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		Superseding AS5716	
Standard Electrical and Logical Interface for Airborne Fuzing Systems			

RATIONALE

Document has been revised to include definitions for the following interfaces: 3 power supply; Initiation inhibit discrete interface; Target detection sensor interface; Post release environment sensor interface. These elements complete the definitions in the Standard of all elements necessary for the Class 2 and Class 3 interfaces for interchangeable fuzes. Also included are a small number of revisions to clarify elements of the previous standard that were unclear (definitions of bit mapping) and corrections to inconsistent tolerance margins.

FOREWORD

The standard addresses the electrical, logical and functional characteristics of the interface between the weapon's fuzing system(s) and the rest of the weapon, to enable interoperability of fuzing systems and weapon systems. The goal is to improve the effectiveness and readiness of NATO forces by reducing the logistics associated with supporting airborne weapon systems in the theater of operation.

This effort has been closely coordinated with the SAE AS-1B7 Fuzing System Mechanical Task Group which has been tasked by the AS-1 Technical Committee to generate an AS standardizing the mechanical fuzing system interface for the fuzing system wells and fuze electrical connector.

For information on the standardization of the mechanical interface between 3-inch bomb fuzes and the remainder of the weapon, reference should be made to document AS5680A.

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1. SCOPE

This interface standard applies to fuzes/fuzing systems (referred to as fuzing system hereafter) in airborne weapons that use a MIL-STD-1760 type interface. It defines the powers, the discrete signals and the serial data interface for the communications at the interface between the fuzing system and the remainder of the weapon, including the weapon control unit.

The Class 1 interface is an electrical only interface that facilitates use of MIL-STD-1760 type platform store interfaces for the fuze to monitor intentional release and defines the fuze interface bus communications protocol to allow sending and receiving data from fuzing systems.

Class 2 interfaces add a defined connector and additional interfaces to facilitate the exchange of compatible fuzing systems.

Class 3 interfaces add further interface definitions to facilitate the exchange of AS5680A compatible fuzing systems components.

The bus communications protocol provides a means by which the weapon may set mission parameters within the fuzing system main housing and in other devices external to the fuzing system main housing. The standard also defines the target detection signal to be provided by a target detection device external to the fuzing system.

This standard does not address the mechanical interfaces to target detection devices or to other sensors that are external to the fuzing system main housing.

CAUTION

The user of this standard should be aware that the weapon and the fuzing system will need to be evaluated against and comply with all applicable safety standards.

It should be noted that the fuzing system safety boundary may encompass the entire weapon system.

CAUTION

This version of AS5716A includes definitions of Class 2 and Class 3 interfaces to support the fuzing system interchangeability requested by NATO. Class 2 and Class 3 compliant weapons and fuzing systems allow the use of compliant multiple fuzing systems with a weapon and vice versa.

As a consequence, the user has to implement the necessary procedures or design features to prevent the assembly of unsuitable fuzes or PRES into the weapon in order to ensure safety and full functionality (e.g., the minimum arm times allowed by a specific fuzing system fuze may be less than that required by a weapon system to ensure adequate safety, or a specific PRES may be mounted into the wrong weapon, thus incorrectly sensing the arming environment as being met).

Weapon and fuzing system designers will need to address the interchangeability issue with measures¹ that are beyond the scope of this interface standard in order to satisfy safety standards.

¹ For example, when using a Class 3 interface, the PRES could be an integral part of the weapon that cannot be exchanged in the field, or physical features employed that would permit assembly with only a certified PRES.

CAUTION

This version of AS5716A includes the definition of a Class 3 interface to further support the fuzing system interchangeability requested by NATO. Class 3 interfaces include a standardized interface to a post release environment sensor (PRES) and allow for this element of the safe and arming functionality of the fuzing system to be permanently incorporated with the weapon system. Subclasses of the Class 3 interface are then intended to electrically and logically discriminate between different PRES technologies and environmental sensor techniques.

This approach permits a PRES (and associated weapon system) to be used with multiple fuzing systems, and a fuzing system to be used with multiple PRES types (i.e., multiple weapon systems).

As a consequence it is possible to use combinations of fuzing systems and PRES which may not be compatible, thus potentially resulting in a hazardous condition or a degraded capability and reliability.

Specifically subclass A1 of Class 3 defines a simple analog interface for post release air speed sensors with no digital safeguards. This provides a significant risk of unintended and untested combinations of fuzing systems, PRES and weapon to be physically connected in the field, causing a potential safety hazard.

For fuzing systems belonging to or being compatible with Class 3, subclass A1, the user has to solely rely on procedures in the field to prevent hazards due to incompatible combinations of fuzing systems, PRES and weapons and to ensure full functionality.

The use of Class 3, subclass A1, interfaces therefore is strongly discouraged.

2. REFERENCES

2.1 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 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.

2.1.1 SAE Publications

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

AS5680A Fuze Well Mechanical Interface

2.1.2 NATO Publications

Available from national Points of Contact.

STANAG 4187, Ed. 4 Fuzing Systems - Safety Design Requirements

AOP-16, Ed. 4 Fuzing Systems: Guidelines for STANAG 4187

AOP-38, Ed. 3 Glossary of Terms and Definitions Concerning the Safety and Suitability for Service of Munitions, Explosives and Related Products

2.1.3 U.S. Government Publications

Available from the Document Automation and Production Service (DAPS), Building 4/D, 700 Robbins Avenue, Philadelphia, PA 19111-5094, Tel: 215-697-6257, <https://assist.daps.dla.mil/quicksearch/>.

MIL-HDBK-1763 Aircraft/Stores Compatibility: Systems Engineering Data Requirements and Test procedures
15 June 1998

MIL-STD-704F Aircraft Electrical Power Characteristics
30 December 2008

MIL-STD-1316E Safety Criteria for Fuze Design
14 January 1999

MIL-STD-1553B Aircraft Internal Time Division Command/Response Multiplex Data Bus
15 January 1996

MIL-STD-1760E Interface Standard for Aircraft/Store Electrical Interconnection Systems
24 October 2007

2.2 TIA Publications

Available from Telecommunications Industry Association, 2500 Wilson Boulevard, Suite 300, Arlington, VA 22201, Tel: 703-907-7700, <http://www.tiaonline.org/standards/>

TIA-422-B Electrical Characteristics of Balanced Voltage Digital Interface Circuits (ANSI/TIA/EIA-422-B-1994)
(R2000) (R2005)

TIA-485-A Electrical Characteristics of Generators and Receivers for Use in Balanced Digital Multipoint Systems
(ANSI/TIA/EIA-485-A-98)(R2003)

2.2.1 ISO Publications

Available from American National Standards Institute, 25 West 43rd Street, New York, NY 10036-8002, Tel: 212-642-4900, <http://www.ansi.org>, or from International Organization for Standardization, 1, rue de Varembe, Case postale 56, CH-1211 Geneva 20, Switzerland, Tel: +41-22-749-01-11, <http://www.iso.org>.

ANSI X3.4-1986 American National Standard for Information Systems - Coded Character Sets - 7-Bit American
National Standard Code for Information Interchange (7-Bit ASCII)

ANSI IEEE/ASTM American National Standard for Use of the International System of Units (SI): The Modern Metric
SI 10-1997 System

ISO 1000: 1992 SI Units and Recommendations for the use of their multiples and of certain other units

ISO 3166-1: 2006 ISO 3166-1:2006 Codes for the representation of names of countries and their subdivisions -
Part 1: Country codes

ISO 7498: 1984 Open Systems Interconnection - Basic Reference Model

2.3 Definitions

AIRCRAFT STATION INTERFACE: The electrical interface(s) on the aircraft structure where the mission or carriage store(s) is electrically connected. The connection is usually on the aircraft side of an aircraft-to-store umbilical cable. The aircraft station interface locations include, but are not limited to, pylons, conformal and fuselage hard points, internal weapon bays, and wing tips. [Source: MIL-STD-1760]

ARMED: The fuzing system is considered armed when all safety breaks and switches have been made ineffective and any firing stimulus can cause the system to function. For technical details on the specific definition of the armed state see the nationally applicable standardization documents, e.g., NATO STANAG 4187, NATO AOP-38 or MIL-STD-1316.

ARMING: The process by which the fuzing system progresses from an unarmed to an armed state.

ARMING DELAY: The Arming Delay is the interval between the fuzing system sensing separation from the aircraft and the earliest point or time at which the fuzing system may arm after separation from the aircraft.

ARMING ENERGY: The energy used to perform the arming process, excluding the energy needed to initiate the firing train. See also Firing Energy

CARRIAGE PHASE: The phase of operation during which the fuzing system is installed in the weapon, up to the initiation of the release process.

CARRIAGE STORE INTERFACE: The electrical interface on the carriage store structure where the aircraft is electrically connected. This connection is usually on the store side of an aircraft-to-store umbilical cable. [Source: MIL-STD-1760]

CARRIAGE STORE STATION INTERFACE: The electrical interface(s) on the carriage store structure where the mission store(s) are electrically connected. This connection is usually on the carriage store side of an umbilical cable. [Source: MIL-STD-1760]

CHARACTER STUFFING: If certain characters have a special meaning in a message (e.g., Start Flag), Character Stuffing provides a technique to eliminate these special characters from other parts of a message during transmission. The special characters are replaced by selected combinations of two or more characters prior to transmission. After transmission, the selected combinations of two or more characters are again replaced by the special characters, returning the message to its original state.

CHECKSUM: An algorithm-based method of determining the integrity and authenticity of a digital data object. Used to check whether errors or alterations have occurred during the transmission or storage of a data object. [Source: Australian Government, National Archives of Australia, <http://www.naa.gov.au/recordkeeping/er/guidelines/14-glossary.html>]

COMMIT TO SEPARATE STORE OR SUBMUNITION: (CTS) A command defined in MIL-STD-1760. Commit to Separate Store or Submunition is sent by the aircraft in conjunction with Release Consent, to command the weapon to prepare for release of the weapon or a submunition(s).

COMMITTED TO STORE OR SUBMUNITIONS SEPARATION: (CTSS) A signal defined in MIL-STD-1760. The weapon uses Committed to Store or Submunition Separation to signal to the aircraft that the weapon or the submunition is ready for immediate release.

DISARM: To restore a fuzing system to a non-armed condition from an armed condition, either reversibly, to permit rearming, or irreversibly and permanently (sterilization). [Source: NATO AOP-38]; see also Unarmed

DISTRIBUTED FUZING SYSTEM: A fuzing system whose components (e.g., fuzing system main housing, sensors, etc.) are not located within a single device, but in multiple devices, such that there is a connection between these multiple devices, allowing the transfer of signals and/or energy between them. For the purpose of this document the sum of all parts of a distributed fuzing system is considered to be the fuzing system even if some parts are installed permanently into the weapon (e.g., external sensors).

ENVIRONMENTAL SENSOR: A component or series of components designed to detect and respond to a specific environment. [Source: MIL-STD-1316]

EOD ARM STATE MONITOR: A discrete interface that allows detection of the fuzing system arm state.

EXTERNAL COMPONENTS: See Fuzing System External Components, if related to the fuzing system.

EXTERNAL SENSOR: A sensor that is part of the fuzing system and that is outside of the fuzing system main housing.

FIRING: See Initiation.

FIRING ENERGY: The energy used to initiate the explosive train.

FUZE: A physical system designed to sense a target or respond to one or more prescribed conditions, such as elapsed time, pressure, or command, and subsequently initiate a train of fire or detonation in a weapon. Safety and arming are primary roles performed by a fuze to preclude ignition of the weapon before the desired position or time. The term Fuze usually denotes a single device. See also Fuzing System.

FUZING SYSTEM: A physical system designed to sense a target or respond to one or more prescribed conditions, such as elapsed time, pressure, or command, and to subsequently initiate an explosive train in a weapon. Safety and arming are primary roles performed by a fuzing system to preclude ignition of the weapon before the desired position or time. A safety and arming device is a part of a fuzing system. A fuzing system may or may not be a single device. See also Distributed Fuzing System and Fuzing System External Components.

FUZING SYSTEM EXTERNAL COMPONENTS: Components of a distributed fuzing system, which interface with the fuzing system main housing but are located outside the fuzing system main housing. Examples are power sources, and environmental sensors.

FUZING SYSTEM MAIN HOUSING: For distributed fuzing systems only: The fuzing system main housing (also known as the "fuze can") is a single device that contains safety related fuzing system functions and may contain one or more target or environment sensors. Additional components of the fuzing system (e.g., environment sensors) may be located outside the fuzing system main housing. See Fuzing System External Components.

INITIATION: Firing of the first element of an explosive train.

INITIATION INHIBIT: A discrete signal from the weapon that temporarily prohibits the initiation of the explosive train independent of the arm state.

IN-LINE FUZE: An In-Line Fuze is a fuzing system with a non-interrupted explosive train as defined in STANAG 4187. See also Out-of-Line Fuze

INTERCHANGEABILITY: A condition which exists when two or more items, in a specified life cycle and environment, possess such functional and physical characteristics as to be equivalent in safety, performance and durability, and are capable of being exchanged one for the other without alteration of the items themselves, or of adjoining items, except for adjustment, and without selection for fit and performance. [Source: NATO AOP-38]

INTERFACE CONTROL DOCUMENT: An Interface Control Document describes the interface to a system or subsystem. An Interface Control Document may describe the inputs and outputs of a single system or between two systems/subsystems. The purpose of an Interface Control Document is to communicate all possible inputs to and all potential outputs from a system for some potential or actual user of the system. [Source: based on Wikipedia.org]

INTEROPERABILITY: The ability of systems, units or forces to provide services to and accept services from other systems, units or forces and to use the services so exchanged to enable them to operate effectively together. [Source: NATO AOP-38]

JETTISON: Deliberate separation from the aircraft or ejection of a weapon, where one prime requirement is for the payload to NOT operate and the fuzing system to remain safe. This may be achieved by one or more methods, depending on the design of the individual weapon and/or fuzing system.

MISSION DATA: Data that is provided to the fuze to enable it to operate in accordance with the mission requirements, e.g., delays, times, distances and warhead initiation criteria.

MISSION STORE INTERFACE: The electrical interface on the mission store external structure where the aircraft or carriage store is electrically connected. This connection is usually on the mission store side of an umbilical cable. [Source: MIL-STD-1760]

MUNITION: See Weapon

NON-VOLATILE MEMORY: Memory used by the fuzing system that is designed to have a data retention time of at least one year with no power applied to the fuzing system.

OUT-OF-LINE FUZE: An Out-of-Line Fuze is a fuzing system with an interrupted explosive train as defined in STANAG 4187. See also In-Line Fuze

POST RELEASE ENVIRONMENT SENSOR: A sensor to detect and respond to a valid arming environment after the weapon has separated from the aircraft. It is part of the Fuzing System. It may be part of the fuzing system main housing (e.g., accelerometer sensor) or external to the fuzing system main housing (e.g., turbine generator). See also Environmental Sensor.

RELEASE: Deliberate separation of a weapon from the aircraft as part of a sequence with the intention that the complete weapon operate, including payload operation at the correct point in its deployment. For the purposes of this document, release from the aircraft may be by any intended means, including tube or rail launch using rocket propellant, downward ejection or simple release under gravity.

RELEASE CONSENT: A low power discrete from the aircraft to the weapon defined in MIL-STD-1760. When in the enabled state, it is used by the weapon to authorize the use of safety critical functions commanded over the data bus interface.

RELEASE INDICATION: A signal that indicates to the fuzing system that the separation of the weapon from the aircraft has taken place or will take place irreversibly under fault-free conditions.

RELEASE & FREE FLIGHT PHASE: A phase during weapon and fuzing system operation that starts with the end of the Release Preparation phase and includes all operations during actual release and consecutive free flight of the weapon.

RELEASE PREPARATION PHASE: A phase during weapon and fuzing system operation, that starts with the end of the Carriage phase and includes all operations necessary to prepare weapon and fuzing system for release, but does not include the actual release.

SAFETY CRITICAL: Any single entity/function, which in case of failure or absence has the potential to severely compromise safe operation and handling (including manufacturing, maintenance, transport, disposal). The characterization of the entities/functions as safety critical is made within the design and safety analysis of the system.

SAFETY RELATED: Any single entity/function that provides or ensures safety.

SEPARATION: The terminating of all physical contact between a store, or portions thereof, and an aircraft; or between a store, or portions thereof, and suspension equipment. [Source: MIL-HBK-1763]

SINGLE-SHOT DEVICE: Any device that operates only once due to irreversible processes taking place. Typical examples in fuzing systems are pyrotechnic actuators or mechanical devices that lock after operation.

STORE: See Weapon

TARGET DETECTION DEVICE: A sensor to detect and respond to a target or environment. The presence of that target or environment is used by other elements of the fuzing system to determine when to initiate the payload.

UMBILICAL DISCONNECT: The permanent physical disconnection of the MSI connection either immediately before or during the separation of the weapon from the aircraft or carriage system.

UNARMED: A [fuzing] system is unarmed when all safety devices are in a safe position. [Source: NATO AOP-38]

VOLATILE MEMORY: Memory used by the fuzing system to store data that does retain the data only while power is applied.

WEAPON: For the purposes of this document only, the term "weapon" denotes all of the carried equipment below the MSI connector. The terms "store" and "munition" are retained only where they form part of a definition extracted directly from other released publications and may be considered in this context to be synonymous with "weapon".

WEAPON SIDE: For the purposes of this document only, the term "Weapon Side" refers to the other side of the connector interface from the fuzing system main housing. It may include the weapon (guidance computer, mission computer), power sources, etc., as well as additional components of the fuzing system, such as target sensors or environment sensors.

2.4 Abbreviations

ac: Alternating Current

ACK: Acknowledge

BC: MIL-STD-1553 Bus Controller

BIT: Built In Test

CTS: Commit to Separate Store or Submunitions

CTSS: Committed to Store or Submunitions Separation

dc: Direct Current

EOD: Explosive Ordnance Disposal

FIA: Fuze Inhibit Arming

FCM: Fuze Cancel Mission

FAD: Fuze Arming De-Inhibit

FPR: Fuze Prepare for Release

FRI: Fuze Release Imminent

FRR: Fuze Ready for Release

FS: Fuzing System

FSQ: Fuze Status Query

ICD: Interface Control Document

LB: Lower Byte

LSB: Least Significant Bit

MSB: Most Significant Bit

MSI: Mission Store Interface

NSAA: National Safety Approving Authority

PDU: Protocol Data Unit

PRASS: Post Release Air Speed Sensor

PRES: Post Release Environment Sensor

RC: Release Consent

RCM: Release Consent Monitor

RF: Radio Frequency

RI: Release Indication

RMS: Root Mean Square

RT: MIL-STD-1553 Remote Terminal

SDU: Service Data Unit

TBD: To Be Defined / To Be Determined

TDD: Target Detection Device

UART: Universal Asynchronous Receiver/Transmitter

UB: Upper Byte

2.5 Nomenclature

Byte: One byte comprises eight bits. Where bytes are mentioned in this document, it always refers to 8 bits of data. A byte may represent data or a control code associated with communications protocol.

Command: A message by the weapon to the fuzing system.

Data Frame: A data frame of the Fuzing System Serial Data Interface comprises a message preceded by a Start Flag and terminated by an End Flag. A data frame of the Post Release Environment Sensor Serial Data Interface comprises a synchronizing flag followed by a message.

Message: A message on the Fuzing System Serial Data Interface comprises a number of complete PDUs including an address byte, a control byte and any data as applicable. A message may be a command or a response. A message on the Post Release Environment Sensor Serial Data Interface comprises a set of message data bytes.

Protocol Data Unit: A Protocol Data Unit (PDU) is the smallest communications component that can be transmitted and comprises a Start Bit, one byte (8 bits) of data, a Parity Bit and an End Bit.

Response:	A message by the fuzing system to the weapon.
Service Data Unit:	A Service Data Unit (SDU) is one byte of information to be transferred. The information may represent any data associated with communications protocol.
Word:	One word comprises two bytes. Where words are mentioned in this document, this refers to 2 bytes (16 bits) of data.

For this standard, the following connotations apply to all data transmitted over the serial data interfaces:

ASCII:	ASCII characters are marked with quotes. Multiple ASCII characters may be combined into a single set of quotation marks. It is assumed that each ASCII character is transmitted as a single byte. Examples: "M", "RI"
Binary:	Binary data is divided into 8 bit sections, followed by the character "b" in lower case, and either marked by rectangular brackets or boxes. It is noted MSB first. Example:[01111111b] [10011011b] or 01111111b 10011011b
Decimal:	Decimal data is shown with no additional markings.
Hexadecimal:	Hexadecimal data is shown as 2 characters, followed by the character "h" in lower case, and either marked by rectangular brackets or boxes. Example:[7Dh] [5Eh] or 7Dh 5Eh
Transmitted Data:	Data transmitted as part of an example sequence is marked by boxes; brackets for binary and hexadecimal data are omitted for ease of reading. Boxes are also applied around textual comments intended to illustrate the use of a particular data feature, e.g., Start/Stop Flags. Example: Start Flag : 20h : "q" : <requested data> : End Flag
Unspecified Contents:	Triangular brackets mark unspecified contents, e.g., where a weapon command contains the data that is not specified in the text or example. Example: <data> denotes the mission data in an "M" command
Bit numbering:	MIL-STD-1760 word data uses the notation -00- for MSB, -15- for LSB. To avoid misinterpretation, where this document refers to a single bit in a word or byte it will use the following terminology: "B7" (MSB), "B6", ..., "B0" (LSB) will be used to describe TIA-422 and TIA-485 numbered bits, and "-00-", ..., "-15-" will be used for any MIL-STD-1760 numbered bits. For details see 4.3.2.1.1.

3. GENERAL INFORMATION

This section provides a general overview of the interface between the fuzing system, external fuzing system components, and the weapon with the requirements described in Section 4 of this standard.

3.1 General Interface Information

This standard defines the requirements for both sides of the interface with one side being the fuzing system main housing and the other the weapon and the fuzing system's external components. The physical interface defined in this standard is at the connector to the fuzing system main housing. The interface functionality defined includes serial communications, power sources, discrete signals and reference lines between the fuzing system main housing and the weapon and external component(s) at the interface.

3.1.1 Functional Interface Classes

The fuzing system main housing and the weapon and fuzing system external component(s) interface functionality is divided into three classes, Class 1, Class 2 and Class 3, with each subsequent class adding more functionality (i.e., capability) across the interface.

A Class 1 interface defines the electrical signals and data content between the fuzing system and the weapon required to permit the weapon to program and read the fuzing system settings and for the fuzing system to independently sense sufficient information to enable it to be ready for and to detect valid and intentional release of the weapon from the aircraft.

A Class 2 interface comprises a Class 1 interface with the addition of a standardized connector interface between the fuzing system main housing and the weapon. A Class 2 interface also provides additional interface functionality (i.e., Target Detection Device Signal, Port 3 Power, and Initiation Inhibit).

A Class 3 interface comprises a Class 2 interface with the addition of standard definitions of the interfaces between the fuzing system main housing and the weapon's Post Release Environment Sensor. Fuzing systems conforming to the Class 3 functional interface specification provide for an analog signal and/or digital communication directly from that weapon's post release environment sensor to the fuzing system main housing through the discrete connection Post Release Environment Sensor Signal and the Post Release Environment Sensor Serial Data Interface. Thus this interface specification in combination with AS5680A facilitates the exchange of the fuzing system main housing. The application of the functional interface Class 3 is limited to free fall weapons with field installable fuzes.

For the Class 3 interface further subclasses are defined. These subclasses are specified by their electrical signal and the digital data at the interface for an external component, i.e., a post release environment sensor of the fuzing system. The definitions for standard Class 3 interface subclasses are shown in 3.1.2.3.1.

3.1.2 Interface Connections

Figure 1 through Figure 3 show the interface connections and the direction of signaling and power supply for a Class 1, Class 2, and Class 3 interface, respectively.

In Figure 1 through Figure 3, "Weapon Side of Interface" refers to the exterior portion of the fuzing system connector to which the weapon and the fuzing system's external components connect. The "Fuzing System Main Housing Side of Interface" refers to the interior portion of the connector to which the fuzing system main housing connects.

Sections 4.1 and 4.2 provide detailed requirements for the weapon and the fuzing system respectively.

Section 4.5 defines when these signals and power supplies are available at the interface, prior to, during, and after weapon release.

3.1.2.1 Class 1 Interface

Figure 1 shows the interface connections and the direction of signaling and power supply for a Class 1 functional interface.

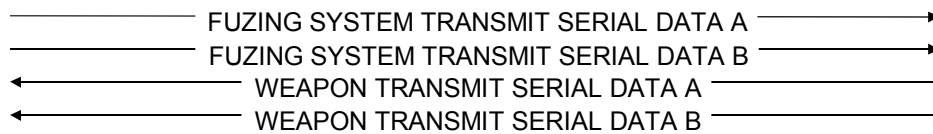
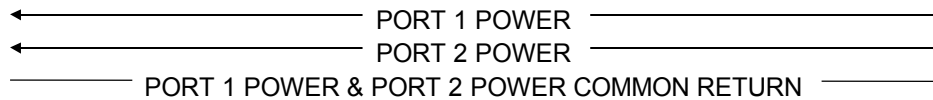
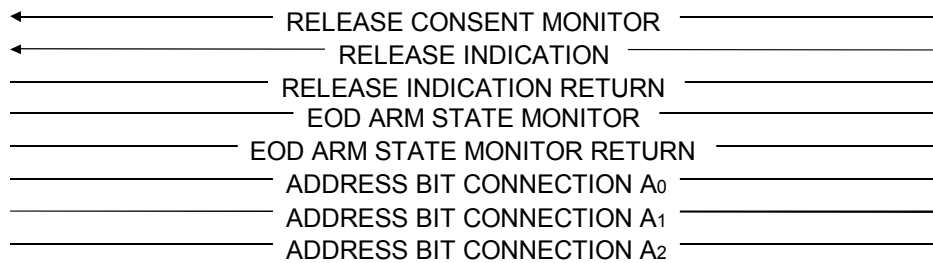
**FUZING SYSTEM MAIN HOUSING
SIDE OF INTERFACE****WEAPON SIDE
OF INTERFACE****SERIAL DATA LINES****POWER****DISCRETE SIGNALS****REFERENCE LINES**

FIGURE 1 - CLASS 1 FUZING SYSTEM INTERFACE CONNECTIONS AND
DIRECTION OF SIGNAL FLOW

3.1.2.2 Class 2 Interface and Contact Allocations

Figure 2 shows the interface connections and the direction of signaling and power supply for a Class 2 functional interface.

The contact layout of the contacts for Class 2 defined in Table 1 is specified in AS5680.

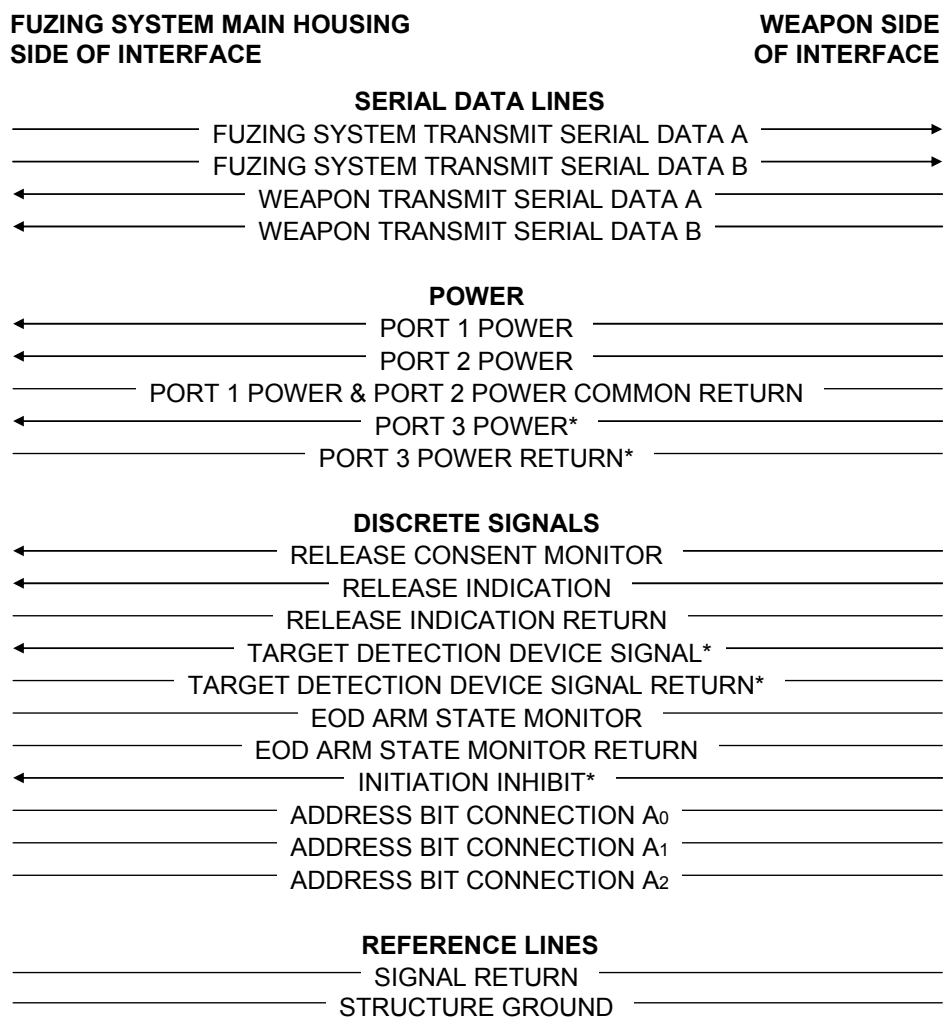


FIGURE 2 - CLASS 2 FUZZING SYSTEM INTERFACE CONNECTIONS AND DIRECTION OF SIGNAL FLOW

NOTE: A single asterisk "*" annotates connections added to a Class 1 interface as defined in Figure 1.

TABLE 1 - CLASS 2 INTERFACE CONNECTOR CONTACT ALLOCATION

Contact	Interface Functionality
1	Port 3 Power Return
2	Port 3 Power
3	Port 1 Power and Port 2 Power Common Return
4	Release Indication
5	Release Indication Return
6	Structure Ground
7	Reserved
8	Reserved
9	Signal Return
10	Release Consent Monitor
11	Guard Pin
12	Port 1 Power
13	Guard Pin
14	Weapon Transmit Serial Data A
15	Weapon Transmit Serial Data B
16	Fuzing System Transmit Serial Data B
17	Fuzing System Transmit Serial Data A
18	Port 2 Power
19	Initiation Inhibit

Contact	Interface Functionality
20	Guard Pin
21	Guard Pin
22	Address Bit Connection A0
23	Address Bit Connection A1
24	Address Bit Connection A2
25	Guard Pin
26	Guard Pin
27	Guard Pin
28	Reserved
29	Reserved
30	Guard Pin
31	Guard Pin
32	Target Detection Device Signal Return
33	Target Detection Device Signal
34	Guard Pin
35	Reserved
36	EOD Arm State Monitor Return
37	EOD Arm State Monitor

3.1.2.3 Class 3 Interface and Contact Allocations

Figure 3 shows the interface connections and the direction of signaling and power supply for a Class 3 functional interface.

The contact layout of the contacts for Class 3 defined in Table 2 is specified in AS5680.

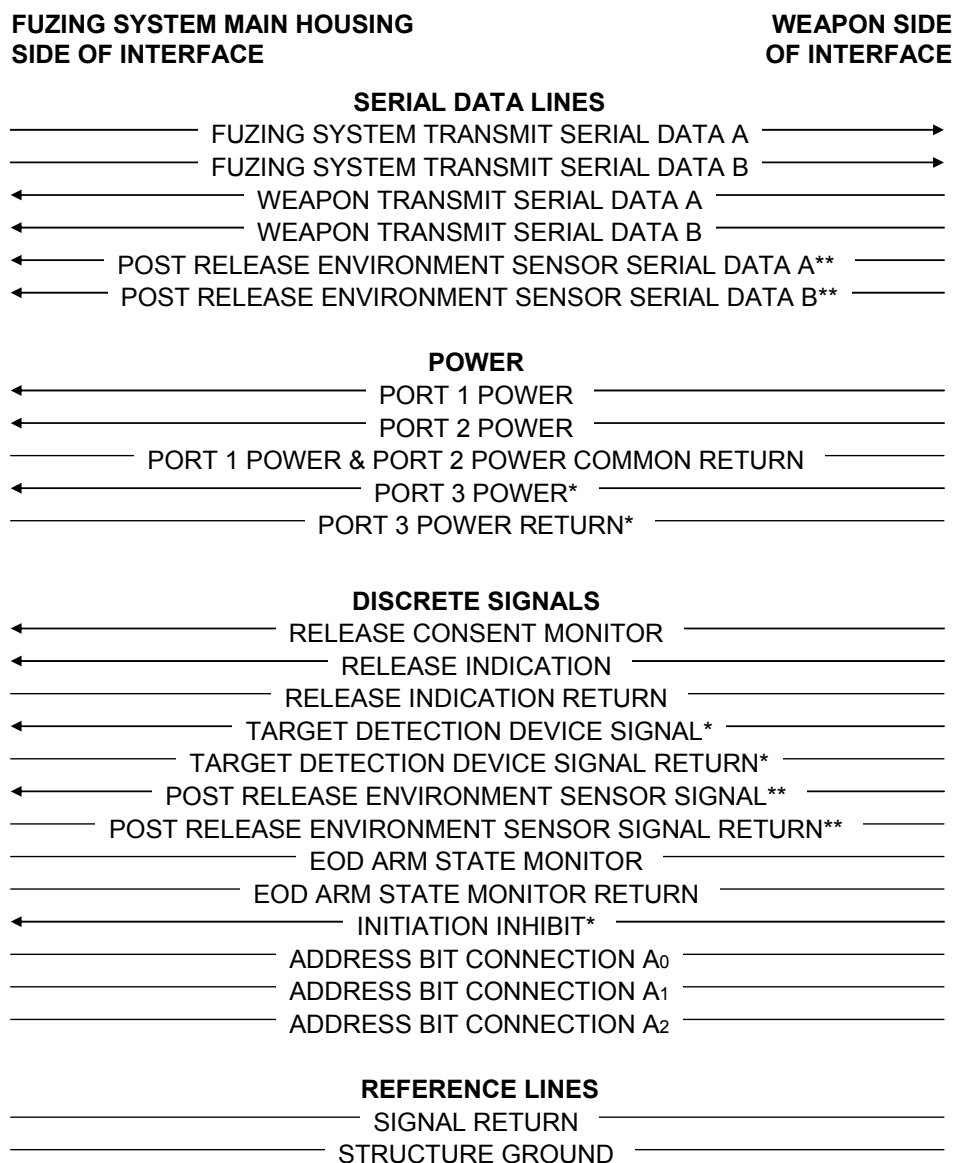


**FIGURE 3 - CLASS 3 FUZING SYSTEM INTERFACE CONNECTIONS AND
DIRECTION OF SIGNAL FLOW**

NOTE: A single asterisk "*" annotates connections added to a Class 1 interface as specified in Figure 1 and two asterisks "**" annotates connections added to a Class 2 interface as specified in Figure 2.

TABLE 2 - CLASS 3 INTERFACE CONNECTOR CONTACT ALLOCATION

Contact	Interface Functionality	Contact	Interface Functionality
1	Port 3 Power Return	20	Guard Pin
2	Port 3 Power	21	Guard Pin
3	Port 1 Power and Port 2 Power Common Return	22	Address Bit Connection A0
4	Release Indication	23	Address Bit Connection A1
5	Release Indication Return	24	Address Bit Connection A2
6	Structure Ground	25	Guard Pin
7	Post Release Environment Sensor Signal	26	Guard Pin
8	Post Release Environment Sensor Signal Return	27	Guard Pin
9	Signal Return	28	Post Release Environment Sensor Serial Data A
10	Release Consent Monitor	29	Reserved
11	Guard Pin	30	Guard Pin
12	Port 1 Power	31	Guard Pin
13	Guard Pin	32	Target Detection Device Signal Return
14	Weapon Transmit Serial Data A	33	Target Detection Device Signal
15	Weapon Transmit Serial Data B	34	Guard Pin
16	Fuzing System Transmit Serial Data B	35	Post Release Environment Sensor Serial Data B
17	Fuzing System Transmit Serial Data A	36	EOD Arm State Monitor Return
18	Port 2 Power	37	EOD Arm State Monitor
19	Initiation Inhibit		

3.1.2.3.1 Class 3 Functional Interface Subclasses

The Class 3 interface is defined for fuzing systems so that compliant fuzing system main housings can be interchanged in the field.

Class 3 type A subclasses, i.e., subclasses starting with designation “A”, employ the analog Post Release Environment Sensor Signal contacts (see 3.4.6) to provide defined signals when the expected post release environment is detected. Class 3 type AD subclasses, i.e., subclasses starting with designations “AD”, provide analog signals with the addition of a digital signal informing the fuze about the post release environment sensor subclass and environment data (see 3.2.2). Class 3 type D subclasses are for fuzing systems that use information only in a digital format.

At this issue, four Class 3 interface subclasses, A1, AD1, D1, and D2, are defined, see Table 3. A1, AD1, and D1 allow for the use of air speed sensing post release environment sensors (PRASS) with a fuzing system. D2 allows for the use of two state digital post release environment sensors with a fuzing system.

TABLE 3 - DEFINITION OF CLASS 3 SUBCLASSES

Subclass Type	Subclass Designation	Analog PRES Signal required	Digital PRES Interface required	Description
A	A1	yes	no	Analog PRASS Digital data may be present but is not required.
AD	AD1	yes	yes	PRASS with both analog and serial data interface
D	D1	no	yes	PRASS with serial data interface only
D	D2	no	yes	Two state post release environment sensor

For details of each subclass see 4.1.4.6 and 4.2.4.6 for the analog signal and 4.4 for the digital signal.

NOTE: Later editions of the standard, or slash sheet increments, are anticipated to provide additional subclass definitions and information on fuzing systems interchangeability.

3.2 Digital Communication

The interface provides separate digital serial data communication interfaces between the fuzing system, its external components, and the weapon.

The Fuzing System Serial Data Interface is for general communications between the fuzing system and weapon (e.g., loading data such as arm time, function delay times). This serial data interface connects the fuzing system main housing and the weapon and is available for all classes of interfaces.

The Post Release Environment Sensor Serial Data Interface is for communication between the fuzing system main housing and a post release environment sensor.

3.2.1 Fuzing System Serial Data Interface

The Fuzing System Serial Data Interface is a four-wire TIA-485 compliant interface. It provides two connections (Weapon Transmit Serial Data A and Weapon Transmit Serial Data B) for a TIA-485 data bus communications channel between the weapon and the fuzing system and two connections (Fuzing System Transmit Serial Data A and Fuzing System Transmit Serial Data B) for a TIA-485 data bus communications channel between the fuzing system and the weapon.

NOTE: The TIA-485 data bus specifies only the electrical characteristics of the driver and the receiver. It does not specify any data protocol.

The requirements for the Fuzing System Serial Data Interface are defined in 4.1.2.1 and 4.2.2.1.

The Fuzing System Serial Data Interface transfers data to and from the weapon using a common logical data protocol. This protocol includes an address capability for use in future systems employing multiple fuzing systems and/or target detection devices. Detailed requirements for the Fuzing System Serial Data Interface protocol are contained in 4.3.

3.2.2 Post Release Environment Sensor Serial Data Interface

The Post Release Environment Sensor Serial Data Interface is a 2-wire TIA-422-B interface. It provides two connections (Post Release Environment Sensor Serial Data A and Post Release Environment Sensor Serial Data B) for data bus communications between the post release environment sensor and the fuzing system.

NOTE: The TIA-422-B data bus specifies only the electrical characteristics of the driver and the receiver. It does not specify any data protocol.

The requirements for the Post Release Environment Sensor Serial Data Interface are defined in 4.1.2.2, 4.2.2.2, and 4.4.

3.3 Power Requirements

3.3.1 Port 1 Power, Port 2 Power and Port 3 Power and Returns

The interface provides connections for three separate power sources. These consist of Port 1 Power, Port 2 Power and Port 3 Power. Port 1 Power and Port 2 Power both use the Port 1 Power and Port 2 Power Common Return. Port 3 Power uses the Port 3 Power Return.

Class 1 interfaces provide connections for Port 1 Power, Port 2 Power and the Port 1 Power and Port 2 Power Common Return only.

The intended use for Port 1 Power is to support fuzing system and weapon interface functionality (e.g., serial communication) during Carriage and Release Preparation (see 4.5.2 and 4.5.3), prior to the availability of Port 2 Power.

The intended use for Port 2 Power is to support fuzing system and weapon interface functionality (e.g., serial communication, monitoring of discrete signals) during Release Preparation (see 4.5.3) and Release & Free Flight (see 4.5.4).

Class 2 and Class 3 interfaces provide connections for Port 3 Power in addition to the Class 1 interfaces.

The intended use for Port 3 Power is to support fuzing system functionality (e.g., post release functions including arming and firing) during Release & Free Flight (see 4.5.4).

Detailed power requirements for the weapon are contained in 4.1.3 and in 4.2.3 for the fuzing system. Section 4.5 defines requirements as to when the weapon makes the power sources available to the fuzing system.

NOTE: Power supply requirements for a weapon specific post release environment sensor are outside the scope of this interface standard.

3.4 Discrete Signal Requirements

The interface provides connections for Release Consent Monitor, Release Indication, Explosive Ordnance Disposal (EOD) Arm State Monitor, Initiation Inhibit, Target Detection Device Signal, Post Release Environment Sensor Signal, and Address Bit Discretes connections. Detailed requirements are contained in 4.1.4 for the weapon and in 4.2.4 for the fuzing system. Section 4.5 defines requirements on the provision and use of these signals.

3.4.1 Release Consent Monitor

The interface provides one connection, with the Port 1 Power and Port 2 Power Common Return (see 3.3.1) serving as a return, for a Release Consent Monitor signal. The Release Consent Monitor provides an indication to the fuzing system of the status of the Release Consent signal at the aircraft-store interface (see MIL-STD-1760). Detailed requirements are contained in 4.1.4 for the weapon and in 4.2.4 for the fuzing system. Section 4.5 describes the application of the Release Consent Monitor signal to the fuze.

3.4.2 Release Indication

The interface provides two connections, Release Indication and Release Indication Return. The method used involves routing a current through the fuzing system. The transition from current being detected to no current being detected provides an indication to the fuzing system that the weapon has begun to separate from the aircraft. Detailed requirements are contained in 4.1.4 for the weapon and in 4.2.4 for the fuzing system. Section 4.5 provides more requirements on the usage of Release Indication.

3.4.3 EOD Arm State Monitor and Return

The interface provides two connections for an EOD Arm State Monitor, with one serving as a return. The EOD Arm State Monitor and the EOD Arm State Monitor Return are provided at the interface to enable EOD and factory personnel to monitor the type of fuzing system (in-line or out-of-line) and to establish its safe and armed state. With the fuzing system installed in the weapon, this capability may only be available if the weapon provides external access to the two connections.

Detailed requirements are contained in 4.1.4 for the weapon and in 4.2.4 for the fuzing system.

3.4.4 Initiation Inhibit

Class 2 interfaces provide a single contact that may be used to inhibit the initiation of the fuzing system. The return for this signal is the Signal Return. When the fuzing system provides this capability, the fuzing system immediately inhibits firing whenever the signal is applied. Detailed requirements are contained in 4.1.4 for the weapon and in 4.2.4 for the fuzing system.

3.4.5 Target Detection Device Signal and Return

Class 2 interfaces provide a differential signal pair that may be used to signal the presence of a target to the fuzing system. When applied and enabled by the mission data and by the status of the fuzing system, the fuzing system starts initiation of the payload. Detailed requirements are contained in 4.1.4 for the weapon and in 4.2.4 for the fuzing system.

3.4.6 Post Release Environment Sensor Signal and Return

Class 3 interfaces provide two connections, Post Release Environment Sensor Signal and Post Release Environment Sensor Signal Return. They provide the analog signal of a post release environment sensor to the fuzing system.

Detailed requirements, including those for the functional interface subclasses are contained in 4.1.4 and 4.2.4.

3.4.7 Address Bit Discretes

The interface provides three Address Bit connections, A_0 , A_1 , and A_2 , to assign the fuzing system's physical address. Detailed requirements are contained in 4.1.4 for the weapon and in 4.2.4 for the fuzing system.

3.5 Reference Lines

3.5.1 Signal Return

The interface provides one connection to be used as a return for the Address Bit connections, as signal common for the Fuzing System Serial Data Interface (see 3.2.1) and for other connections requiring a return. Detailed requirements are contained in 4.1.5 for the weapon and in 4.2.5 for the fuzing system.

3.5.2 Structure Ground

The interface provides a single connection to be used as a Structure Ground. This connection provides a low resistance conductive path between the fuzing system structure and the weapon structure. Detailed requirements are contained in 4.1.5 for the weapon and 4.2.5 for the fuzing system.

3.6 Sequence of Operations

This standard defines three different phases of weapon operations of the interface. These are Carriage phase, Release Preparation phase, and Release & Free Flight phase. They are specified in detail in 4.5.

The Carriage phase is the phase of operation during which the fuzing system is installed in the weapon, up to the initiation of the release process. The operations defined for this phase may also be applicable to ground operations of weapons prior to being fitted to the aircraft.

The Release Preparation phase starts with the end of Carriage phase and includes all of the interface operations necessary to prepare weapon and fuzing system for release.

The Release & Free Flight phase starts with the end of Release Preparation phase and includes all of the interface operations during actual release and subsequent free flight of the weapon.

Section 4.5 contains detailed requirements of the interface for the weapon and the fuzing system on the sequence of operation and timing.

4. DETAILED REQUIREMENTS

This section contains the detailed interface requirements placed on the weapon and the fuzing system.

4.1 Detailed Requirements on the Weapon

This section describes requirements on elements of the weapon that reside on the weapon side of the fuzing system main housing connector.

NOTE: This section includes requirements related to components of a distributed fuzing system that are not part of a fuzing system main housing, e.g., external sensors, and that may be installed permanently in the weapon.

4.1.1 Connector Type, Contact Identification, and Interface Functionality

4.1.1.1 Class 1 Connector Type and Contact Locations

For a Class 1 interface a standard weapon interface connector is not specified.

4.1.1.2 Class 2 and Class 3 Connector Type and Contact Locations

The allocation of functions to specific connector contacts is defined in this standard. The definition of the connector for Class 2 and Class 3 is contained in AS5680A.

4.1.2 Requirements for Digital Communication

4.1.2.1 Fuzing System Serial Data Interface

The weapon supplies a four-wire TIA-485 compliant interface on the Fuzing System Serial Data Interface.

The weapon shall provide two TIA-485 transmitter contacts: One contact Weapon Transmit Serial Data A, whose electrical characteristics meet the TIA-485 signal "A" (inverting) characteristics, and one contact Weapon Transmit Serial Data B, whose electrical characteristics meet the TIA-485 signal "B" (non-inverting) characteristics. This differential signal pair shall use the Signal Return contact (see 4.1.5.1) as a ground reference for voltage excursion reference purposes.

The weapon shall provide two TIA-485 receiver contacts: One contact Fuzing System Transmit Serial Data A, whose electrical characteristics meet the TIA-485 signal "A" (inverting) characteristics, and one contact Fuzing System Transmit Serial Data B, whose electrical characteristics meet the TIA-485 signal "B" (non-inverting) characteristics. This differential signal pair shall use the Signal Return contact (see 4.1.5.1) as a ground reference for voltage excursion reference purposes.

The Fuzing System Serial Data Interface communications shall operate in a half-duplex mode. The communications data rate shall be 115 200 bits per second $\pm 2\%$ using the protocol specified in 4.3.

4.1.2.2 Post Release Environment Sensor Serial Data Interface

External post release environment sensors conforming to the functional interface Class 3 subclass types AD and/or D utilize the Post Release Environment Sensor Serial Data Interface for identification and data transmission purposes.

The weapon supplies a two-wire TIA-422-B compliant interface on the Post Release Environment Sensor Serial Data Interface.

The weapon shall provide two TIA-422-B transmitter contacts: One contact Post Release Environment Sensor Serial Data A, whose electrical characteristics conform to the TIA-422-B specifications for inverting signals, and one contact Post Release Environment Sensor Serial Data B, whose electrical characteristics meet the TIA-422-B specifications for non-inverting signals. The Post Release Environment Sensor Signal Return contact specified in 4.1.4.6 shall act as a ground reference for voltage excursion reference purposes for this differential signal pair.

The Post Release Environment Sensor Serial Data Interface shall operate in simplex mode. The communications data rate shall be 38 400 bits per second $\pm 2\%$, using the protocol specified in 4.4.

Post release environment sensors that do not support the Post Release Environment Sensor Serial Data Interface shall connect together the Post Release Environment Sensor Serial Data pair.

4.1.3 Power Requirements

4.1.3.1 Port 1 Power

The weapon shall provide a Port 1 Power contact and a Port 1 Power and Port 2 Power Common Return contact as the return line.

4.1.3.1.1 Power Application

Prior to the start of the release sequence, Port 1 Power may be applied at any time in accordance with 4.5.2.

After an intentional power removal the weapon shall wait at least 60 ms before applying Port 1 Power again.

4.1.3.1.2 Voltage Level

The normal steady state voltage limits between the Port 1 Power contact and the Port 1 Power and Port 2 Power Common Return contact shall be a minimum of 7 V dc ($V_{\min}$ in Figure 4) and a maximum of 12 V dc ($V_{\max}$ in Figure 4) at any current up to the maximum current load of Figure 5.

When the weapon does not supply Port 1 Power, the voltage between the Port 1 Power contact and the Port 1 Power and Port 2 Power Common Return contact shall not exceed 0.1 V dc (V_{off} in Figure 4).

4.1.3.1.3 Voltage Stabilization Time

The stabilization times for Port 1 Power (see Figure 4) shall not exceed 10 ms. Voltages during the stabilization periods shall not exceed 15 V dc.

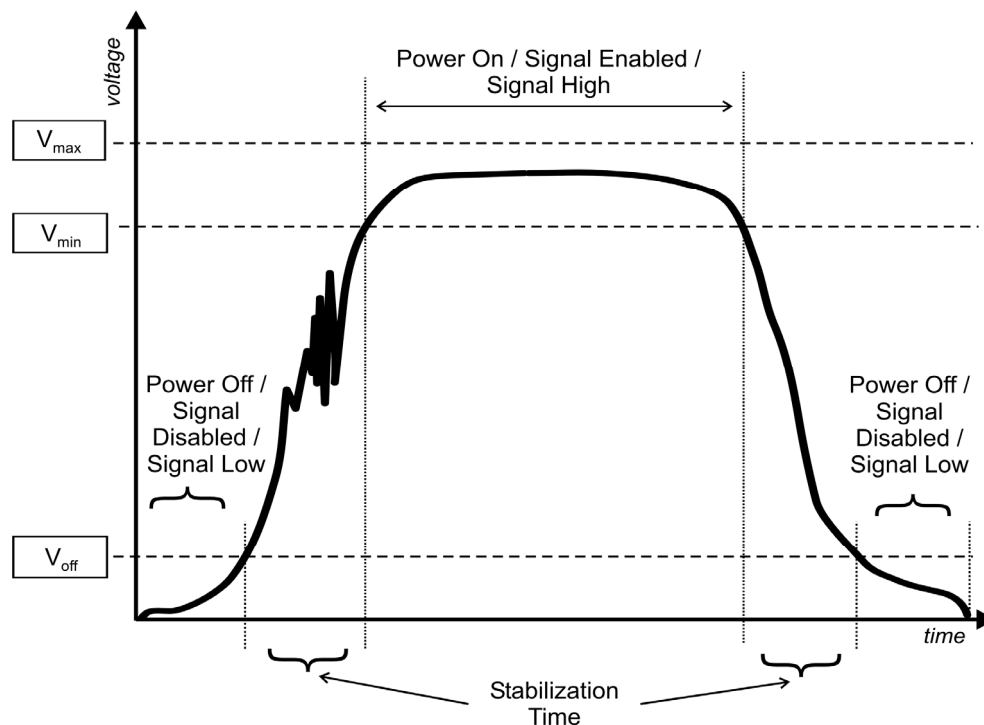


FIGURE 4 - POWER STABILIZATION REQUIREMENTS

4.1.3.1.4 Current Capacity

Port 1 Power shall be capable of sourcing the maximum current load level of Figure 5.

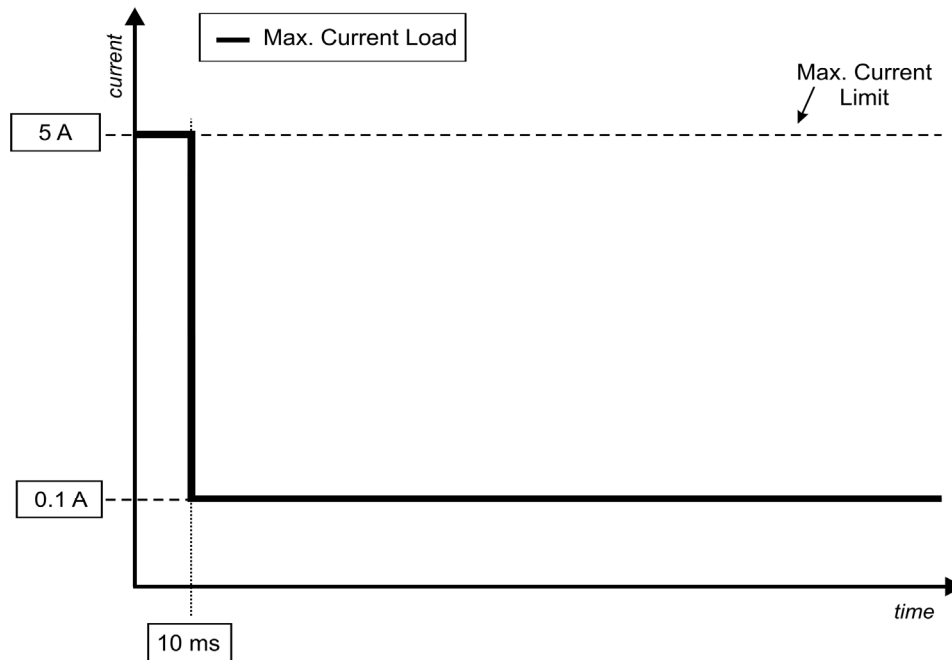


FIGURE 5 - PORT 1 POWER CURRENT LIMITS

NOTE: The origin of the time line depicted in Figure 5 coincides with the moment of achievement of $V_{\min}$ as per 4.1.3.1.2.

4.1.3.1.5 Overcurrent Protection

The weapon shall ensure that the current never exceeds the maximum current limit of Figure 5. This power may be removed to achieve this current limit operation.

4.1.3.1.6 Off-state Leakage Current

The weapon shall ensure that the off-state leakage current never exceeds 1.0 mA.

4.1.3.1.7 Power Drop-Out

After any recognized drop of the voltage below the minimum voltage defined in 4.1.3.1.2 the weapon may request the fuzing system status as detailed in 4.3.

4.1.3.2 Port 2 Power

The weapon shall provide a Port 2 Power contact and use the Port 1 Power and Port 2 Power Common Return contact as the return.

4.1.3.2.1 Power Application

Port 2 Power shall only be applied following a valid Commit-To-Separate-Store-or-Submunition (CTS) from the aircraft and shall be stabilized prior to Fuze Release Imminent (FRI, see 4.3.3.2.1 and 4.5). Once applied, this power shall be continuously applied until the end of mission or until the mission is aborted according to 4.5.5.3.