.0 VDC

    2. Maximum voltage, in accordance with MIL-STD-704 for 28 VDC

    3. Voltage transients shall not exceed the upper limit defined in MIL-STD-704 for 28 VDC

b. Excitation current

1. Minimum current of 5.0 milliamperes

2. Maximum current of 100 milliamperes

c. Resistance detection threshold. An interface disconnected condition shall be detected for any resistance level of 100 kilohms or greater. An interface connected condition shall be detected for any resistance level of 2.0 ohms or less.

5.2.6 Store: Safety Enable Discrete Interface

The store shall provide connections for a safety enable discrete interface in the MMSI signal set. The store shall use the safety enable discrete interface if the Commit to Separate Store or Submunition function (bit D8) or the Fire, Launch or Release function (bit D10) of the Critical Control 1 data word in the Mission Store Control message (see Appendix B of MIL-STD-1760) is implemented.. The store shall act on these safety critical commands received over the digital data 1 interface only if the safety enable discrete signal is in the enabled state.

The store is not required to use the safety enable discrete interface in other instances. However, if required by the system specification or ICD, other bits in the Critical Control 1 and Critical Control 2 words may also be protected by the safety enable discrete. If the safety enable discrete interface is used, the store shall comply with the requirements below.

If the safety enable discrete is not used, the resistance between the safety enable discrete connection and the safety enable power return connection shall be greater than 100 kilohms (at DC).

The store shall not execute any safety critical functions (e.g., arm or employ) solely as a result of the activation of safety enable discrete.

CAUTION

The Safety Enable Discrete interface is provided to enable a safety or irreversible function within the store. The discrete is enabled when the Carriage System determines that safety criteria for the Store safety or irreversible function have been met.

5.2.6.1 Voltage Level

The store shall establish the appropriate enable or inhibit state when the following voltage levels are applied to the safety enable discrete connection (referenced to the safety enable power return connection) at the MMSI:

a. Steady-state conditions:

Enable: ≥ 15.0 VDC and ≤ Maximum voltage as defined in MIL-STD-704 for 28 VDC

Inhibit: ≥ -0.5 VDC and ≤ 5.5 VDC

b. Voltage transients up to the limits of MIL-STD-704 for 28 VDC applications.

5.2.6.2 Current Level

The store shall limit the load current to a range of 5.0 to 100 milliamperes when the steady state enable voltages (see 5.1.6.1.a) are applied to the MMSI.

5.2.6.3 Stabilization Time

The store shall be compatible with carriage systems which deliver a signal to the MMSI with a transition time (between enable and inhibit states) of up to 6.0 milliseconds.

5.2.6.4 Enable Lead Time

The store shall be capable of accepting safety critical commands over the digital data interface within 10 milliseconds after a valid enable signal is applied to the MMSI.

5.2.6.5 Inhibit Lead Time

The store shall functionally reject any safety critical commands over the digital data interface within 10 milliseconds after a valid inhibit is applied to the MMSI.

5.2.6.6 Power Return

The safety enable power return connection at the MMSI shall be the power return for the safety enable discrete signal.

5.2.7 Store: Power Interfaces

The store shall provide a set of power connections in the MMSI signal set. This shall include connections for operational power, auxiliary power and safety enable power along with associated returns.

The store shall only use either Operating Power or Auxiliary Power from which the store derives operating power for internal electronics. Current draw on the unused power interface shall be less than 5 milliamps.

The store shall be compatible with simultaneous (within 100 ms) application of Operating Power or Auxiliary Power.

If the operating power interface is not used by the store, the resistance between the unused power connection and the associated return connection at the MMSI shall be greater than 100 kilohms (at DC).

If the auxiliary power interface is not used by the store, the resistance between the unused power connection and the associated return connection at the MMSI shall be greater than 100 kilohms (at DC).

If the safety enable power interface is not used by the store, the resistance between the unused power connection and the associated return connection at the MMSI shall be greater than 100 kilohms (at DC).

5.2.7.1 Operating Power

The store shall provide connections in the MMSI signal set for an operating power interface from which the store may derive normal operating power for internal electronics. Application of operating power shall not cause an unsafe condition in the store.

5.2.7.1.1 Voltage Level

The store shall be compatible with operating power voltages at the MMSI which comply with the 28 VDC normal and abnormal characteristics and voltage transients for utilization equipment defined in MIL-STD-704.

5.2.7.1.2 Load Current

The store shall comply with the load requirements stated herein when the MMSI operating power voltage is within the specified MIL-STD-704 range. The store load applied to the operating power connection at the MMSI shall not exceed the maximum load current level of Figure 6.

5.2.7.1.3 Load Isolation

The store shall provide a minimum isolation of 100 kilohms (at DC) between the MMSI operating power and safety enable power connections. The store may provide continuity between the associated power return connections.

5.2.7.1.4 Overcurrent Compatibility

The store shall not become unsafe if fault currents up to the maximum overcurrent level of Figure 6 are sourced into the MMSI operating power connection.

5.2.7.1.5 Off-state Leakage Current

The store shall be compatible with off-state leakage currents supplied to the MMSI of up to 1.0 milliampere DC between the operating power connection and its return.

5.2.7.1.6 Stabilization Time

The store shall be compatible with MMSI operating power voltages which are below the levels of 5.2.7.1.1 for up to 6.0 milliseconds during power turn-on and turn-off (see Figure 7).

5.2.7.1.7 Power Return

The operating power return connection at the MMSI shall be the reference for the associated operating power connection. The store shall be compatible with carriage systems which connect the operating power return to structure ground. The store shall also be compatible with carriage systems which isolate the operating power return from structure ground.

5.2.7.1.8 Power Utilization

Stores shall utilize operating power only for powering those store functions which are not safety critical or which have sufficient safety interlocks such that store safety is not significantly degraded with the activation of operating power.

5.2.7.2 Safety Enable Power

The store shall provide connections in the MMSI for a safety enable power interface from which the store may derive power for performing safety critical functions, as applicable.

5.2.7.2.1 Voltage Level

The store shall be compatible with safety enable power voltages at the MMSI which comply with the 28 VDC normal and abnormal characteristics and voltage transients for utilization equipment defined in MIL-STD-704 with the following addition: the store shall be compatible with a normal steady state lower voltage limit of 22.0 VDC.

5.2.7.2.2 Load Current

The store shall comply with the load current requirements stated herein when the MMSI safety enable power voltage is within the range of 22.0 to 31.5 VDC. The store load applied to the safety enable power connection at the MMSI shall not exceed the maximum load current level of Figure 8. Current above a leakage level of 1.0 milliampere maximum shall only be drawn by the store for a period of 100 milliseconds maximum, while critical functions are performed in response to an external command.

5.2.7.2.3 Load Isolation

The store shall provide a minimum isolation of 100 kilohms (at DC) between the MMSI safety enable power and operating power connections (see 5.2.7.1.3). The store may provide continuity between the associated power return connections.

5.2.7.2.4 Overcurrent Compatibility

The store shall not become unsafe if fault currents up to the maximum overcurrent level of Figure 8 are sourced into the MMSI safety enable power connection.

5.2.7.2.5 Off-state Leakage Current

The store shall be compatible with off-state leakage currents supplied to the MMSI of up to 1.0 milliampere DC between the safety enable power connection and its return.

5.2.7.2.6 Stabilization Time

The store shall be compatible with MMSI safety enable power voltages which are below the levels of 5.2.7.2.1 for up to 6.0 milliseconds during power turn-on and turn-off (see Figure 7).

5.2.7.2.7 Power Return

The safety enable power return connection at the MMSI shall be the reference for the associated safety enable power connection. The store shall be compatible with carriage systems which connect the safety enable power return to structure ground. The store shall also be compatible with carriage systems which isolate the operational power return from structure ground.

5.2.7.2.8 Power Utilization

Stores shall utilize safety enable power to power those safety critical functions for which insufficient interlocks exist in the store for assuring that the required level of store safety can be achieved once the associated power interface is activated. The store shall not execute any safety critical functions (e.g., arm or employ) solely as a result of the activation of safety enable power. Stores may utilize safety enable power for powering non-safety critical store functions with the understanding that carriage systems will not energize this power interface until required safety criteria have been satisfied.

5.2.7.3 Auxiliary Power

The store shall provide connections in the MMSI signal set for an auxiliary power interface from which the store may derive operating power for internal electronics. Application of auxiliary power shall not cause an unsafe condition in the store.

5.2.7.3.1 Voltage Level

The store shall be compatible with auxiliary power voltages at the MMSI which comply with the 270 VDC normal and abnormal characteristics and voltage transient limits for utilization equipment defined in MIL-STD-704.

5.2.7.3.2 Load Current

The store shall comply with the load requirements stated herein when the MMSI auxiliary power voltage is within the specified MIL-STD-704 range. The store load applied to the auxiliary power connection at the MMSI shall not exceed the maximum load current level of Figure 9.

5.2.7.3.3 Load Isolation

The store shall provide a minimum isolation of 100 kilohms (at DC) between the MMSI auxiliary power and safety enable power connections.

The store shall provide a minimum isolation of 100 kilohms (at DC) between the MMSI auxiliary power return and safety enable power return connections.

The store shall provide a minimum isolation of 100 kilohms (at DC) between the MMSI auxiliary power and operating power connections.

The store shall provide a minimum isolation of 100 kilohms (at DC) between the MMSI auxiliary power return and operating power return connections.

5.2.7.3.4 Overcurrent Compatibility

The store shall not become unsafe if fault currents up to the maximum overcurrent level of Figure 9 are sourced into the MMSI auxiliary power connection.

5.2.7.3.5 Off-state Leakage Current

The store shall be compatible with off-state leakage currents supplied to the MMSI of up to 1.0 milliampere DC between the auxiliary power connection and its return.

5.2.7.3.6 Stabilization Time

The store shall be compatible with MMSI auxiliary power voltages which are below the levels of 5.2.6.3.1 for up to 6.0 milliseconds during power turn-on and turn-off (see Figure 7).

5.2.7.3.7 Power Return

The auxiliary power return connection at the MMSI shall be the reference for the associated auxiliary power connection. The store shall be compatible with carriage systems which isolate the auxiliary power return from structure ground.

5.2.7.3.8 Power Utilization

Stores shall utilize auxiliary power only for powering those store functions which are not safety critical or which have sufficient safety interlocks such that store safety is not significantly degraded with the activation of auxiliary power.

5.2.8 Store: Structure Ground Interface

The store shall provide a conductive path from the MMSI structure ground to store structure, capable of carrying overcurrents associated with the power limits specified in 5.1.7.1.4. The structure ground interface shall not be used as a signal return path or power return path except under fault conditions within the store. The voltage drop between the MMSI structure ground interface and the store ground shall not exceed 0.2 volts when conducting 8.0 amperes (continuous).

5.2.9 Store: Platform Class Interface

The carriage system provides an indication of the velocity capability of the platform to each weapon by providing a three state discrete at the MSCI. The three possible states provided at the MSCI are: open circuit, 28 VDC and 28 VDC return in accordance with the requirements of 5.1.9.

The store shall provide a platform class connection in the MMSI signal set. Use of the platform class is optional, based on individual store requirements. Use of this interface by stores shall, however, comply with the MMSI requirements below.

If the platform class interface is not used by the store, the resistance between the unused platform class interface and all other signals at the MMSI shall be greater than 100 kilohms (at DC).

5.2.9.1 Platform Class #1: Airborne High Speed Platforms (> 250 knots)

Platform class #1 is indicated by the presence of an open circuit on the platform class interface from the carriage system. The store shall provide the source for this interface. These requirements apply to the platform class referenced to the operating power return connection.

a. Open circuit voltage

    1. Minimum voltage of 4.0 VDC

    2. Maximum voltage, in accordance with MIL-STD-704 for 28 VDC

    3. Voltage transients shall not exceed the upper limit defined in MIL-STD-704 for 28 VDC

b. Resistance detection threshold.

1. A platform class #1 condition shall be detected for any resistance level of 100 kilohms or greater.

5.2.9.2 Platform Class #2: Airborne Low Speed Platforms (≤ 250 knots)

Platform class #2 is indicated by the presence of 28 VDC at the platform class interface from the carriage system. The store shall limit the load current to a range of 5.0 to 100 milliamperes when the steady state voltages (see 5.1.9.2) are applied to the MMSI platform class interface from the carriage system. The store shall establish connection to platform class #2 when the following conditions exist at the MMSI:

a. Steady state voltage

1. Minimum voltage of 20.0 VDC

2. Maximum voltage, in accordance with MIL-STD-704 for 28 VDC

5.2.9.3 Platform Class #3: Surface Platforms

Platform class #3 is indicated by the presence of a short circuit on the platform class interface from the carriage system. The store shall provide the source for this interface. These requirements apply to the platform class referenced to the operating power return connection.

a. Excitation current

1. Minimum current of 5.0 milliamperes

2. Maximum current of 100 milliamperes

b. Resistance detection threshold.

1. A platform class #3 condition shall be detected for any resistance level of 2.0 ohms or less.

5.3 Interface Initialization

5.3.1 Carriage System Initialization Requirements

The carriage system shall comply with the following default procedure (in the sequence presented) for initializing stores connected to MSCIs. The carriage system may initialize stores using other procedures, provided the carriage system:

a. knows (prior to power application) the identity of the connected store, and

b. has a prior established alternate procedure for safely initializing that store.

5.3.1.1 Pre-initialization Conditions

The carriage system shall provide the following pre-initialization conditions at the MSCI:

a. All power interfaces shall be deactivated.

b. Safety enable discrete interface shall be in the inhibit state.

NOTE: Digital data interfaces, mated status interfaces, platform class, and high bandwidth interface may be active.

5.3.1.2 Power Application

For a Class I or Class II signal set, the carriage system shall apply operating power to the MSCI.

For a Class IA or Class IIA signal set, the carriage system shall apply operating power and auxiliary power to the MSCI. The carriage system may apply operating power and auxiliary power simultaneously (within 100 ms).

The safety enable power interface shall remain deactivated.

5.3.1.3 First Communication

The carriage system shall send to the store (over the digital data 1 interface) transmit command(s) for the Store Description message as defined in MIL-STD-1760, Appendix B. The carriage system shall not require a valid store response (see MIL-STD-1760, Appendix B) to any of these transmit commands if sent within 150 milliseconds after operating power application. The carriage system shall not require a “not busy” response (see AS5652) to any of these transmit commands if sent within 500 milliseconds after operating power application (for class I and II) or auxiliary power application (for class IA and IIA). The carriage system shall not require full performance interactive communications in accordance with the system specification for any transmit or receive messages if sent within the time specified in Power-up Time (see MIL-STD-1760E Table B-IV).

5.3.2 Store Initialization Requirements

Stores shall comply with the following initialization requirements in the sequence presented.

Class 1A and class IIA stores which use auxiliary power exclusively shall not be required to provide a store response associated with application of operating power only.

5.3.2.1 Pre-initialization Conditions

Pre-initialization conditions as described in 5.3.1.1 will be provided by the carriage system to the store at the MMSI.

5.3.2.2 Power Application

The store shall be compatible with the application of operating power (auxiliary power for class IA and Class IIA stores) for accomplishment of initialization functions. The store shall not require the application of any other interface power for completing the initialization requirements specified herein.

5.3.2.3 First Response

From 150 milliseconds after operating power (auxiliary power for class IA and Class IIA stores) application onward, the store shall be capable of responding to valid commands received over the digital data interface. The required store response shall be either:

a. A valid status word indicating a busy condition, or

b. A valid status word indicating a non-busy condition plus the appropriate valid data words.

If a store receives any commands before the 150 ms has transpired, the store shall either respond as defined above or shall not respond at all.

5.3.2.4 First Required Non-busy Response

Within 500 ms of interface operating power (auxiliary power for class IA and Class IIA stores) application, the store shall be capable of responding to a valid Store Description message transmit command. This response shall be a valid status word indicating a non-busy condition (see AS5652) plus the appropriate valid data words as defined in MIL-STD-1760, Appendix B.

5.3.2.5 First Required Full Communication Response

Within the time specified in Power-up Time (see MIL-STD-1760E Table B-VIII) of interface operating power (auxiliary power for class IA and Class IIA stores) application, the store shall be capable of responding to any valid message in accordance with the system's performance specification.

5.4 Power Interface Interrupts

5.4.1 Store Compatibility

Power interrupts of 200 microseconds or less on the operating power or auxiliary power interface shall have no effect on store function. Full communication function shall be maintained during such interrupts and no power interrupt notification shall occur. For power interrupts greater than 200 microseconds, the store may request full or partial initialization.

5.4.2 Carriage System Compatibility

The carriage system shall be compatible with stores which request full or partial store system initialization following an operating power interrupt in excess of that allowed in 5.4.1.

5.4.2.1 Full Initialization

If the store requests full initialization, then the carriage system shall comply with 5.3.1.1 through 5.3.1.3 to satisfy the request. The carriage system, however, is not required to request the Store Description message demanded in 5.3.1.3.

5.4.2.2 Partial Initialization

If no partial initialization procedure has been agreed in the interface control document (ICD) between the carriage system and store, the carriage system shall substitute full initialization.

5.4.3 Store Power Interrupt Notification

In the event that the store requires a full or partial initialization following a power interrupt with a duration in excess of that allowed in 5.4.1, the store shall notify the carriage system utilizing the service request with vector word procedure in Appendix C.

5.5 Connector Characteristics

5.5.1 MSCI Connectors

a. MSCI connectors shall meet the form, fit, function, and interface requirements of MIL-C-38999, Series III, Shell Size 15, Polarization Key Identification N connectors.

b. MSCI connectors shall be plugs with pin contacts or pin termini.

c. MSCI connectors shall be in accordance with MIL-STD-1560, Insert Arrangement No. 15-21.

5.5.2 MMSI Connectors

a. MMSI connectors shall be in accordance with MIL-DTL-38999, Series III, Shell Size 15, Polarization Key Identification N.

b. MMSI connectors shall be receptacles with socket contacts or socket termini.

c. MMSI connectors shall be in accordance with MIL-STD-1560, Insert Arrangement No. 15-21.

5.5.3 Contacts

Contacts/termini and seal plugs/dummy contacts for MSCI and MMSI connectors shall meet the form, fit, function, and interface characteristics of those listed in Table 1 and Table 2.

Table 1 - Connector contacts/termini and seal plugs

Size	AS39029 Slash Sheet	Abbreviated Title	Seal Plugs/Dummy Contacts
22	/56	Contact, socket	MS27488-22 BLACK
22	/58	Contact, pin	MS27488-22 BLACK
20	/56	Contact, socket	MS27488-20 RED
20	/58	Contact, pin	MS27488-20 RED
12	/102	Contact, coaxial, pin	AS85049/80-12 YELLOW
12	/103	Contact, coaxial, socket	AS85049/80-12 YELLOW

5.5.4 Connector Insert Arrangement

The MMSI insert arrangement is illustrated on Figure 12.

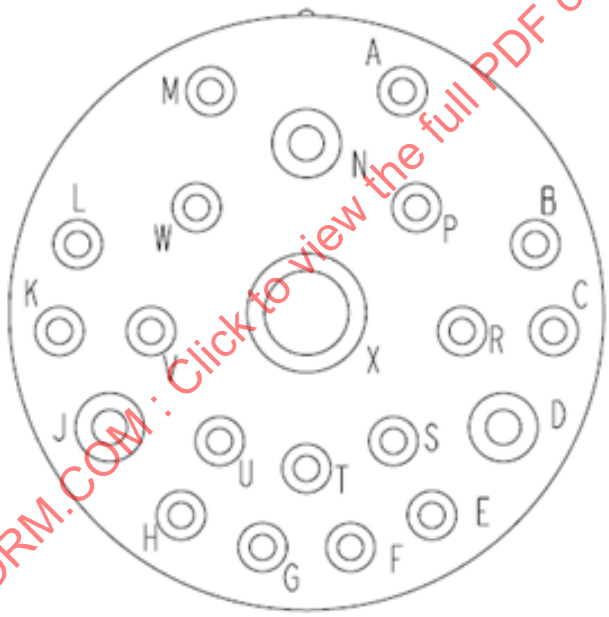


Figure 12 - Connector insert arrangement (15-21)

Table 2 - Connector contact functional assignment

Contact Location	Size	Nomenclature
M	22	Up Fibre Channel_H*
L	22	Up Fibre Channel_L*
W	22	Up Fibre Channel_S*
A	22	Down Fibre Channel_H*
B	22	Down Fibre Channel_L*
P	22	Down Fibre Channel_S*
E	22	Auxiliary Power **
H	22	Auxiliary Power Return **
D	20	Operating Power Return
N	20	Operating Power
J	20	Structure Ground
V	22	Safety Enable Power
K	22	Safety Enable Return
R	22	Safety Enable Discrete
F	22	Carriage Mated
G	22	Store Mated
U	22	Digital Data 1_H
S	22	Digital Data 1_L
C	22	Digital Data 1_S
T	22	Platform Class
X	12 (Coax)	High Bandwidth*

* Not applicable to class II interface
** Applicable only to Class IA and Class IIA Interfaces

NOTE: Appendix B provides a cross reference between the signal set defined above and the Joint Miniature Munitions Interface (JMMI).

5.5.5 Plugged Cavities

MSCI connectors may use plugged cavities in lieu of pin termini for any unused interface. MMSI connectors may use plugged cavities in lieu of socket contacts for any unused interface. Any plugged cavity must not interfere with a functional contact in the mating connector.

5.5.6 Connector Location and Orientation

The connector location and orientation are considered elements of the mechanical interface, and are not defined in this electrical interface standard. Applicable mechanical interface standards and specifications for items on which this interface is employed may have requirements in this area.

6. NOTES

(This section contains information of a general or explanatory nature which may be helpful, but is not mandatory.)

6.1 Intended Use

This standard is intended to be used as a requirement in contracts for small weapons and related devices which should have a common electrical interface.

6.2 Acquisition Requirements

Acquisition documents should specify the following:

a. Title, number, and date of this standard.

6.3 Revision Indicator

A change bar (l) located in the left margin is for the convenience of the user in locating areas where technical revisions, not editorial changes, have been made to the previous issue of this document. An (R) symbol to the left of the document title indicates a complete revision of the document, including technical revisions. Change bars and (R) are not used in original publications nor in documents that contain editorial changes only.

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APPENDIX A - ADDITIONAL HIGH BANDWIDTH TYPE A SIGNAL PATH REQUIREMENTS FOR MIL-STD-1760 MINIATURE STORE CARRIAGE SYSTEMS

A.1 SCOPE

This appendix specifies the characteristics for high bandwidth Type A signal paths in miniature store carriage systems which interface to a host aircraft platform through a MIL-STD-1760 mission store interface (MSI). The stated requirements apply to signal paths between the MSI and the MSCI. Requirements for other system configurations may be added later to this document as additional system architectures associated with the carriage and employment of miniature stores evolve. This appendix is a mandatory part of this standard. The information contained herein is intended for compliance.

A.2 DEFINITIONS

A.2.1 Definitions

The following definitions are applicable to Appendix A of this standard.

A.2.2 Random Noise

Randomly occurring noise that is distributed over a large bandwidth (sometimes known as white or pink noise). Random noise which is keyed on and off from time to time (sometimes known as burst noise) is included.

A.2.2.1 Periodic Noise

Noise made up of discrete frequency components. Periodic noise includes the effects of crosstalk from aircraft and store signal sources.

A.2.2.2 Impulse Noise

Spurious spikes, which may occur randomly or at fixed intervals.

A.2.2.3 Stimulated Noise

Additional noise that is induced by the presence of an input signal.

A.2.2.4 Common Mode Noise

The potential difference between the signal return (shield) connection of the HB interface and local structure ground.

A.3 HIGH BANDWIDTH INTERFACES

The miniature store carriage system shall provide HB interfaces (as required) at the MIL-STD-1760 primary signal set MSI and a HB interface at each MSCI for bi-directional simplex transfer of Type A signals between the miniature mission store and the host platform. At the carriage store MSI, the carriage store HB interfaces shall comply with the mission store requirements of MIL-STD-1760 except as stated herein.

A.3.1 Signal Transfer Capability

The employment of the MIL-STD-1760 MSI High Bandwidth interfaces will depend on the system specification. For the (optional) routing of video signals, the MIL-STD-1760 HB3 interface shall be used. For the (optional) routing of time correlation signals, the MIL-STD-1760 HB1 interface shall be used. The miniature store carriage system shall implement a signal routing network between each employed MIL-STD-1760 HB interface at the MSI and each MSCI HB interface. The number and type of simultaneous connections supported by the signal routing network depend on the system specification

A.3.2 Type A Signal Path Characteristics

A.3.2.1 Return Loss

The input return loss of each signal path shall not be less than 20 dB over the frequency band 20 Hz to 20 MHz when the input is terminated with the nominal impedance.

A.3.2.2 Transient Response

The carriage system network transient response shall be such that when each of the signals on Figures A1A, A2A, A3A, and A4A is applied to the input, the output shall meet the requirements on Figures A1B, A2B, and A4A. For the output response envelope on Figure A1B, $V^{I}_{1.0}$ is as defined on Figure A3A. For the response envelope on Figure A2B, $V^{I}_{1.3}$ is as defined on Figure A4A.

A.3.2.3 Insertion Gain

The signal path insertion gain between the input and output shall be 0 dB +0.5/-1.0 dB, where insertion gain = 20 log ($V^{I}_{1.3}$/V). V and $V^{I}_{1.3}$ are defined on Figures A4A and A4B respectively.

A.3.2.4 Representative Pulse Delay

The representative pulse delay of any signal path shall not exceed 1.0 microsecond and shall not vary by more than ±35 nanoseconds from its nominal value. Definition: when the signal on Figure A4A is applied to the input, the representative pulse delay is the time difference between the voltage V/2 being reached on the input signal rising edge and the voltage $V^{I}_{1.3}$/2 being reached on the output signal rising edge where $V^{I}_{1.3}$ is defined on Figure A4A.

A.3.2.5 Equalization

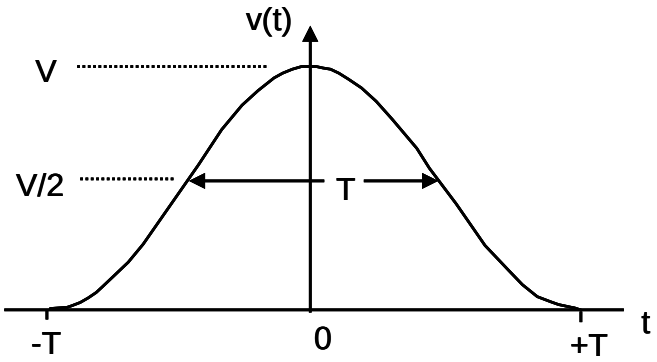
The gain misequalization of any signal path shall not exceed the limits shown on Figure A5. The zero dB gain reference shall be the gain at 20 kHz. The maximum gain between 20 and 200 MHz shall not exceed +3 dB with respect to the zero-dB gain reference.

A.3.2.6 Dynamic Range

When a 1 kHz, 3.5 V_{pp} sine wave is added to a DC voltage of ±0.25 V and then applied at the MSCI input, the signal at the MIL-STD-1760 MSI output of the signal path shall not be compressed or clipped by more than 6%. When a 1 kHz, 3.5 V_{pp} sine wave is added to a DC voltage of ±0.75 V and then applied to the MIL-STD-1760 MSI input, the signal at the MSCI output shall not be compressed or clipped by more than 6%.

A.3.2.7 Signal Path DC Offset

The maximum DC voltage at the output of each signal path shall not exceed ±250 mV with the input terminated with the nominal impedance.

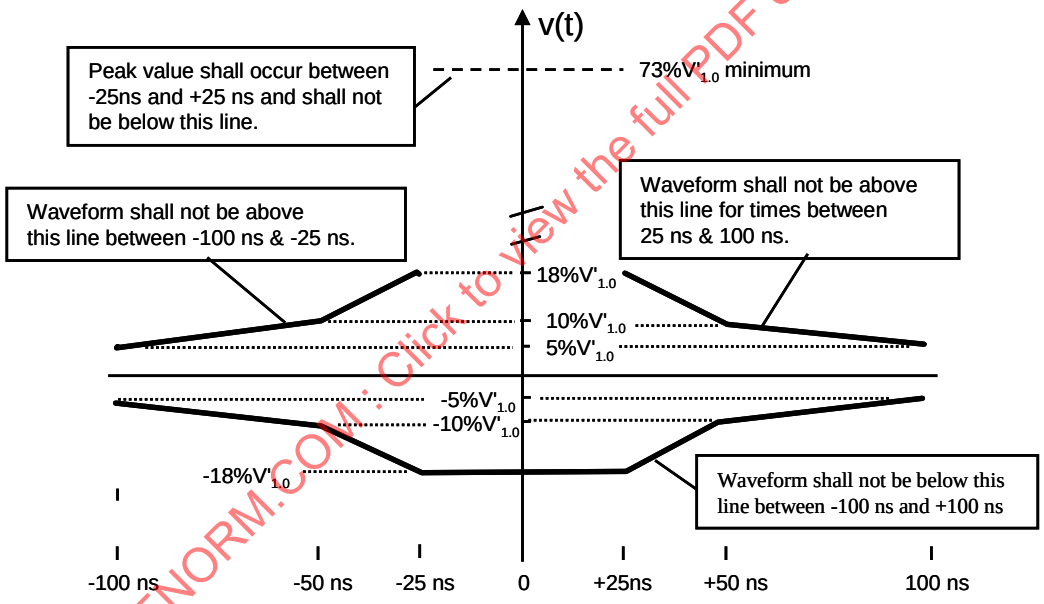


$$v(t) = V \cos^2\left[\frac{\pi t}{2T}\right] \quad \text{for } -T \leq t < +T$$

$$v(t) = 0 \text{ volts elsewhere}$$

where T = 25 nanoseconds, V = ± 1.0 volt

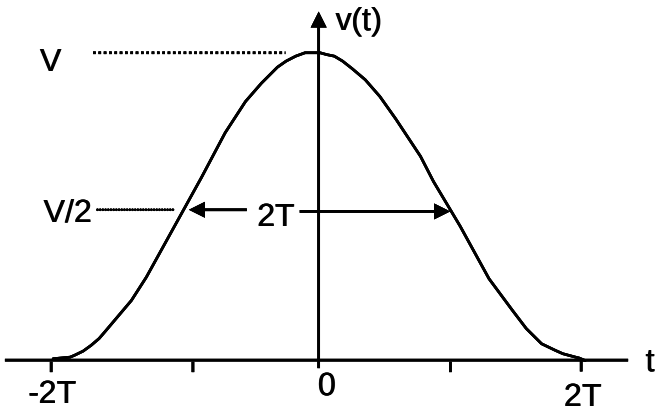
Figure A1A - Cosine-squared T signal



NOTE 1: The time envelope (0 ns) is arbitrary with respect to both the stimulus and response waveforms.
NOTE 2: For sampled systems, the response envelope shall apply for any alignment of the input signal with respect to the sample clock.

Figure A1B - Allowed response envelope for cosine-squared T signal

Figure A1 - Cosine-squared T signal requirements

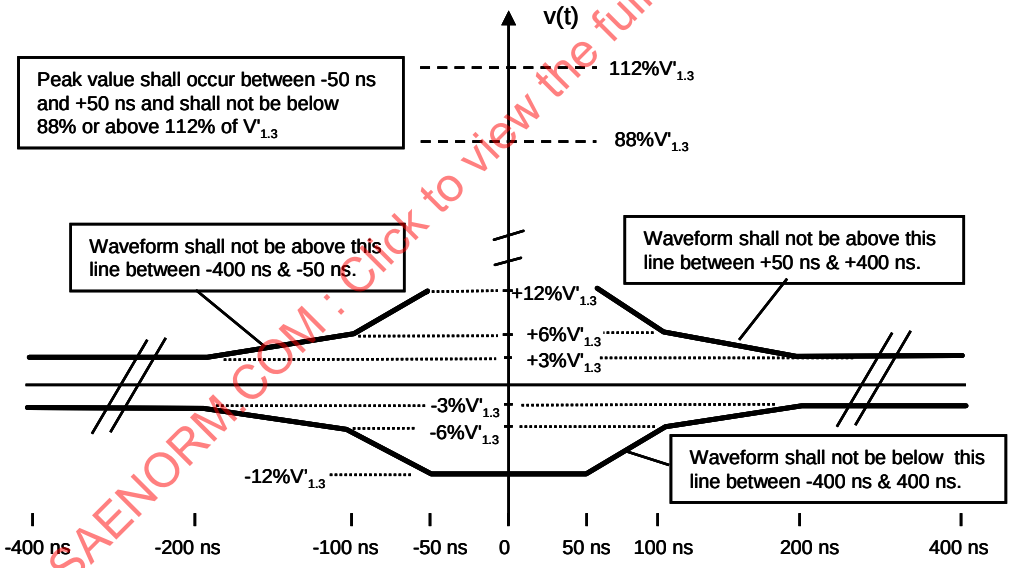


$$v(t) = V \cos^2 \left[\frac{\pi t}{4T} \right] \text{ for } -2T \leq t < 2T$$

$$v(t) = 0 \text{ volts elsewhere}$$

where 2T = 50 nanoseconds, V = ± 1.3 volt

Figure A2A - Cosine-squared 2T signal



NOTE: The time origin (0 ns) of the envelope is arbitrary with respect to both the stimulus and response waveforms.

Figure A2B - Allowed response envelope for cosine-squared 2T signal

Figure A2 - Cosine-squared 2T signal requirements