SAE Aerospace
An SAE International Group

AEROSPACE STANDARD

SAE AS5716

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Standard Electrical and Logical Interface for Airborne Fuzing Systems

RATIONALE

The Society for Automotive Engineers (SAE), AS-1 Technical Committee Aircraft Systems and System Integration, formed SAE AS-1B6, Fuze Systems Task Group, to generate an Aerospace Standard (AS) to support interoperability and interchangeability of airborne weapons and their fuzing systems. This effort was initiated in response to a request made to the SAE AS-1 Technical Committee by the North Atlantic Treaty Organization (NATO) Air Armament Panel for AS-1 to undertake a study or series of studies related to airborne weapons fuzing system standardization.

This standard addresses weapons using MIL-STD-1760, aircraft to weapon interfaces as this is the interface generally employed for all modern airborne weapons of NATO countries.

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 fuzes, 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 revision of the standard will enable interoperability of MIL-STD-1760 compliant airborne weapons insofar as fuzing system operation is concerned (Class 1 interface). Future revisions of this standard will enable the interchangeability of field-installable fuzing systems. Class 2 will provide for whole fuzing systems (including all its external components) to be interchangeable. Class 3 will provide for components within fuzing systems to be interchangeable.

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 interfaces such as fuzing system wells, mechanical safety linkages and fuzing system associated components in order to achieve airborne fuzing systems interoperability.

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 AS5680.

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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 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, for Class 1 interfaces. Future issues of the standard will provide for additional fuzing system related functionality defined as Class 2 and Class 3 interfaces. For future issues of this standard, the connector definition is contained in AS5680.

This standard does not impose any safety requirements and does not supersede or replace any existing applicable safety standards.

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, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Telephone: 877-606-7323 (inside USA and Canada) or 724-776-4970 (outside USA), Web address: http://www.sae.org

AS5680 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 US 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, http://assist.daps.dla.mil/quicksearch/

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

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

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

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

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

2.1.4 TIA Publications

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

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

2.1.5 ISO Publications

Available from American National Standards Institute, 25 West 43rd Street, New York, NY 10036-8002, Tel: 212-642-4900, 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, 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 SI 10-1997	American National Standard for Use of the International System of Units (SI): The Modern Metric 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

2.2 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]

CLASS 1 INTERFACE: An interface between the weapon and the fuzing system that allows the interchangeability of MIL-STD-1760 compliant weapons.

CLASS 2 INTERFACE: An interface between the weapon and the fuzing system that allows the interchangeability of (compliant) fuzing systems installed in MIL-STD-1760 compliant weapons.

CLASS 3 INTERFACE: An interface between the weapon and the fuzing system that allows the interchangeability of fuzing system components within (compliant) fuzing systems installed in MIL-STD-1760 compliant weapons.

COMMIT TO SEPARATE STORE OR SUBMUNITION: 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: 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 devices, 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 all 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 signaled to the fuzing system, which in turn initiates 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.

2.3 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 Bit

LSB: Least Significant Bit

MSB: Most Significant Bit

MSI: Mission Store Interface

PDU: Protocol Data Unit

PRES: Post Release Environment Sensor

RC: Release Consent

RCM: Release Consent Monitor

RF: Radio Frequency

RI: Release Indication

RT: MIL-STD-1553 Remote Terminal

SDU: Service Data Unit

TDD: Target Detection Device

UB: Upper Bit

2.4 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 comprises a message preceded by a Start Flag and an End Flag.

Message: A message 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.

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 bus:

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: “A”, “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 marks 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 “A” or “M” command

3. GENERAL INFORMATION

This section provides a general overview of the interface between the fuzing system, external fuzing system components, and weapon with the requirements being contained 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 3 interface may have further sub classes to assure safety is not compromised. It is expected that sub classes will define specific types and characteristics of weapon safety related external components.

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. The intent of weapons and fuzing systems with Class 1 compliance is to facilitate interoperability and interchangeability of weapons through standardization of the weapon to fuzing system interface for both data interfacing and release detection.

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, Initiation Inhibit). The intent of weapons and fuzing systems with Class 2 compliance is to facilitate interchangeability of fuzing systems between weapons.

A Class 3 interface comprises a Class 2 interface with the addition of standard definitions of interfaces between the fuzing system main housing and its external components such as post release environmental sensors. The intent of Class 3 compliant weapons and fuzing systems is that the fuzing system main housing may be interchangeable with other Class 3 compliant fuzing systems with similar external components (e.g. sensors).

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 portion of the connector internal to the fuzing system main housing.

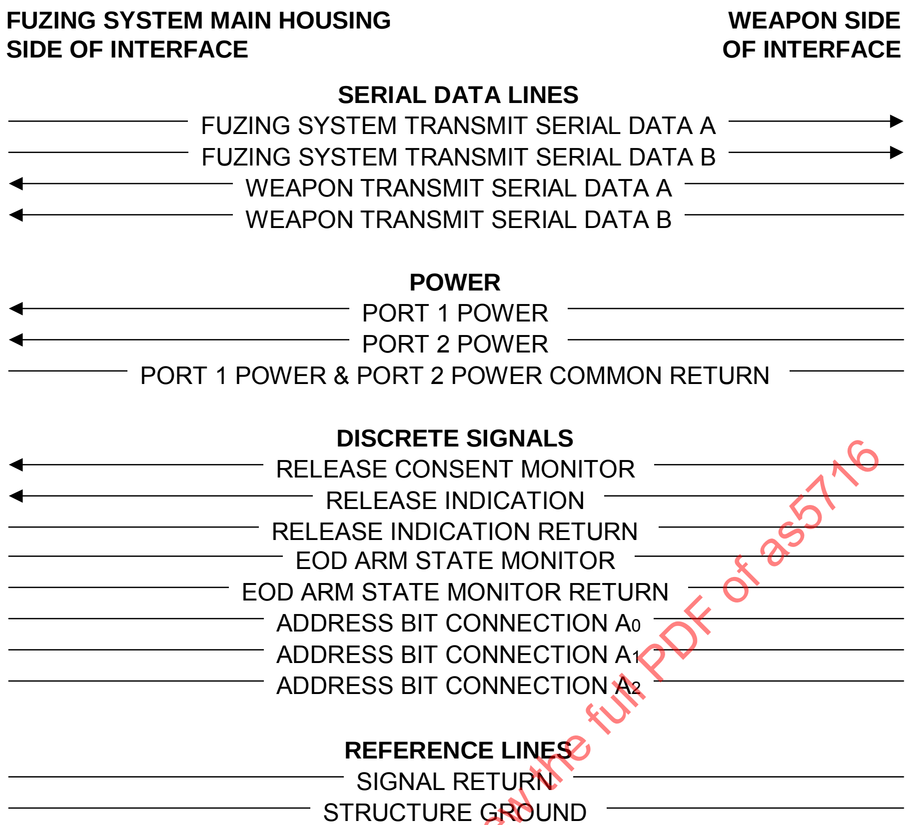

FIGURE 1 - CLASS 1 INTERFACE CONNECTIONS AND DIRECTION OF SIGNAL FLOW

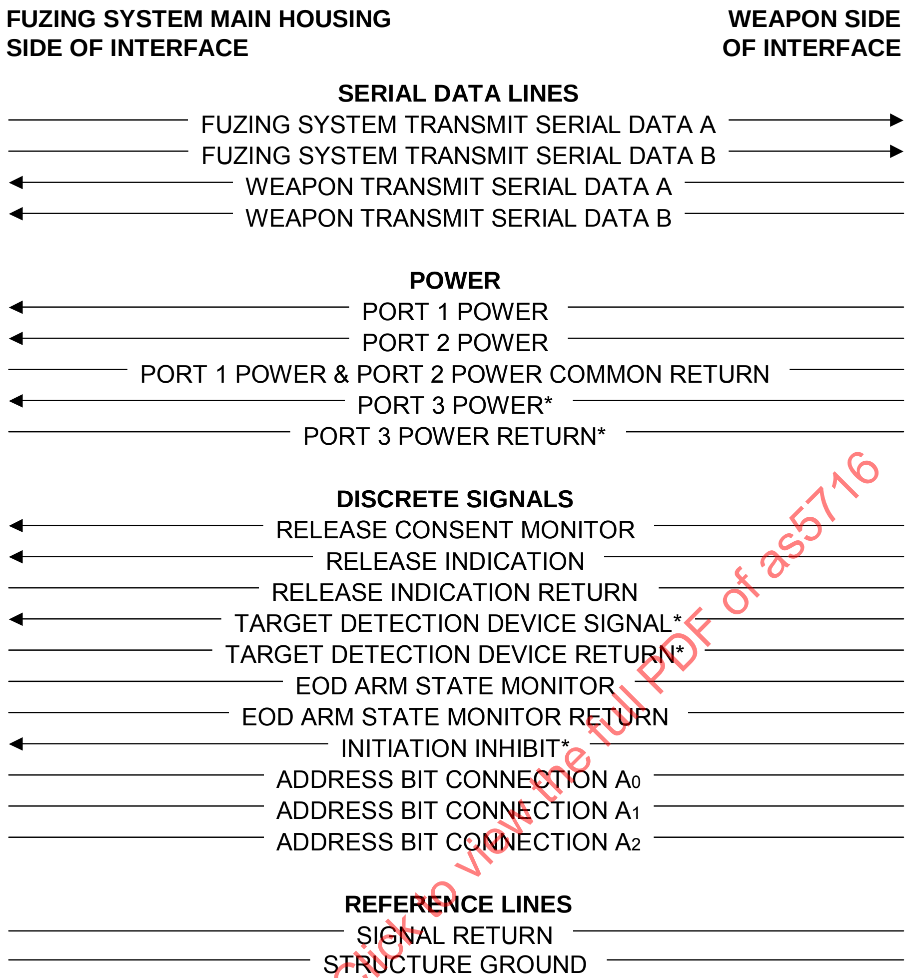

FIGURE 2 - CLASS 2 FUZING SYSTEM INTERFACE CONNECTIONS AND DIRECTION OF SIGNAL FLOW

NOTE: A single asterisk (“*”) annotates connections added to a Class 1 interface as defined in Figure 1.

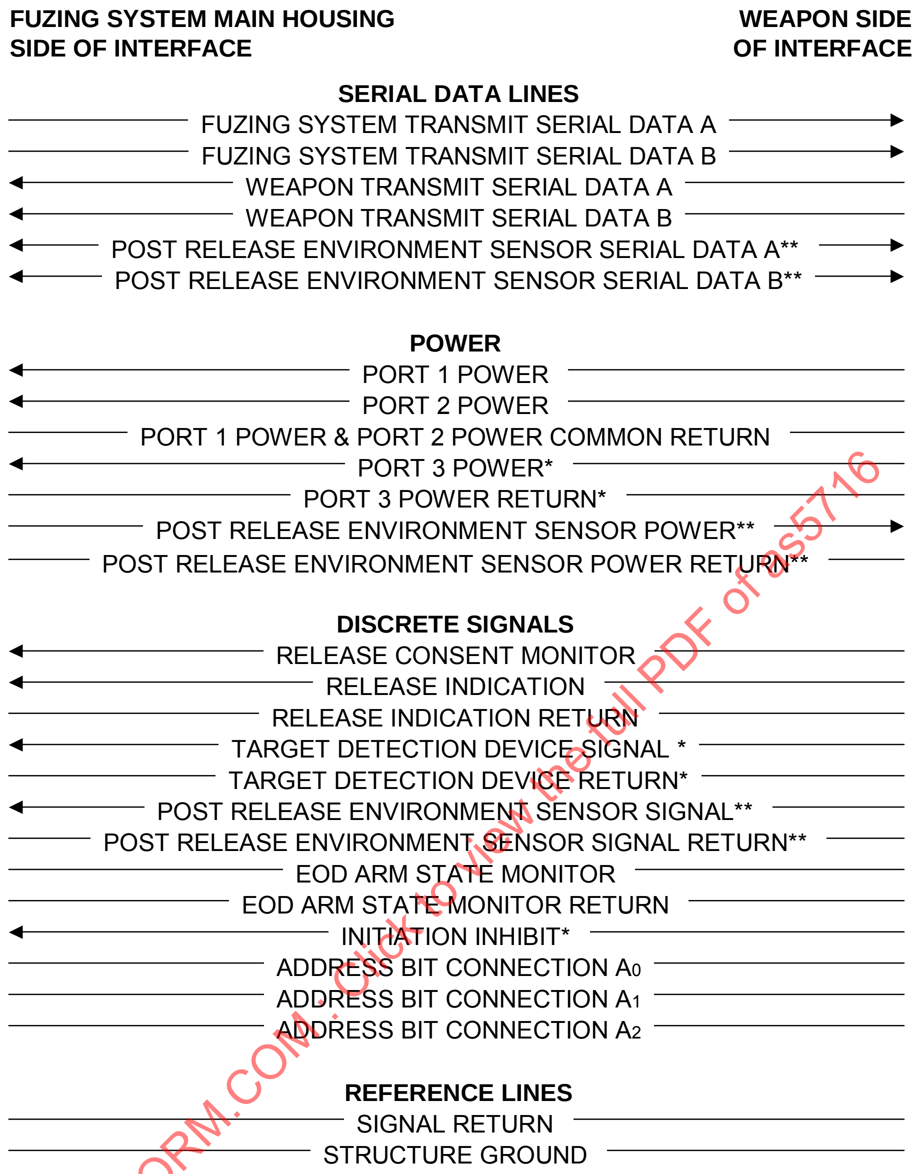

FIGURE 3 - CLASS 3 FUZING SYSTEM INTERFACE CONNECTIONS AND DIRECTION OF SIGNAL FLOW

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.

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

Section 4.6 defines when these signals and power supplies are available at the interface, prior to, during, and after weapon release.

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 Environmental Sensor Serial Data interface is for communication between the fuzing system and its Post Release Environmental Sensor. This serial data interface connects the fuzing system main housing and the Post Release Environmental Sensor and is available for Class 3 interfaces.

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 Fuzing System Serial Data Interface communications operates in half-duplex mode at a data rate of 115 200 baud.

The requirements for the Fuzing System Serial Data Interface are defined in sections 4.1.2 and 4.2.2.

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 section 4.3.

3.2.2 Target Detection Device Serial Data Interface

Not defined in this issue of the standard.

3.2.3 Post Release Environment Sensor Serial Data Interface

Not defined in this issue of the standard.

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 and 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 4.6.2 and 4.6.3), 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 4.6.3) and Release & Free Flight (see 4.6.4).

Detailed power requirements for the weapon are contained in 4.1.3 and 4.2.3 for the fuzing system. Section 4.6 defines requirements as to when the weapon makes the power sources available to the fuzing system.

3.3.2 Post Release Environment Sensor Power and Return

Not defined in this issue of the 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, Post Release Environment Sensor, and Address Bit connections. Detailed requirements are contained in 4.1.4 for the weapon and 4.2.4 for the fuzing system. Section 4.6 defines requirements on the provision and use of these signals.

3.4.1 Release Consent Monitor Signal

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 4.2.4 for the fuzing system. Section 4.6 defines when the weapon makes the Release Consent Monitor signal available across the interface.

3.4.2 Release Indication Signal

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 4.2.4 for the fuzing system. Section 4.6 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 and to establish its arm 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 4.2.4 for the fuzing system.

3.4.4 Initiation Inhibit

Not defined in this issue of the standard.

3.4.5 Target Detection Device Signal and Return

Not defined in this issue of the standard.

3.4.6 Post Release Environment Sensor Signal and Return

Not defined in this issue of the standard.

3.4.7 Address Bit Discretes

The interface provides three Address Bit connections to assign the fuzing system's address. Detailed requirements are contained in 4.1.4 for the weapon and 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 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 4.6.

The Carriage phase of the interface operation 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 4.6 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

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 Connector Type and Contact Locations

The definition of the connector for a Class 2 interface for 3 inch fuzes is defined in AS5680. The allocation of functions to specific connector contacts will be defined in a future issue of this standard.

4.1.1.3 Class 3 Connector Type and Contact Locations

The definition of the connector for a Class 3 interface for 3 inch fuzes is defined in AS5680. The allocation of functions to specific connector contacts will be defined in a future issue of this standard.

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 baud ±3%.

4.1.2.2 Target Detection Device Serial Data Interface

Not defined in this issue of the standard.

4.1.2.3 Post Release Environment Sensor Serial Data Interface

Not defined in this issue of the standard.

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 4.6.2.

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 times shall not exceed 15 V dc.

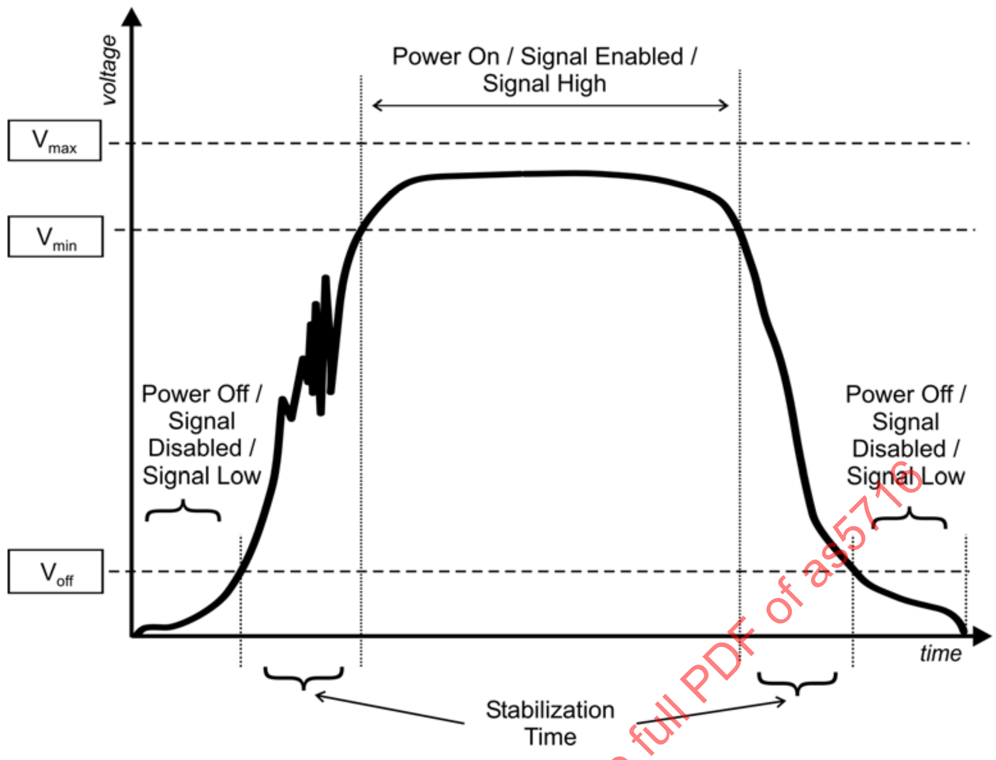

FIGURE 4 - POWER STABILIZATION REQUIREMENTS

4.1.3.1.4 Current Capacity

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

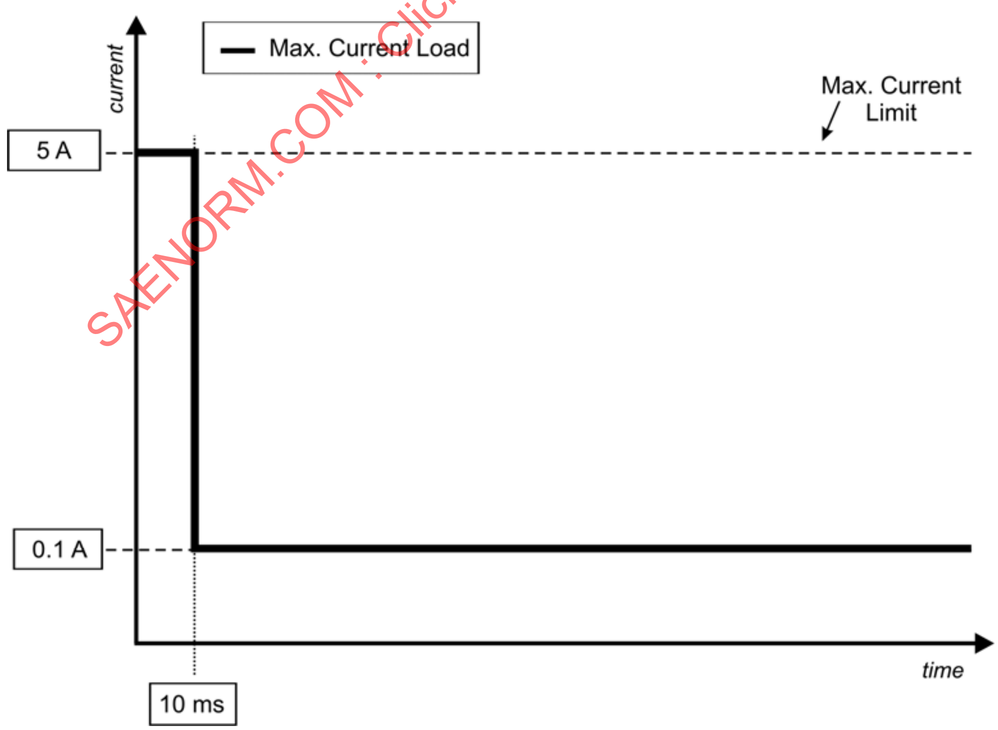

FIGURE 5 - PORT 1 POWER CURRENT LIMITS

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 4.3.3.2.2 and 4.6). Once applied, this power shall be continuously applied until the end of mission or the mission is aborted according to 4.6.5.3.

4.1.3.2.2 Voltage Level

The voltage between the Port 2 Power contact and the Port 1 Power and Port 2 Power Common Return contact shall comply with the 28 V dc 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 fuzing system interface shall be 18.0 V dc (V_{min} in Figure 4) at any current up to full rated load. Voltage transients at the fuzing system interface shall not exceed those defined in MIL-STD-704.

When the weapon does not supply Port 2 Power, the voltage between the Port 2 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).

4.1.3.2.3 Voltage Stabilization Time

The stabilization times for Port 2 Power (see Figure 4) shall not exceed 10 ms. Voltages during the stabilization times shall not exceed 32 V dc.

4.1.3.2.4 Current Capacity

The weapon shall be capable of sourcing the maximum current load shown in Figure 6 and additional pulse currents up to the maximum current limit shown in Figure 6 with a total charge of 250 mA·s in any given 10 second period.

NOTE: A current pulse capability is provided to permit the fuzing system to undertake momentary actions requiring pulse currents in excess of the normal average current. In order to permit different pulse shapes the requirement is expressed as a maximum electrical charge (250 mA·s) per time (10 s). This covers short, high pulses (e.g. 5 A · 50 ms = 250 mA·s) as well as long, low current pulses (e.g. 50 mA · 5 s = 250 mA·s), as long as the total charge does not exceed 250 mA·s (=250 mC) in any given ten second period.

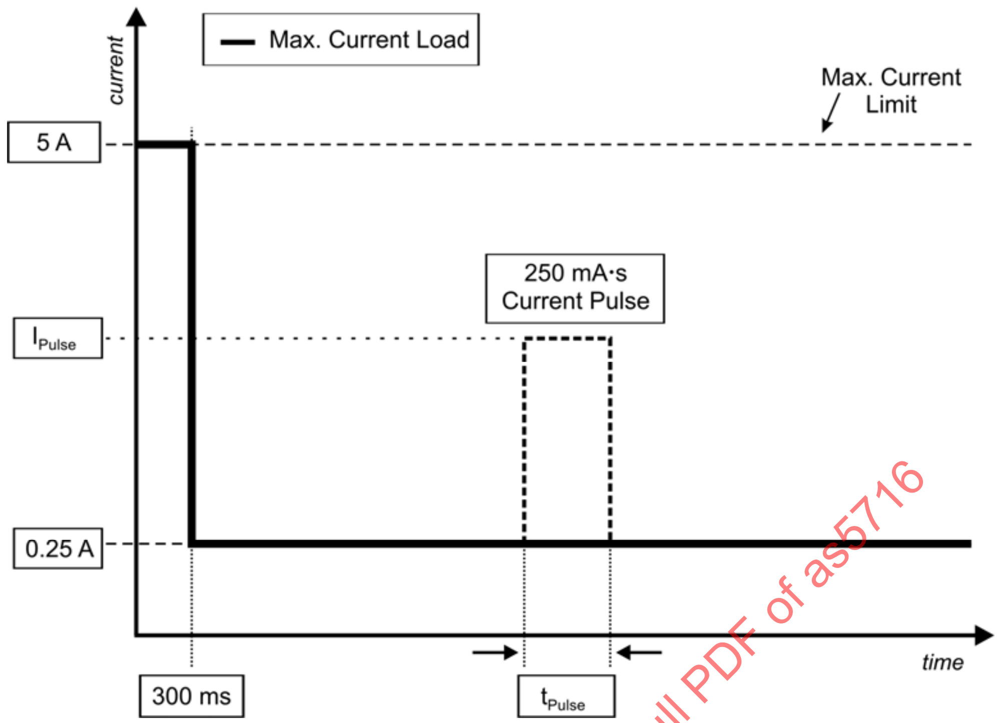

FIGURE 6 - PORT 2 POWER CURRENT LIMITS

4.1.3.2.5 Overcurrent Protection

The weapon shall ensure that the current never exceeds the maximum current limit of Figure 6. This power may be removed to achieve this current limit operation.

4.1.3.2.6 Off-State Leakage Current

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

4.1.3.2.7 Power Drop-Out

After any recognized drop of the voltage below the minimum voltage defined in 4.1.3.2.2 the weapon may request the fuzing system status as detailed in 4.3.

4.1.3.3 Port 3 Power

Not defined in this issue of the standard.

4.1.4 Requirements for Discrete Signals

4.1.4.1 Release Consent Monitor

The weapon shall provide a Release Consent Monitor contact with the Port 1 Power and Port 2 Power Common Return serving as a return. This signal is provided to enable the fuzing system to monitor the status of the Release Consent signal present at the weapon's MIL-STD-1760 MSI connector.Voltage Levels

4.1.4.1.1.1 Release Consent Monitor Enabled

Under steady state conditions and whenever the signal Release Consent is enabled from the aircraft, the voltage between the Release Consent Monitor contact and Port 1 Power and Port 2 Power Common Return contact at the interface shall be a minimum of 13.0 V dc and a maximum of 31.5 V dc.

Voltage transients shall remain within the limits stated in MIL-STD-704 for 28 V dc applications.

4.1.4.1.1.2 Release Consent Monitor Disabled

Under steady state conditions and whenever the signal Release Consent is disabled from the aircraft, the voltage level between the Release Consent Monitor contact and Port 1 Power and Port 2 Power Common Return contact at the interface shall not exceed 1.5 V dc.

Voltage transients shall remain within the limits stated in MIL-STD-704 for 28 V dc applications.

4.1.4.1.2 Voltage Stabilization Time

With any resistive load between 320 Ω and 3.8 kΩ connected between the Release Consent Monitor contact and the Port 1 Power and Port 2 Power Common Return contact, the voltage provided by the weapon at the interface shall reach steady state levels within 3 ms during transitions between the enabled and disabled states.

4.1.4.1.3 Current Levels

With Release Consent Monitor in the enabled state, the weapon shall support a fuzing system draw of up to 10 mA on the Release Consent Monitor contact.

4.1.4.2 Release Indication

4.1.4.2.1 General

The weapon shall provide a Release Indication contact and a Release Indication Return contact. This signal is provided to enable the fuzing system to monitor for release from the aircraft.

4.1.4.2.2 Voltage Levels

The voltage level on the Release Indication contacts with respect to the Signal Return contact shall not exceed 31.5 V dc .

4.1.4.2.3 Current Levels

Prior to separation from the aircraft, whenever the fuzing system is receiving either Port 1 Power or Port 2 Power, and with the fuzing system presenting a load as defined in 4.2.4.2.1, the weapon shall support a current draw of up to 100 mA dc. This represents a signal high condition.

After separation from the aircraft and with the fuzing system presenting a load as defined in 4.2.4.2.1, the weapon shall limit the current draw to a maximum of 1.5 mA dc. This represents a signal low condition.

4.1.4.2.4 Transition Times

With the fuzing system presenting a load as defined in 4.2.4.2.1, the time taken for the Release Indication current to stabilize in transition from a signal high to a signal low shall not exceed 10 ms.

4.1.4.3 EOD Arm State Monitor

The weapon side of the interface shall provide two contacts for the EOD Arm State Monitor signal and the EOD Arm State Monitor Return. These contacts are solely for the purpose of EOD or factory determination of the safe or armed state of the fuzing system.

The weapon may connect the two contacts to a separate connector mounted on the weapon structure for the purpose of providing an externally accessible monitor of the armed state of the fuzing system. If this connection is not made, the weapon shall interconnect the two contacts close to the interface connector with a resistance of 100 kΩ ±10%.

The weapon shall make no other connection to the EOD Arm State Monitor contacts.

4.1.4.4 Initiation Inhibit

Not defined in this issue of the standard.

4.1.4.5 Target Detection Device Signal and Return

Not defined in this issue of the standard.

4.1.4.6 Post-Release Environment Sensor Signal and Return

Not defined in this issue of the standard.

4.1.4.7 Address Bit Discretes

The weapon shall provide an address interface for assigning a unique, fixed address to the fuzing system mated to that interface. Each address interface shall include three binary encoded Address Bit contacts (A_0, A_1, A_2) with the Signal Return serving as the common return.

4.1.4.7.1 Address Assignment

The weapon shall supply a logic “0” state or logic “1” state on each of the three binary weighted Address Bit contacts as defined in 4.1.4.7.2.

The weapon shall supply a logic “0” state or logic “1” state on the Address Bit contacts such that at least one Address Bit is set to logic “1”.

The address assigned to a fuzing system shall be defined as follows:

$$Address = A_2 \times 2^2 + A_1 \times 2^1 + A_0 \times 2^0$$

The weapon shall supply a steady state address prior to powering up the fuzing system, and shall maintain this address without any changes while power is applied to the fuzing system.

4.1.4.7.2 Address Signal

For a logic state “0” the weapon shall maintain an open circuit connection between the Address Bit contact and the Signal Return contact. The resistance between the Address Bit contact and Signal Return contact shall be at least 1 MΩ.

For a logic state “1” the weapon shall maintain a closed circuit connection between the Address Bit contact and the Signal Return contact. The resistance between the Address Bit contact and Signal Return contact shall be less than 2 Ω.

The weapon shall be compatible with voltages between Address Bit contacts and the Signal Return contact up to 31.5 V dc.

The weapon shall be compatible with currents up to 10 mA on each Address Bit contacts.

4.1.5 Reference Line Requirements

4.1.5.1 Signal Return

The weapon shall provide a Signal Return contact on the weapon/fuzing system interface for use as the ground reference for the Fuzing System Serial Data Interface and as the reference contact for the Address Bit contacts and other signals to be defined in future issues of this document.

4.1.5.2 Structure Ground

The weapon shall provide a low resistance conductive path between the Structure Ground contact in the interface connector and the weapon structure.

The Structure Ground interface shall not be used as a signal return or as a power return, except under fault conditions.

4.1.5.2.1 Current Carrying Capacity

The Structure Ground interface shall be capable of continuously carrying a current of 5 A. When carrying a current of 5 A, the voltage drop between the connector contact and the weapon structure shall not exceed 0.2 V dc.

4.2 Detailed Requirements on the Fuzing System

4.2.1 Connector Type, Contact Identification, and Interface Functionality

4.2.1.1 Class 1 Connector Type and Contact Locations

For a Class 1 interface a standard fuzing system interface connector is not specified.

4.2.1.2 Class 2 Connector Type and Contact Locations

The definition of the connector for a Class 2 interface for 3 inch fuzes is defined in AS5680. The allocation of functions to specific connector contacts will be defined in a future issue of this standard.

4.2.1.3 Class 3 Connector Type and Contact Locations

The definition of the connector for a Class 3 interface for 3 inch fuzes is defined in AS5680. The allocation of functions to specific connector contacts will be defined in a future issue of this standard.

4.2.2 Requirements for Digital Communication

4.2.2.1 Fuzing System Serial Data Interface

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

The fuzing system shall provide two TIA-485 transmitter contacts. One contact Fuzing System Transmit Serial Data A, whose electrical characteristics meet the TIA-485 signal “A” (inverting) characteristics, the other 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 4.2.5.1) as a ground reference for voltage excursion reference purposes.

The fuzing system shall provide two TIA-485 receiver contacts. One contact Weapon Transmit Serial Data A, whose electrical characteristics meet the TIA-485 signal “A” (inverting) characteristics, the other 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 4.2.5.1) 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 at 115 200 baud ±3%.

4.2.2.2 Target Detection Device Serial Data Pair

Not defined in this issue of the standard.

4.2.2.3 Post Release Environment Sensor Serial Data Pair

Not defined in this issue of the standard.

4.2.3 Power Requirements

4.2.3.1 Port 1 Power

The fuzing system shall provide a Port 1 Power contact and a Port 1 Power and Port 2 Power Common Return contact.

4.2.3.1.1 Power Application

The fuzing system shall be capable of communicating over the Fuzing System Serial Data Interface, monitoring the discrete connections (see 4.1.4) and carrying out valid commands per 4.3 using Port 1 Power. Upon application of Port 1 Power, the fuzing system shall provide Power Interrupt Notification in accordance with 4.3.

4.2.3.1.2 Voltage Level

The fuzing system shall be capable of performing in accordance with 4.2.3.1.1 using Port 1 Power with a minimum of 6 V dc (V_{min} in Figure 4) applied.

4.2.3.1.3 Voltage Stabilization Time

The fuzing system shall be compatible with the application and removal of Port 1 Power in accordance with 4.1.3.1.3.

4.2.3.1.4 Current Load

The fuzing system load applied to the Port 1 Power contact shall not exceed the maximum current load of Figure 5, when Port 1 Power in accordance with 4.1.3.1.2 is available.

4.2.3.1.5 Power Interrupt

The fuzing system shall be capable of continued operation in the case of Port 1 Power dropping as low as 0 V dc for up to 35 ms.

If Port 1 Power drops below the voltage specified in 4.2.3.1.2 for more than 20 ms, the fuzing system shall set all mission and status data stored in volatile memory to their default values within another 10 ms. Default values for mission data are specified in the fuzing system specification or ICD, default values for status data are defined in 4.3.3.5.2 for “f” response data and 4.3.3.5.4 for “r” response data.

4.2.3.1.6 Off-state Leakage Current

The fuzing system shall be compatible with off-state leakage currents up to 1.0 mA dc supplied to the Port 1 Power contact.

4.2.3.1.7 Load Isolation

The fuzing system shall provide a minimum isolation resistance of 100 kΩ between the Port 1 Power contact and each of the Port 2 Power and Port 3 Power contacts.

4.2.3.2 Port 2 Power

The fuzing system shall provide a Port 2 Power contact and use the Port 1 Power and Port 2 Power Common Return contact.

4.2.3.2.1 Power Application

The fuzing system shall be capable of communicating over its Serial Data Interface, carrying out valid commands per 4.3, and monitoring the discrete signals defined in 4.2.4 once Port 2 Power is stabilized.

4.2.3.2.2 Voltage Level

The fuzing system shall be capable of performing in accordance with 4.2.3.2.1 when a minimum voltage of 17 V dc (V_{min} of Figure 4) is applied between the Port 2 Power contact and the Port 1 Power and Port 2 Power Common Return contact.

4.2.3.2.3 Current Load

When Port 2 Power in accordance with 4.2.3.2.2 is available, the fuzing system load applied to the Port 2 Power contact shall not exceed the maximum current load as defined in Figure 6 and additional pulse currents extracting a charge of up to 250 mA·s in any given ten second period.

4.2.3.2.4 Power Interrupt

Once Port 2 Power has been applied and while the fuzing system is not in the armed state, the fuzing system shall be capable of continued operation in the case of Port 2 Power dropping as low as 0 V dc for up to 35 ms.

If Port 2 Power drops below the voltage specified in 4.2.3.2.2for more than 20 ms, the fuzing system shall set all mission and status data stored in volatile memory to their default values within another 10 ms. Default data for mission data is specified in the fuzing system specification or ICD, default values for status data are defined in 4.3.3.5.2 for "f" response data and 4.3.3.5.4 for "r" response data.

4.2.3.2.5 Off-State Leakage Current

The fuzing system shall be compatible with off-state leakage currents up to 1.0 mA dc supplied between the Port 2 Power contact and the common Port 1 Power and Port 2 Power Common Return contact.

4.2.3.2.6 Load Isolation

The fuzing system shall provide a minimum isolation resistance of 100 kΩ between the Port 2 Power contact and each of the Port 1 Power and Port 3 Power contacts.

4.2.3.3 Port 3 Power

Not defined at this issue of the standard.

4.2.3.4 Port 1 Power and Port 2 Power Common Return

The fuzing system shall isolate the Port 1 Power and Port 2 Power Common Return from the Structure Ground with a resistance greater than 100 kΩ.

4.2.3.5 Port 3 Power Return

Not defined at this issue of the standard.

4.2.3.6 Post Release Environmental Sensor Power and Return

Not defined at this issue of the standard.

4.2.4 Requirements for Discrete Signals

4.2.4.1 Release Consent Monitor

The fuzing system shall provide a Release Consent Monitor contact and use the Port 1 Power and Port 2 Power Common Return contact as the reference return line.

4.2.4.1.1 Voltage Levels

The fuzing system shall be compatible with voltage transients that are within the limits stated in MIL-STD-704 for 28 V dc applications.

4.2.4.1.1.1 Release Consent Monitor Enabled

Upon detecting a minimum voltage of 13 V dc on the Release Consent Monitor contact the fuzing system shall set the bit Release Consent Monitor State (bit 0, byte 1) of the “f” fuzing system response data (see 4.3.3.5.2) to logic “1”.

4.2.4.1.1.2 Release Consent Monitor Disabled

Upon detecting a maximum voltage of 1.5 V dc on the Release Consent Monitor contact the fuzing system shall set the bit Release Consent Monitor State (bit 0, byte 1) of the “f” fuzing system response data (see 4.3.3.5.2) to logic “0”.

4.2.4.1.2 Voltage Stabilization Time

The fuzing system shall be compatible with transition times between states of up to 3 ms.

4.2.4.1.3 Current Levels

When the Release Consent Monitor signal is in the enabled state, the fuzing system shall limit the maximum current to 10 mA.

4.2.4.2 Release Indication

The fuzing system shall provide two contacts, Release Indication and Release Indication Return, to loop the Release Indication current into and then out of the fuzing system.

4.2.4.2.1 Voltage Levels

The fuzing system shall limit the voltage across the Release Indication contacts to less than 3.0 V dc for all currents specified in 4.1.4.2.3.

4.2.4.2.2 Current Levels

If the fuzing system uses the Release Indication signal, the following requirements apply.

The fuzing system shall limit the maximum current to 100 mA.

The fuzing system shall interpret a detected current of 5 mA or more, referred to as signal high, as indicating the weapon is not separated from the aircraft. Upon detecting a current of 5 mA or more the fuzing system shall set the bit Release Indication State (bit 1, byte 1) of the “f” fuzing system response data (see 4.3.3.5.2) to logic “1”.

The fuzing system shall interpret an absence of current or a detected current of less than 1.5 mA, referred to as signal low, as indicating the weapon is separated from the aircraft. Upon detecting no current or a current of less than 1.5 mA the fuzing system shall set the bit Release Indication State (bit 1, byte 1) of the “f” fuzing system response data (see 4.3.3.5.2) to logic “0”.

NOTE: Release Indication is high whenever the weapon is attached to the aircraft. It may provide up to 32 V and 100 mA dc to the fuzing system. This poses a safety concern to many safety boards. The fuzing system may need to utilize additional means to ensure that Release Indication cannot power any safety circuits until the start of the release sequence.

4.2.4.2.3 Transition Times

The fuzing system shall be compatible with 10 ms minimum for current stabilization during power application or for transitions between high current and low current levels.

4.2.4.3 EOD Arm State Monitor

The fuzing system shall provide an EOD Arm State Monitor contact and an EOD Arm State Monitor Return contact.

If the fuzing system does not have an EOD Arm State Monitor capability, the fuzing system shall provide an input resistance of 1MΩ ±10% across the two contacts. No other connection shall be made to the contacts. No other EOD Arm State Monitor requirements apply to this fuzing system interface.

If the fuzing system has an EOD Arm State Monitor capability, the following requirements apply for in-line fuzing systems and out-of-line fuzing systems respectively.

4.2.4.3.1 In-line Fuzing Systems

When in the armed state, an in-line fuzing system shall provide a voltage between 0.4 V dc and 5 V dc on the EOD Arm State Monitor contact with respect to its return contact.

When in the unarmed state, an in-line fuzing system shall provide a voltage of less than 0.4 V dc on the EOD Arm State Monitor contact with respect to its return contact.

The input resistance across the EOD Arm State Monitor contact and the EOD Arm State Monitor Return contact shall be 100 kΩ ± 10%.

4.2.4.3.2 Out-of-line Fuzing Systems

When in the armed state, an out-of-line fuzing system shall have an input resistance across the EOD Arm State Monitor contact and its return of 25 kΩ ± 10%.

When in the unarmed state, an out-of-line fuzing system shall have an input resistance across the EOD Arm State Monitor contact and its return of 10 kΩ ± 10%.

At no time in its operation shall the out-of-line fuzing system produce an ac or dc voltage across the EOD Arm State Monitor contact and its return contact.

4.2.4.4 Initiation Inhibit

Not defined in this issue of the standard.

4.2.4.5 Target Detection Device Signal and Return

Not defined in this issue of the standard.

4.2.4.6 Post-Release Environment Sensor Signal and Return

Not defined in this issue of the standard.

4.2.4.7 Address Bit Discretes

The fuzing system shall provide and monitor three Address Bit contacts A_0, A_1, A_2 for an address interface for detecting the assigned fuzing system address.

4.2.4.7.1 Address Assignment

The three Address Bit contacts provide a binary encoded address. The address assigned to the fuzing system shall be defined as follows:

$$\text{Address} = A_2 \times 2^2 + A_1 \times 2^1 + A_0 \times 2^0$$

4.2.4.7.2 Address Signal

When reading the address, the fuzing system shall provide a voltage up to 31.5 V dc between the Address Bit contacts and the Signal Return contacts.

The fuzing system shall limit the current to no more than 10 mA between each Address Bit contact and the Signal Return contact.

A voltage of greater than 1.5 V dc between an Address Bit contact and the Signal Return contact shall be considered a logic “0”.

A current of 3 mA or more between an Address Bit contact and the Signal Return contact shall be considered a logic “1”.

4.2.5 Reference Line Requirements

4.2.5.1 Signal Return

The fuzing system shall provide and use Signal Return contact as the ground reference for the Fuzing System Serial Data Interface and as the reference contact for the Address Bit contacts and other signals to be defined in future issues of this document.

4.2.5.2 Structure Ground

The fuzing system shall provide a Structure Ground contact.

The fuzing system shall provide a low resistance conductive path between the Structure Ground contact in the interface connector and the fuzing system structure.

The Structure Ground interface shall not be used as a signal return or as a power return, except under fault conditions.

4.2.5.2.1 Current Carrying Capacity

The Structure Ground interface shall be capable of continuously carrying a current of 5 A.

When carrying a current of 5 A, the voltage drop between the connector contact and the fuzing system structure shall not exceed 0.2 V dc.

4.3 Fuzing System Serial Data Interface

This section defines the serial data interface and protocol by which the weapon and the fuzing system communicate.

4.3.1 Overview

NOTE: This introductory section provides an overview of the Fuzing System Serial Data Interface; 4.3.1 does not define any specific requirements on interface operation.

The serial data protocol uses TIA-485 on a 4-wire interface (2 wires for weapon to fuzing system and 2 wires for fuzing system to weapon data transfers). It permits a single weapon and multiple fuzing systems on the serial bus.

NOTE: The serial interface can be used for weapons and fuzing systems using TIA-422, as well, but in this case is restricted to a single fuzing system on the bus.

The communication is half-duplex, i.e. only one entity on the serial data interface is transmitting at a time. To achieve this, the communication follows a strict Command/Response and Set/Get approach.

The Command/Response approach means that the communication is always initiated by the weapon by sending a command and the fuzing system is required to respond. That also means that fuzing systems can not communicate with each other.

The Set/Get approach means that the weapon either sends data to the fuzing system (Set Command) or requests data from the fuzing system (Get Command), e.g. to verify the current settings of the fuzing system. The fuzing system responds to a Set Command with a simple acknowledgement (containing no data). The fuzing system responds to a Get Command with a message containing the requested data. The only exception is the “F” command, where the fuzing system acknowledgement contains status data.

All messages consist of the following:

- Unique Start Flag
- Address of the fuzing system (recipient or sender)
- Control Byte
- Data, if required
- Unique Stop Flag

The unique Start Flag and Stop Flag ensure that the recipient can check the received message for the required length.

The address identifies the receiving or sending fuzing system and the direction from/to the weapon.

The Control Bytes identify the message. The weapon always sends the capital characters in the Control Byte, while the fuzing system replies with the lower case version. This way the weapon can verify that the fuzing system has received/replied the correct Control Byte. The Control Byte determines the type of data and the number of data bytes that follow, if any at all.

Examples of protocol usage can be found in 4.3.4.

This interface is intended for weapons in a MIL-STD-1760 environment. Some data originate from the aircraft and have the MIL-STD-1760 data format. This section also details how the data is converted into the TIA-485 protocol.

4.3.2 General Requirements

4.3.2.1 Service Data Unit Format

Data is transmitted in Service Data Units (SDU). Each SDU contains a single byte of information to be transferred. Each byte has 8 bits and is transmitted with the Least Significant Bit (LSB, bit A0) first.

4.3.2.1.1 Bit order for transmit of MIL-STD-1760 words

MIL-STD-1760 data words have 16 bits each and are transmitted Most Significant Bit (MSB, bit A15) first. When MIL-STD-1760 data words are transmitted over the serial data interface, each word is split into two SDU, with the upper byte transmitted first.

The transmitted bit order for converted MIL-STD-1760 words shall be as shown in Figure 7.

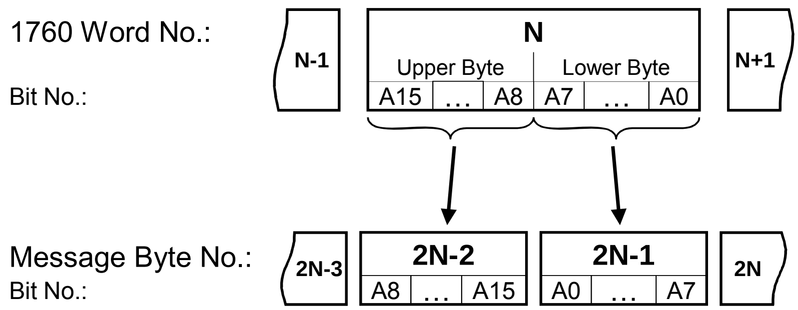

FIGURE 7 - BIT TRANSFER ORDER FOR MIL-STD-1760 FUZING SYSTEM SETTING DATA

To allow the use of standard TIA-485 hardware, the MIL-STD-1760 data which is transferred Most Significant Word first, Most Significant Bit first, is transmitted over the TIA-485 bus as Most Significant Word first, Upper Byte first, Least Significant Bit first (see Figure 7).

4.3.2.2 Protocol Data Unit Format

All data is transmitted in Protocol Data Units (PDU) over the TIA-485 bus. A PDU shall comprise an eleven bit packet comprising a start bit, an SDU, a parity bit, and a stop bit

Bit order in the PDU shall be as shown in Figure 8.

Start Bit : SDU : Parity Bit : Stop Bit

FIGURE 8 - BIT ORDER IN A PROTOCOL DATA UNIT

The PDU shall employ even parity, such that the modulo-2 sum of the bits in the PDU is zero.

4.3.2.3 Message Format and Content

A message shall comprise a PDU containing an Address Byte, followed by a PDU containing a Control Byte, and a maximum of a further 62 bytes of data (after character stuffing is removed), contained in PDUs (see Figure 9). Where character stuffing is required (see 4.3.2.4.3), the actual transmitted data content on the serial bus will comprise more than 62 PDU.

Address Byte : Control Byte : Data Content (0-62 Bytes)

FIGURE 9 - ILLUSTRATION OF A MESSAGE

The address byte shall identify the direction and the intended recipient or sender of the transmission in accordance with Table 1. Reserved Bits shall not be used.

TABLE 1 - ADDRESS BYTE

Bit	Definition	Reference
0	Recipients/Senders Address Bit A_0	see 4.3.2.3.1.1
1	Recipients/Senders Address Bit A_1	see 4.3.2.3.1.1
2	Recipients/Senders Address Bit A_2	see 4.3.2.3.1.1
3	Address Space Bit 1	see 4.3.2.3.1.2
4	Address Space Bit 2	see 4.3.2.3.1.2
5	Reserved	
6	Reserved	
7	Direction Bit	see 4.3.2.3.1.3

4.3.2.3.1.1 Recipient/Sender Address

Bits 0 to 2 are used to binary code the address of the device according to the following scheme:

$$\text{Address} = A_2 \text{ x } 2^2 + A_1 \text{ x } 2^1 + A_0 \text{ x } 2^0$$

For messages from the weapon to the fuzing system the address is the address of the receiving fuzing system. For responses from the fuzing system to the weapon, the address is the address of the sending fuzing system. The address is assigned to the fuzing system as described in 4.1.4.7.1.

Addresses 1 to 7 are assigned to individual fuzing systems. Each address shall be assigned to one fuzing system only.

Address 0 is reserved for broadcasts and shall not be assigned to any fuzing system.

Broadcast shall only be used to send messages from the weapon to all fuzing systems within one address space. Bit 7 (Direction) shall set to logic “0” for broadcasts (see 4.3.2.3.1.4).

4.3.2.3.1.2 Address Space

Bits 3 and 4 indicate the type of receiving or sending device (e.g. fuzing system).

Bit 3 and 4 both shall be set to logic “0” for fuzing systems.

All other combinations are reserved and shall not be used. Further address allocations will be included in future issues to this document.

4.3.2.3.1.3 Reserved Address Bits

All address bits marked as Reserved in Table 1 shall be set to logic “0” and shall be ignored by the recipient.

4.3.2.3.1.4 Direction

Bit 7 indicates the direction of the transmission. For messages from the weapon to the fuzing system Bit 7 shall be set to logic “0”. For responses from the fuzing system to the weapon Bit 7 shall be set to logic “1”.

4.3.2.3.2 Control Byte

The Control Byte defines the message content type applicable to the remainder of the message.

A list of the permitted Control Bytes for the Fuzing System Serial Data Interface is shown in 0 for the weapon and 4.3.3.4 for the fuzing system.

4.3.2.3.3 Data Content

For some Control Bytes additional data content is transmitted. The data is part of the message and follows the Control Byte.

Data content for the Fuzing System Serial Data Interface is defined in 4.3.3.3 for the weapon and 4.3.3.5 for the fuzing system.

4.3.2.4 Data Frame Format

All communications on the serial signal pair shall comprise of data frames consisting of a PDU containing the Start Flag, a message (see 4.3.2.3), and a PDU containing the End Flag (see Figure 10).

Start Flag : <message> : End Flag

FIGURE 10 - ILLUSTRATION OF A DATA FRAME

4.3.2.4.1 Start Flag

The Start Flag shall be a PDU containing an SDU byte with the value [7Eh].

4.3.2.4.2 End Flag

The End Flag shall be a PDU containing an SDU with the value [7Fh]

4.3.2.4.3 Character Stuffing

Character stuffing shall be employed to ensure that the Start Flag and End Flag characters are uniquely transmitted at the start and end of any data frame.

A Protocol Escape character [7Dh] is defined and used in the message content to signify the use of a two byte sequence to transmit a single byte of data.

If a byte within the message is the same as the Start Flag character [7Eh], then the transmitting system shall replace this character with the sequence [7Dh] [5Eh] in the transmitted message.

If a byte within the message is the same as the End Flag [7Fh], then the transmitting system shall replace this character with the sequence [7Dh] [5Fh] in the transmitted message.

If a byte within the message is the same as the Protocol Escape [7Dh], then the transmitting system shall replace this character with the sequence [7Dh] [5Dh] in the transmitted message.

At the receiver, character destuffing is employed to restore the message content. On receiving a Protocol Escape [7Dh] byte, the receiving system shall wait for the subsequent data byte (as noted above), and when this subsequent data byte is received, shall place the appropriate intended message byte in the output buffer.

4.3.2.5 Data Flow Control

4.3.2.5.1 General

Communications are only initiated by the weapon, and sent to an addressed fuzing system, which will then respond with an acknowledgement of the message receipt, or data as requested in the weapon message.

Simultaneous communications to all fuzing systems within one address space may be initiated by using the broadcast address, in which case all fuzing systems receiving the message shall act on the message but shall not respond.

The weapon shall transmit using the Weapon Transmit Serial Data Pair only.

The fuzing system shall transmit using the Fuzing System Transmit Serial Data Pair only.

4.3.2.5.2 Weapon Transmission Timing and Data Format

Prior to any transmission, the weapon shall ensure that the Weapon Transmit Serial Data Pair is active (driven by the weapon) a minimum of 0.5 ms before sending any frame.

On completion of transmission of the data frame, the weapon shall stop driving the Weapon Transmit Serial Data Pair within 0.5 ms of sending the final End Flag.

The weapon shall wait until either the reception of the End Flag signaling completion of the fuzing system response data frame before transmitting again or until the maximum response time for the fuzing system has elapsed (see 4.3.2.5.7), whichever occurs earlier. There is no waiting time in the case of broadcasts.

The weapon shall wait a minimum of 1 ms after the reception of the End Flag signaling completion of the fuzing system response data frame before re-activating the Weapon Transmit Serial Data bus drivers for any subsequent data transmissions.

4.3.2.5.3 Weapon Data Format

The weapon shall format any data frame as per 4.3.2.4, containing a message using the appropriate Address Byte as defined in 4.3.2.3.1, and followed by a Control Byte. See Table 2, 0 and 4.3.3.4 for lists of Control Bytes and expected responses.

See 4.3.4 for examples of the protocol usage.

TABLE 2 - CONTROL BYTES FOR THE FUZING SYSTEM SERIAL DATA INTERFACE

Control Bytes for	**Control Bytes**												
Weapon Command	"A"	"C"	"F"	"I"	"M"	"Q"	"R"	"S"	"U"	"V"	"W"	"X"	"Y"
Fuze Response	"a"	"c"	"f"	"i"	"m"	"q"	"r"	"s"	"u"	"v"	"w"	"x"	"y"

4.3.2.5.4 Weapon Data Frame Timeout

Data transmitted by the weapon may contain gaps between the data frames or within the data frames. Apart from the timings in 4.3.2.5.2, there are no time out restraints on the weapon communications.

4.3.2.5.5 Fuzing System Transmission Timing

On receipt of a data frame from the weapon, and providing that the data frame passes the protocol checks (see 4.3.2.5.8), the fuzing system shall turn on the Fuzing System Transmit Serial Data Pair drivers a minimum of 1 ms after the reception of the End Flag signaling completion of the weapon transmitted data frame.

The fuzing system shall then ensure that the Fuzing System Transmit Serial Data Pair is active (driven by the fuzing system) a minimum of a further 0.5 ms before initiating any transmission.

The fuzing system shall send this response in accordance with the timing requirements defined in 4.3.2.5.7.

On completion of transmission of the response, the fuzing system shall turn off (enter a high impedance state) the Fuzing System Transmit Serial Data Pair drivers within 0.5 ms of sending the final End Flag.

4.3.2.5.6 Fuzing System Response Requirements and Data Format

Where the Address Byte of the weapon sent message is set to broadcast (address 0), the fuzing system(s) shall not make any response transmission.

The Address Byte used by the fuzing system in the message shall be as defined in 4.3.2.3.1. The Control Byte sent by the fuzing system shall be the lower case ASCII version of the Control Byte sent by the weapon. See Table 2 for a list of Control Bytes applicable to the Fuzing System Serial Data Interface. Data, if required by the weapon sent message, is defined in subsequent sections of this standard (see 4.3.3.4).

In response to any weapon message sent to the Address Space for fuzing systems where either the address matches that of the fuzing system or is "0" (broadcast), the fuzing system then shall set bits in the "r" response as follows:

- With the exception of a message with the "R" command, on receipt of a valid message sent to the fuzing system address "0" (broadcast), the fuzing system shall set Bit 0 of Byte 1 of the "r" response data (4.3.3.5.4), to logic "1", to indicate that the message was sent to the broadcast address.

- With the exception of a message with the "R" command, on receipt of a valid message not sent to the broadcast address, the fuzing systems shall set Bit 0 of Byte 1 of the "r" response data (4.3.3.5.4), to logic "0", to indicate that the message address matches that of the fuzing system.

- With the exception of a message with the “R” command, on receipt of a valid message, the fuzing system shall set Bits 2, and 3 of Byte 1 of the “r” response data (4.3.3.5.4), to logic “0”, indicating reception of a message with a permitted control byte and acceptance of the command.

- With the exception of a message with the “R” command, on receipt of a message with a invalid control byte, the fuzing system shall set Bit 2, of Byte 1 of the “r” response data (4.3.3.5.4), to logic “1” to indicate that the last control byte was not permitted and the last message was not accepted.

- With the exception of a message with the “R” command, if the fuzing system has detected errors during the transmission, the fuzing system shall set Bit 3, of Byte 1 of the “r” response data (4.3.3.5.4), to logic “1” to indicate that the last message was not accepted.

In response to any valid weapon message that passes the protocol checks (see 4.3.2.5.8) and where the Address and Address Space in the Address Byte match that of the fuzing system, the fuzing system shall send an acknowledge response using a data frame as defined in 4.3.2.4.

- Where the command does not require the fuzing system to send data, the fuzing system response shall comprise the Start Flag, Address Byte, the lower case version of the weapon sent Control Byte and the Stop Flag only. It shall be sent to confirm that the message has been received, and that any checksum in the message has been evaluated as valid according to the protocol checks in 4.3.2.5.8.

- Where the command requires the fuzing system to send data, the fuzing system response shall comprise the Start Flag, Address Byte, the lower case version of the weapon sent Control Byte, followed by the requested data as defined in 4.3.3.5) and completed with the End Flag.

See 4.3.4 for examples of the protocol usage.

4.3.2.5.7 Fuzing System Data Frame Timeout

The fuzing system shall complete transmission of any message within 50 ms of reception of the End Flag in the preceding message from the weapon.

Where the preceding message from the weapon contained an “F” Control Byte (see 4.3.3.3.2), the fuzing system shall complete sending of the “f” response data within 5 ms of the reception of the End Flag in the preceding message from the weapon.

4.3.2.5.8 Protocol Checks

Communication protocol checks shall be carried out on receipt of all messages. The failure of any protocol check shall result in the recipient discarding the complete message.

4.3.2.5.8.1 Required Protocol Checks

On receipt of a message, all terminals shall carry out at least the following protocol checks:

a. Verification that each PDU contains 11 bits and that even bit parity exists within each PDU.

b. Verification that each message begins with a Start Flag and ends with an End Flag.

c. Verification that the character within the Control Byte PDU is a permitted character.

d. Verification that the character within the Address Byte PDU is valid, that the address space matches the fuzing system’s address space and that the address either matches the fuzing system’s address or is set to 0 for broadcasts.

4.3.2.5.8.2 Checksum

Where called up as part of the data content, the checksum shall employ the following algorithm, as used in MIL-STD-1760E, Appendix B 4.1.1.2.2.

All checksummed messages shall include a double byte (checksum word), which satisfies the following algorithm:

When each word (2 bytes) of the data, including the checksum word, are rotated right cyclically by a number of bits equal to the number of preceding data words in the message, and all the resultant rotated data words are summed using modulo 2 arithmetic to each bit (with no carries), the sum shall be zero.

4.3.3 Communications Protocol

This section contains requirements specific to the Fuzing System Serial Data Interface communications protocol.

4.3.3.1 General

All messages from the weapon with the exception of broadcasts require a response containing either requested fuzing system data or a simple response acknowledging that a valid message has been received (see 4.3.2.4).

The Control Byte identifies content, length and actions of the messages sent over the data bus.

All Control Bytes sent by the weapon shall employ upper case ASCII Characters. Fuzing system responses shall all employ the lower case of the corresponding weapon command.

The Control Bytes are separated into Safety Related, Non Safety Related and Reserved for Fuzing System Specific Use.

The following tables list the set of Control Bytes that all fuzing systems and weapons shall employ. All other Control Bytes are reserved and shall not be used.

4.3.3.2 Weapon Control Byte Definitions

TABLE 3 - WEAPON COMMANDS, SAFETY RELATED

Control Byte	Definition	Data Content	Fuzing System Response	Notes
A	Set safety critical arming times	MIL-STD-1760 Store Control message including checksum	Acknowledge	See 4.3.3.3.1
F	Command safety critical change of arming status or request arming status	Two Bytes: “RI”, “PR”, “IA”, “AD”, “CM” or “SQ”	Fuzing system to execute and send current status	See 4.3.3.2.2
I	Fuzing system reset	One Byte: “F” or “P”	Acknowledge	See 4.3.3.2.3
Q	Request safety critical arming time settings	None	Fuzing system to send current arming times	See 4.3.3.2.4

TABLE 4 - WEAPON COMMANDS, NON SAFETY RELATED

Control Byte	Definition	Data Content	Fuzing System Response	Notes
C	Request fuzing system identifier	None	Fuzing system to send fuzing system identifier	See 4.3.3.2.5
R	Request fuzing system status	None	Fuzing system to send status information	See 4.3.3.2.6
M	Set non safety related mission data	MIL-STD-1760 Store Control message including checksum	Acknowledge	See 4.3.3.2.7
S	Request non safety related mission data	None	Fuzing system to send current non safety related settings	See 4.3.3.2.8
U	Request fuzing system capabilities	None	Fuzing system to send its current capabilities	See 4.3.3.2.9

TABLE 5 - WEAPON COMMANDS, FUZING SYSTEM SPECIFIC

Control Byte	Definition	Data Content	Fuzing System Response	Notes
L	Laboratory set command	User specified	Acknowledge	See 4.3.3.2.10
O	Laboratory request command	None	User specified	See 4.3.3.2.10
V	Set weapon/ fuzing system specific safety related or safety critical data	User specified	Acknowledge	See 4.3.3.2.11
W	Set weapon/ fuzing system specific non safety related data	User specified	Acknowledge	See 4.3.3.2.11
X	Request weapon/ fuzing system specific safety related or safety critical settings	None	User specified	See 4.3.3.2.11
Y	Request weapon/ fuzing system specific non safety related settings	None	User specified	See 4.3.3.2.11

Commands with the control bytes “A”, “M”, “V” and “W” are used to transmit mission data to the fuzing system.

NOTE: Whenever mission data is mentioned in this document, it refers to the data set through commands with the control bytes “A”, “M”, “V” and “W”.

4.3.3.2.1 Control Byte “A”

The weapon shall send a message with the Control Byte “A” and the data as defined in 4.3.3.3.1 whenever arming times are required to be sent to the fuzing system.

The fuzing system shall acknowledge the receipt of the message as defined in 4.3.2.5.6.

On receipt of a message with the Control Byte “A”, the fuzing system shall confirm that the checksum in data bytes 58 and 59 is correct (see Table 6).

If the checksum is correct, the fuzing system then shall set bits 0 through 3 of byte r of the “r” Fuzing System Response Data in accordance with 4.3.3.4.1 and shall store the data defined in 4.3.3.3.1 if the respective invalidity bits are not set. If the invalidity bit is set the fuzing system shall ignore the respective data bytes.

4.3.3.2.2 Control Byte “F”

The weapon shall send a message with the Control Byte “F” followed by data as defined in 4.3.3.3.2 to initiate changes in the fuzing system arming status.

Upon receipt of a message with the Control Byte “F” followed by valid data as defined in 4.3.3.3.2, the fuzing system shall set the appropriate bits in the status message “f” (see 4.3.3.3.2), acknowledge the receipt of valid data as defined in 4.3.2.5.6 and with the data as defined in 4.3.3.5.2, and take the actions defined in 4.3.3.3.2.

4.3.3.2.3 Control Byte “I”

The “I” command provides a mechanism to command the fuzing system to reset as well as acknowledge the receipt of the bit Power Interrupt Notification of the “r” response message data (see 4.3.3.5.4).

Upon receipt of a message with the Control Byte “I” followed by valid data as defined in 4.3.3.3.3, the fuzing system shall acknowledge the receipt of valid data as defined in 4.3.2.5.6, and take the actions defined in 4.3.3.3.3.

4.3.3.2.4 Control Byte “Q”

The weapon shall send a message containing the Control Byte “Q” to request the current arming times settings of the fuzing system.

Upon receipt of a message with the Control Byte “Q” the fuzing system shall respond as defined in 4.3.2.5.6 and send its current arming time settings as defined in 4.3.3.4.4 to the weapon.

4.3.3.2.5 Control Byte “C”

The weapon shall send a message containing the Control Byte “C” to request the fuzing system identifier.

On receipt of a message with the Control Byte “C”, the fuzing system shall respond as defined in 4.3.2.5.6 and send its fuzing system identifier as defined in 4.3.3.4.5 to the weapon.

4.3.3.2.6 Control Byte “R”

The weapon shall send a message containing the Control Byte “R” to request the system status of the fuzing system.

On receipt of a message with the Control Byte “R”, the fuzing system shall respond as defined in 4.3.2.5.6 and send the general fuzing system status as defined in 4.3.3.4.6 to the weapon.

4.3.3.2.7 Control Byte “M”

The weapon shall employ a message with Control Byte “M” and the data as defined in 4.3.3.3.1 whenever fuzing functions other than the arming times are required to be sent to the fuzing system.

The fuzing system shall acknowledge the receipt of the message as defined in 4.3.2.5.6.

On receipt of a message with the Control Byte “M”, the fuzing system shall confirm that the checksum in data bytes 58 and 59 (see table 6) is correct.

If the checksum is correct, the fuzing system then shall set bits 4 through 7 of byte 2 of the “r” Fuzing System Response Data in accordance with 4.3.3.4.7 and shall store the data defined in 4.3.3.3.1 if the respective invalidity bits are not set. If the invalidity bit is set the fuzing system shall ignore the respective data bytes.

4.3.3.2.8 Control Byte “S”

The weapon shall send a message containing the Control Byte “S” to request the current settings (except arming times, see 4.3.3.2.4) of the fuzing system.

On receipt of a message containing the Control Byte “S”, the fuzing system shall respond as defined in 4.3.2.5.6 and with the data as defined in 4.3.3.4.8.

4.3.3.2.9 Control Byte “U”

The weapon shall send a message containing the Control Byte “U” to request the current capabilities of the fuzing system.

On receipt of a message with the Control Byte “U”, the fuzing system shall respond as defined in 4.3.2.5.6 and with the data on its current capabilities as defined in 4.3.3.4.9.

4.3.3.2.10 Control Bytes “L” and “O”

The commands “L” and “O” in Table 5 are reserved for factory or manufacturer usage. The weapon shall not transmit these commands.

Data content for the “L” message and for the response data for “O” messages shall be at the discretion of the fuzing system manufacturer.

The fuzing system shall acknowledge the receipt of the message as defined in 4.3.2.5.6.

On receipt of a message with the Control Byte “O”, the fuzing system shall respond as defined in 4.3.2.5.6 and by the fuzing system manufacturer.

4.3.3.2.11 Control Bytes “V”, “W”, “X” and “Y”

Data content for messages containing the Control Bytes “V” and “W” and for the response data for messages containing the Control Bytes “X” and “Y” is not currently standardized and shall be at the discretion of the fuzing system manufacturer.

The command “V” allows the setting of safety related or safety critical data specific to individual weapon systems and which cannot be set through other commands.

If the fuzing system has received a valid command “V”, it then shall set bits 0 through 3 of byte 3 of the “r” Fuzing System Response Data in accordance with 4.3.3.4.11 and shall store the data.

The command “W” allows the setting of non safety related data specific to individual weapon systems and which can not be set through other commands.

If the fuzing system has received a valid command “W”, it then shall set bits 4 through 7 of byte 3 of the “r” Fuzing System Response Data in accordance with 4.3.3.4.12 and shall store the data.

The fuzing system shall acknowledge the receipt of the message containing the Control Bytes “V” or “W” as defined in 4.3.2.5.6.

The weapon shall send a message containing the Control Byte “X” to request fuzing system data set by the command “V”.

On receipt of a message with the Control Byte “X”, the fuzing system shall respond with the data as defined by the fuzing system specification.

The weapon shall send a message containing the Control Byte “Y” to request fuzing system data set by the command “W”.

On receipt of a message with the Control Byte "Y", the fuzing system shall respond with the data as defined by the fuzing system specification.

4.3.3.3 Weapon Message Data Content

4.3.3.3.1 "A" and "M" Command Data Content

For "A" and "M" commands a full MIL-STD-1760 Store Control message is sent to permit the weapon to send arming times and mission data received from the aircraft unmodified to the fuzing system and to allow the fuzing system to check the integrity of the message and its data content.

The data format for the "A" and "M" commands shall be the MIL-STD-1760 Store Control (BC-RT transfer) message, as received by the weapon from the aircraft, split into bytes, as defined in 4.3.2.1.1, see Table 6. The Command Word (Word 00) and the Status Word (31) of the MIL-STD-1760 message are omitted. Data format for each word is as per MIL-STD-1760.

Data byte numbering starts at data byte 0, thus giving Upper Byte (UB) = 2(N)-2 and Lower Byte (LB) = 2(N)-1, where N is the MIL-STD-1760 Word Number of the original data (see 4.3.2.1.1).

TABLE 6 - DATA CONTENT FOR MESSAGES WITH CONTROL BYTE "A" OR "M"

MIL-STD-1760E Word	Data Byte	Data Bit	MIL-STD-1760 Word Description	Applicability
01	0 - 1		Header(0400 hexadecimal)	Not used
02	2 - 3		Invalidity for MIL-STD-1760 words 01-16	"A", "M"
03	4 - 5		Invalidity for MIL-STD-1760 words 17-30	"A", "M"
04 - 07	6 - 13			Not used
08	14 - 15		Fuzing Mode 1	"M"
09	16 - 17		Arm Delay from Release	"A"
10	18 - 19		Fuze Function Delay from Release	"M"
11	20 - 21		Fuze Function Delay from Impact	"M"
12	22 - 23		Fuze Function Distance	"M"
13 - 14	24 - 27			Not used
15	28 - 29		High Drag Arm Time	"A"
16	30 - 31		Function Time from Event	"M"
17	32 - 33		Void/Layer Number	"M"
18	34 - 35		Impact Velocity	"M"
19 (UB)	36	0 - 3	Fuzing Mode 2, Bit 00 – 03	Not used
19 (UB)	36	4 - 7	Fuzing Mode 2, Bit 04 – 07	"M"
19 (LB)	37	0 - 1	Fuzing Mode 2, Bit 08 – 09	"A"
19 (LB)	37	2 - 4	Fuzing Mode 2, Bit 10 – 12	"M"
19 (LB)	37	5 - 7	Fuzing Mode 2, Bit 13 – 15	Not used
20 - 24	38 - 47			Not used
25	48 - 49		Fuze Time 1	"M"
26	50 - 51		Fuze Time 2	"M"

MIL-STD-1760E Word	Data Byte	Data Bit	MIL-STD-1760 Word Description	Applicability
27	52 - 53			Not used
28	54 - 55		Interstage Gap Time	"M"
29	56 - 57		Lethality Index	"M"
30	58 - 59		Checksum word	"A", "M"

4.3.3.3.1.1 Applicability of "A" and "M" Command Data Content

The "A" command shall be used to send only data related to arming to the fuzing system. Such data is indicated by the character "A" in column Applicability in Table 6. Any other data in the message shall be ignored, except for interpretation of the checksum.

The "M" command shall be used to send data not related to arming to the fuzing system. Such data is indicated by the character "M" in column Applicability in Table 6. Any other data in the message shall be ignored, except for interpretation of the checksum.

Some data, such as the Invalidity Words and the Checksum is relevant for both arming and non arming related functions, and shall be used by the fuzing system in both the "A" and "M" command data. Such data is indicated by both characters "A" and "M" in column Applicability.

For both the "A" and "M" command, the fuzing system shall read the whole message in order to correctly interpret the checksum.

4.3.3.3.2 "F" Command Data Content

The data sent as part of the "F" command shall comprise two bytes, each containing an ASCII character as shown in Table 7.

TABLE 7 - "F" COMMAND DATA CONTENT

Data	Definition
PR	Prepare for Release - FPR
RI	Release Imminent - FRI
IA	Inhibit Arming - FIA
AD	Arming De-Inhibit - FAD
CM	Cancel Mission - FCM
SQ	Status Query - FSQ

4.3.3.3.2.1 Prepare for Release

The weapon shall send an "F" command containing the data "PR" (FPR) upon receipt of a command "Commit to Separate Store of Submunition" (CTS) from the weapon to allow the fuzing system to initiate preparations for proper function at release.

The fuzing system shall accept a message with the Control Byte "F" and data "PR" as valid only if the discrete signal Release Consent Monitor is enabled at the time the message is received.

Upon receipt of a valid command FPR the fuzing system shall set the status bit FPR Received (see 4.3.3.5.2) and then shall acknowledge the receipt as defined in 4.3.2.5.6 and with the data defined in 4.3.3.5.2. The fuzing system will prepare for a release (e.g. BIT, fire up one-shot devices etc.).

Upon completion of these preparations and verifying that it is ready for release as appropriate, the fuzing system shall set the status bit Fuze Ready for Release (see 4.3.3.5.2) in preparation for the continuation of the release process.

NOTE: The fuzing system may be able to set the status bit Fuze Ready for Release in the "f" response to the command FPR (see 4.3.3.3.2), if it is able to complete the release preparations and to verify it is ready for release prior to the "f" response to the command FPR being transmitted.

4.3.3.3.2.2 Release Imminent

The weapon shall send an "F" command containing the data "RI" (FRI) upon completion of weapon actions that would result in setting the flag Committed to Separate Store or Submunition (CTSS).

The fuzing system shall accept a message with the Control Byte "F" and data "RI" as valid only after a valid command FPR has been received and if the discrete signal Release Consent Monitor is enabled at the time the message is received.

Within 5 ms of the receipt of a valid command FRI, the fuzing system shall set the status bit FRI received (see 4.3.3.5.2) to logic "1", acknowledge the receipt as defined in 4.3.2.5.6 and with the data defined in 4.3.3.5.2, and be capable of sensing weapon release.

4.3.3.3.2.3 Inhibit Arming

If the fuzing system provides an arming inhibit capability (see 4.3.3.5.6), the following applies:

- At any time prior to the fuzing system being armed, the weapon may send an "F" command containing the data "IA" (FIA) to prevent completion of the arming process.

- Upon receipt of the data "IA" the fuzing system shall set the status bit Arm Inhibit (see 4.3.3.5.2) to logic "1", then acknowledge the receipt as defined in 4.3.2.5.6 and with the data defined in 4.3.3.5.2, and prevent arming even if all criteria for arming have met. Arming shall be prevented until all criteria for arming have been met and the command FIA has been canceled through the command FAD (see 4.3.3.3.2.4).

If the fuzing system provides a disarm/rearm capability (see 4.3.3.5.6), the following applies:

- At any time after the fuzing system has been armed, the weapon may send an "F" command containing the data "IA" (FIA) to command the fuzing system suspends the armed state.

- Upon receipt of the data "IA" the fuzing system shall set the status bit Arm Inhibit (see 4.3.3.5.2) to logic "1", then acknowledge the receipt as defined in 4.3.2.5.6 and with the data defined in 4.3.3.5.2, and disarm until the command FIA has been canceled through the command FAD (see 4.3.3.3.2.4).

4.3.3.3.2.4 Arm De-Inhibit

If the fuzing system provides an arming inhibit capability or a disarm/rearm capability (see 4.3.3.5.6), the following applies:

- At any time after sending the Arm Inhibit command prior to first arming, the weapon may send an "F" command containing the data "AD" (FAD) to cancel the command FIA and permit arming or rearming of the fuzing system.

- Upon receipt of the data "AD" the fuzing system shall set the status bit Arm Inhibit (see 4.3.3.5.2) to logic "0", then acknowledge the receipt as defined in 4.3.2.5.6 and with the data defined in 4.3.3.5.2, and allow arming or rearming to continue.

Receipt of the Arm De-Inhibit shall not reduce the previously set arming time or override any arming related fuzing system safety features.

4.3.3.3.2.5 Cancel Mission

At any time the weapon may send an “F” command containing the data “CM” (FCM) to irreversibly terminate all fuzing system arming operations.

Upon receipt of the data “CM” the fuzing system shall set the status bit FCM Received (see 4.3.3.5.2) and then acknowledge the receipt as defined in 4.3.2.5.6 and with the data defined in 4.3.3.5.2. The fuzing system shall then transition irreversibly into a Cancelled Mission state defined in the fuzing system specification, which is as safe as practically possible at the time the command is received. The Cancelled Mission state shall satisfy the following requirements:

- If the fuzing system has not yet armed, as a minimum any further completion of the arming sequence is prevented.
- If the fuzing system has been armed and has a disarm feature, it disarms.
- If the fuzing system has been armed and does not have a disarm feature, as a minimum it initiates processes to prevent function of the fuzing system as defined in the fuzing system specification. Such processes may include the discharge of any firing capacitors, the initiation of interlocks on firing functions, or the initiation of actuators to mechanically safe the fuzing system.

4.3.3.3.2.6 Status Query

At any time the weapon may send an “F” command containing the data “SQ” (FSQ) to request the current status of the fuzing system.

Upon receipt of the data “SQ” the fuzing system shall acknowledge the receipt as defined in 4.3.2.5.6 and with the data defined in 4.3.3.5.2.

4.3.3.3.3 “I” Command Data Content

The data sent as part of the “I” command shall comprise one byte, each containing an ASCII character as shown in Table 8.

TABLE 8 - “I” COMMAND DATA CONTENT

Data	Definition
F	Reset all data to default
P	Acknowledge Power Interrupt Notification

4.3.3.3.3.1 Reset All Data to Default State

The weapon shall send an “I” command containing the data “F” (IF) to command the fuzing system to reset all data to its default values and states, including the contents of the “r” response (see 4.3.3.5.4) and the “f” response data (see 4.3.3.5.2). For bit 6 of byte 0 of the “f” response data see below.

On receipt a valid message with the Control Byte “I” and data “F” the fuzing system shall acknowledge the receipt as defined in 4.3.2.5.6 and reset all data to their fuzing system specification default values and states. This includes the response data as defined in 4.3.3.5.2 and 4.3.3.5.4. For bit 6 of byte 0 of the “f” response data see below.

For fuzing systems that provide a disarm (reversible) capability (see 4.3.3.5.6), the fuzing system shall also disarm and set the bit Fuzing System Armed (bit 6, byte 0) of the “f” response message data to logic “0”. All other fuzing systems shall maintain the status of bit 6 of byte 0 unchanged during a reset commanded by IF.

4.3.3.3.3.2 Acknowledge Power Interrupt Notification

The weapon shall send an “I” command containing the data “P” (IP) to command the fuzing system to cancel the bit indicating a Power Interrupt Notification, bit 7 of byte 1 of the “r” response data (see 4.3.3.5.4).

On receipt of this command, the fuzing system shall set the bit 7 of byte 1 of the “r” response data (see 4.3.3.5.4) to logic “0”.

4.3.3.4 Fuzing System Control Byte Definitions

TABLE 9 - FUZING SYSTEM RESPONSE CONTROL BYTES, SAFETY RELATED

Control Byte	Definition	Data Content	Notes
a	Response to an “A” command	None	See 4.3.3.4.1
f	Response to an “F” command	Fuzing system arming status	See 4.3.3.4.2
i	Response to an “I” command	None	See 4.3.3.4.3
q	Response to a “Q” command	Arming times set in fuzing system	See 4.3.3.4.4

TABLE 10 - FUZING SYSTEM RESPONSE CONTROL BYTES, NON SAFETY RELATED

Control Byte	Definition	Data Content	Notes
c	Response to a “C” command	24 bytes containing ASCII description of the fuzing system	See 4.3.3.4.5
r	Response to an “R” command	Non arming related information on fuzing system status	See 4.3.3.4.6
m	Response to an “M” command	None	See 4.3.3.4.6
s	Response to an “S” command	Non arming related mission data	See 4.3.3.4.8
u	Response to an “U” command	4 bytes, describing the current capabilities	See 4.3.3.4.9

TABLE 11 - FUZING SYSTEM RESPONSE CONTROL BYTES, FUZING SYSTEM SPECIFIC

Control Byte	Definition	Data Content	Notes
l	Response to an “L” command	None	See 4.3.3.4.10
o	Response to an “O” command	User specified	See 4.3.3.4.10
v	Response to an “A” command	None	See 4.3.3.4.11
w	Response to a “W” command	None	See 4.3.3.4.12
x	Response to an “X” command	User specified	See 4.3.3.4.13
y	Response to a “Y” command	User specified	See 4.3.3.4.14

4.3.3.4.1 Control Byte “a”

The fuzing system shall send a message comprising Control Byte “a” in response to receiving a valid message containing Control Byte “A”.

The sending of this message confirms that the message was received, but not that the data content has been checked or validated.

On checking and successful validation of the data content of the “A” command, the fuzing system shall set the bits Default “A” Data (bit 0, byte 2) and “A” Message Data Checksum (bit 1, byte 2) of the “r” response data (4.3.3.5.4), to logic “0”.

If the data content is determined to contain a checksum error, the fuzing system shall discard the message and set the bit “A” Message Data Checksum (bit 1, byte 2) of the “r” response data (see 4.3.3.5.4) to logic “1”.

For the purpose of ensuring safety with interoperability all fuzing systems shall have programmable arming delays that extend to at least 60 s. The shortest programmable arming time is defined in the fuzing system specification or ICD.

If the fuzing system determines that any data contained in the message is higher than the highest settable value, it shall set the highest settable value and shall set the bit “A” Message Data Upper Range Exceeded (bit 2, byte 2) of the “r” response message data (see 4.3.3.5.4) to logic “1”, otherwise it shall set the bit to logic “0”.

If the fuzing system determines that any data contained in the message is lower than the lowest settable value, it shall set the lowest settable value and shall set the bit “A” Message Data Lower Range Exceeded (bit 3, byte 2) of the “r” response message data (see 4.3.3.5.4) to logic “1”, otherwise it shall set the bit to logic “0”.

For any data contained in the message, if the values are within the settable range, the fuzing system shall set the exact values as commanded by the message.

4.3.3.4.2 Control Byte “f”

The fuzing system shall send a message comprising Control Byte “f” and the data defined in 4.3.3.5.2 in response to receiving a valid message containing Control Byte “F” to confirm both that the message was received, and that the data in the message has been accepted as valid (see 4.3.3.2.2).

NOTE: In contrast to the responses to the other messages setting or commanding the fuzing system, this response both confirms that an “F” message has been received and that the data content has been accepted as valid and stored for use.

4.3.3.4.3 Control Byte “i”

The fuzing system shall send a message comprising Control Byte “i” in response to receiving a valid message containing Control Byte “I”, and reset the fuzing system and the data in accordance with 4.3.3.3.3.

4.3.3.4.4 Control Byte “q”

The fuzing system shall send a message comprising Control Byte “q” and the data defined in 4.3.3.5.1 in response to receiving a valid message containing Control Byte “Q”.

4.3.3.4.5 Control Byte “c”

The fuzing system shall send a message comprising Control Byte “c” and the data defined in 4.3.3.5.3 in response to receiving a valid message containing Control Byte “C”.

4.3.3.4.6 Control Byte “r”

The fuzing system shall send a message comprising Control Byte “r” and the data defined in 4.3.3.5.4 in response to receiving a valid message containing Control Byte “R”.

4.3.3.4.7 Control Byte “m”

The fuzing system shall send a message comprising Control Byte “m” in response to receiving a valid message containing Control Byte “M”.

The sending of this message confirms that the message was received, but not that the data content has been checked or validated.

On checking and successful validation of the data content of the “M” command, the fuzing system shall set the bits Default “M” Data (bit 4, byte 2) and “M” Message Data Checksum (bit 5, byte 2) of the “r” response data (4.3.3.5.4), to logic “0”.

If the data content is determined to contain a checksum error, the fuzing system shall discard the message and set the bit "M" Message Data Checksum (bit 5, byte 2) of the "r" response data (see 4.3.3.5.4) to logic "1".

If the fuzing system determines that any data contained in the message is higher than the highest settable value, it shall set the highest settable value and shall set the bit "M" Message Data Upper Range Exceeded (bit 6, byte 2) of the "r" response message data (see 4.3.3.5.4) to logic "1", otherwise it shall set the bit to logic "0".

If the fuzing system determines that any data contained in the message is lower than the lowest settable value, it shall set the lowest settable value and shall set the bit "M" Message Data Lower Range Exceeded (bit 7, byte 2) of the "r" response message data (see 4.3.3.5.4) to logic "1", otherwise it shall set the bit to logic "0".

For any data contained in the message, if the values are within the settable range, the fuzing system shall set the exact values as commanded by the message.

4.3.3.4.8 Control Byte "s"

The fuzing system shall send a message comprising Control Byte "s" and the data defined in 4.3.3.5.5 in response to receiving a valid message containing Control Byte "S".

4.3.3.4.9 Control Byte "u"

The fuzing system shall send a message comprising Control Byte "u" and the data defined in 4.3.3.5.6 in response to receiving a valid message containing Control Byte "U".

4.3.3.4.10 Control Bytes "l" and "o"

The control bytes "l" and "o" are reserved for factory or manufacturer usage.

The fuzing system shall send a message comprising Control Byte "l" in response to receiving a valid message containing Control Byte "L". The sending of this message confirms that the message was received, but not that the data content has been checked or validated.

The fuzing system shall send a message comprising Control Byte "o" and the data as defined in the fuzing system ICD in response to receiving a message containing Control Byte "O".

4.3.3.4.11 Control Bytes "v"

The fuzing system shall send a message comprising Control Byte "v" in response to receiving a valid message containing Control Byte "V". The sending of this message confirms that the message was received, but not that the data content has been checked or validated.

On checking and successful validation of the data content of the "V" command, the fuzing system shall set the bits Default "V" Data (bit 0, byte 3) and "V" Message Data Checksum (bit 1, byte 3) of the "r" response data (4.3.3.5.4), to logic "0".

If the data content is determined to contain a checksum error, the fuzing system shall discard the message and set the bit "V" Message Data Checksum (bit 1, byte 3) of the "r" response data (see 4.3.3.5.4) to logic "1".

If the fuzing system determines that any data contained in the message is higher than the highest settable value, it shall set the highest settable value and shall set the bit "V" Message Data Upper Range Exceeded (bit 2, byte 3) of the "r" response message data (see 4.3.3.5.4) to logic "1", otherwise it shall set the bit to logic "0".

If the fuzing system determines that any data contained in the message is lower than the lowest settable value, it shall set the lowest settable value and shall set the bit "V" Message Data Lower Range Exceeded (bit 3, byte 3) of the "r" response message data (see 4.3.3.5.4) to logic "1", otherwise it shall set the bit to logic "0".

For any data contained in the message, if the values are within the settable range, the fuzing system shall set the exact values as commanded by the message.

4.3.3.4.12 Control Bytes “w”

The fuzing system shall send a message comprising Control Byte “w” in response to receiving a valid message containing Control Byte “W”. The sending of this message confirms that the message was received, but not that the data content has been checked or validated.

On checking and successful validation of the data content of the “W” command, the fuzing system shall set the bits Default “W” Data (bit 4, byte 3) and “W” Message Data Checksum (bit 5, byte 3) of the “r” response data (4.3.3.5.4), to logic “0”.

If the data content is determined to contain a checksum error, the fuzing system shall discard the message and set the bit “W” Message Data Checksum (bit 5, byte 3) of the “r” response data (see 4.3.3.5.4) to logic “1”.

If the fuzing system determines that any data contained in the message is higher than the highest settable value, it shall set the highest settable value and shall set the bit “W” Message Data Upper Range Exceeded (bit 6, byte 3) of the “r” response message data (see 4.3.3.5.4) to logic “1”, otherwise it shall set the bit to logic “0”.

If the fuzing system determines that any data contained in the message is lower than the lowest settable value, it shall set the lowest settable value and shall set the bit “W” Message Data Lower Range Exceeded (bit 7, byte 3) of the “r” response message data (see 4.3.3.5.4) to logic “1”, otherwise it shall set the bit to logic “0”.

For any data contained in the message, if the values are within the settable range, the fuzing system shall set the exact values as commanded by the message.

4.3.3.4.13 Control Bytes “x”

The fuzing system shall send a message comprising Control Byte “x” and the data as defined in the fuzing system specification or ICD in response to receiving a valid message containing Control Byte “X”.

4.3.3.4.14 Control Bytes “y”

The fuzing system shall send a message comprising Control Byte “y” and the data as defined in the fuzing system specification or ICD in response to receiving a valid message containing Control Byte “Y”.

4.3.3.5 Fuzing System Message Data Content

4.3.3.5.1 “q” Fuzing System Response Data Content (Arming Related Settings)

In response to a “Q” command, the fuzing system shall send the data as shown in Table 12.

NOTE: This fuzing system response is deliberately not the MIL-STD-1760 Store Response message, which can be constructed by the weapon from this data and other responses.

TABLE 12 - “q” FUZING SYSTEM RESPONSE DATA (ARMING TIMES)

Data Byte	Definition	Notes
0 - 1	Elements of Arming Mode 1 and Arming Mode 2	Arming mode settings; see Table 13
2	Arming Time (UB)	Current arming time setting
3	Arming Time (LB)	
4	High Drag Arm Time (UB)	Current high drag arming time setting
5	High Drag Arm Time (LB)	

TABLE 13 - ARMING MODE BYTES 0 AND 1 DEFINITIONS

Byte	BIT	Definition
0	0	Arm Delay From Release is Enabled (corresponds to MIL-STD-1760E Table B-XIX Fuzing Mode #1, Bit 14)
0	1 - 7	Reserved
1	0 - 7	Reserved

4.3.3.5.2 "f" Fuzing System Response Data Content (Fuzing System Safety Status)

In response to an "F" command, the fuzing system shall send two bytes as shown in Table 14.

The default values are indicated in the table by underlining and shall be the initial state of the bits at initial power up or - with the exception of bit 6 of byte 0 - after a reset command "IF" in accordance with 4.3.3.3.3.

For fuzing systems with status data stored in volatile memory, the default values at application of Port 1 Power or after a reset in accordance with 4.2.3.1.5 or 4.2.3.2.4 shall be as shown in Table 14, with the exception of bit 6 of byte 0.

For fuzing systems with status data stored in non-volatile memory, the data is not changed by removal and re-application of Port 1 Power.

The bit Fuzing System Armed (Bit 6, byte 0) shall be set to logic "0" while the fuzing system is not armed. It shall be set to logic "1" whenever the fuzing system is armed. Fuzing systems that provide a Arm Status Monitoring Capability (Bit 5, byte 2, of "u" response message data, see 4.3.3.5.6) shall report the actual arming status as determined. Fuzing systems that do not have such a capability, shall report the arming status based on available information (e.g. fuzing system design, status information and actions taken) as accurate as possible.

TABLE 14 - "f" FUZING SYSTEM RESPONSE DATA (STATUS)

Byte	Bit	Definition	Values
0	0	Reserved	0
0	1	FPR Received	0= FPR not received 1= FPR received
0	2	FRI Received	0= FRI not received 1= FRI received
0	3	Fuze Ready for Release (FRR)	0= Fuzing system not Ready for Completion of Release Sequence 1= Fuzing system Ready for Completion of Release Sequence
0	4	Arm Inhibit	0= Arm Inhibit not set 1= Arm Inhibit set
0	5	Reserved	0
0	6	Fuzing System Armed	0= Fuzing system not armed 1= Fuzing system armed
0	7	FCM Received	0= FCM not received 1= FCM received
1	0	Release Consent Monitor State	0 = Release Consent Monitor disabled 1 = Release Consent Monitor enabled

Byte	Bit	Definition	Values
1	1	Release Detection State	0= Released from aircraft detected 1= Not released from aircraft
1	2 - 7	Reserved	0

The bit FRR set to logic "1" indicates that the fuzing system has successfully accepted a FPR message, and has undertaken any necessary internal actions and safety checks to prepare for release, and is able to accept an FRI message to continue the release sequence. If the fuzing system is no longer ready for release, the fuzing system shall set the bit FRR to logic "0". However, the weapon may not check that status again.

The bit Release Detection State shall be set to logic "0" once the fuzing system has detected a release from the aircraft as defined in 4.6.4.2 that under normal operations will cause the fuzing system to arm.

4.3.3.5.3 "c" Fuzing System Response Data Content (Fuzing System Identifier)

The data sent in response to the "C" command shall contain the data as shown in Table 15.

TABLE 15 - "C" FUZING SYSTEM RESPONSE DATA (IDENTIFIER)

Data Bytes	Definition	Contents
0 - 1	Country code	National Authority, ASCII coded country code as defined in ISO 3166
2 - 17	Fuzing system type	ASCII coded type of fuzing system
18 - 23	Fuzing system modification or configuration identifier	ASCII coded modification (version number of fuzing system type)

All entries shall be left aligned, i.e. start at byte 0 for the country code, at byte 2 for the type and at byte 18 for the modification respective. Alphabetical characters shall be uppercase. Unused bytes shall be ASCII space [20h]. For an example see 4.3.4.2.

The Fuzing System Identifier shall be assigned by the National Safety Approving Authorities for fuzing systems.

4.3.3.5.4 "r" Fuzing System Response Data Format (Fuzing System Status Codes)

In response to an "R" command the fuzing system response data shall contain the data shown in Table 16.

Data byte 0 indicates the BIT result and any BIT error codes. The bits shall be set by the fuzing system according to the state and result of any internal BIT. BIT error codes are fuzing system specific as defined in the fuzing system specification or ICD.

Data bytes 1 through 3 display temporary error codes and the result of the execution of weapon commands to the fuzing system prior to this "R" command. The fuzing system shall set the bit General Fuze Error (bit 1, byte 1) to communicate any general software or hardware errors to the weapon. Its operation shall be as specified in the fuzing system specification.

The default value status is indicated in Table 16 by underlining and shall be the initial state of the bits at initial power up or after reset command "IF".

For fuzing systems with mission and status data stored in volatile memory, the default values at application of Port 1 Power or after a reset in accordance with 4.2.3.1.5 or 4.2.3.2.4 shall be as shown in Table 16.

For fuzing systems with mission and status data stored in non-volatile memory, the data is not changed by removal and re-application of Port 1 Power.